JOHNS HOPKINS
UNIVERSITY & MEDICINE

Johns Hopkins Information Transport Systems Design and Construction Specification

April 2024

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To: Architects, Consultants, and Contractors
Re: Use of Johns Hopkins Cable Plant Design and Construction Specification
Date: April 2024

Intended Use

This is a general specification for use in designing and installing the information transport systems (ITS) infrastructure for the Johns Hopkins Institutions. The specification as presented here includes all possible elements for an ITS installation. Designers and Architects will need to select and modify sections of this specification as required for their project. Not all divisions and sections will be applied to every project. Not all paragraphs of any given section may apply to a given project. System variables (e.g. copper pair counts, fiber backbone size) may be displayed as an example within this general specification.

When generating a project specification:

Designers and Architects will need to submit specifications based on this document to the appropriate Johns Hopkins IT Infrastructure Team for approval of options selected from this specification.

Designers and Architects will need incorporate all design considerations and standards into each project in respect to equipment room sizing, layout, communications power and protection requirements, cooling requirements, cable selection, and pathways as outlined in the following specification sections.

- Equipment room sizing, power and cooling requirements
  - 27 11 00 Communications Equipment Rooms
- Equipment room layout
  - Appendix B
- Communications power and protection
  - 27 11 26 Communications Rack Mount Power Protection and Power Strips
- Cable Selection
  - Refer to detailed specification sections
- Pathways
  - Refer to detailed specification sections

Designers and Architects shall not add language to this specification when generating a project-specific specification *without* approval of Johns Hopkins.

Errors and omissions within this document shall be reported for correction in the general specification.

Copyright Information

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27 00 00 - COMMUNICATIONS GENERAL

PART 1 GENERAL

1. 1 PURPOSE

A. This specification is intended to define the standards, criteria, and assumptions to be used in the design, documentation, and specification of a network infrastructure to support the Johns Hopkins (JH) enterprise. This specification shall form the basis for the design.

B. This specification is based on NFPA 70 (NEC), IEEE C2 (NESC), ANSI/TIA/EIA Telecommunication Standards, and BICSI methodologies (TDMM and CO-OSP). The requirements within those documents are not superseded by this document unless specifically stated. As required, NEC and NESC code requirements cannot be superseded by this document at any time. ANSI/TIA/EIA standards and BICSI methodologies may be superseded, as specified, or may be made stricter by this document. Not all codes, standards, and methodologies are specifically addressed by this document. The absence of a specific reference to an element of those codes, standards, and methodologies does not relinquish compliance with those elements.

C. Unauthorized deviations from this specification may require re-design, re-construction, or re-installation of ISP/OSP elements at the Designers'/Contractors' expense. Designers and Contractors shall get prior approval to deviate from this specification or ANSI/TIA/EIA standards. Contractors cannot deviate from NEC and NESC requirements.

D. "Codes" refer to the NFPA 70 (National Electrical Code) and IEEE C2 (National Electric Safety Code). "Standards" refer to ANSI, ASTM, and UL standards. "Methodologies' refers to BISCI manuals for telecommunications design and CO-OSP. "Specifications" refers to Johns Hopkins documents for installations. These statements are for clarification and not meant as all-inclusive definitions.

E. Like standards and codes, this document uses the word "shall" to indicate mandatory requirements and "may" or "should" to indicate optional components. Conflicts within this document are to be resolved by JH Networking, Telecommunications, and/or Johns Hopkins Personnel prior to application of the specification by a Contractor.

F. While the ANSI/TIA/EIA standards and BICSI methodologies may refer to "telecommunications network", this specification will refer to Information Transport System as defined below.

1. 2 SECTION INCLUDES

A. Section 27 05 01: Minor Communications Demolition

B. Section 27 05 26: Grounding and Bonding for Communications Systems

C. Section 27 05 28: Interior Pathways for Communications Systems

1. Section 27 05 28.02: Systems Furniture
2. Section 27 05 28.10: Conduit
3. Section 27 05 28:11: Surface Metallic Raceways
4. Section 27 05 28.12: Surface Nonmetallic Raceways
5. Section 27 05 28.13: Communication Systems Furniture Poles
6. Section 27 05 28.14 Cable Trays for Communications

7. Section 27 05 28.15 Boxes
8. Section 27 05 28.29 Hangers and Supports for Communications

D. Section 27 05 43: Underground Ducts and Raceways for Communications

E. Section 27 05 53: Identification for Communications Systems

1. 3 RELATED SECTIONS

A. Section 27 11 00: Communications Equipment Room

B. Section 27 11 13: Communications Entrance Protection

C. Section 27 11 16: Communications Cabinets, Racks, Frames, and Enclosure

D. Section 27 11 19: Communications Termination Blocks and Patch Panels

E. Section 27 11 26: Communications Rack Mount Power Protection and Power Strips

F. Section 27 13 13: Communications Copper Intrabuilding Backbone Cabling

G. Section 27 13 23: Communications Optical Fiber Intrabuilding Backbone Cabling

H. Section 27 15 00: Communications Horizontal Cabling

I. Section 27 15 33: Communications Coaxial Horizontal Cabling

J. Section 27 15 43: Communications Work Areas, Faceplates, and Connectors

K. Section 27 16 19: Communications Station Cords, Patch Cords, and Cross Connect Wire

L. Section 27 18 00: Communications Testing

M. Section 27 21 33: Data - Communications Wireless Access Points

N. Section 27 3223: Elevator Telephones

O. Section 27 3226: Ring-Down Emergency Telephones

P. Appendices:

1. A – Special Project Procedure for Healthcare Facilities
2. B – Enlarged Network Room Layouts
3. C – Telecommunications Detail

1. 4 REFERENCES

A. ANSI/TIA/EIA standards referenced below may include multiple components which apply to JH projects. In all cases, the current versions or succeeding documents for the codes, standards, and methodologies listed above shall be used.

B. Should conflicts exist within the standards, then the Johns Hopkins Infrastructure Project Team shall resolve the conflict.

1. 5 DEFINITIONS

A. Cable Plant Infrastructure Elements

1. Information Transport System (ITS): Any copper cabling or optical fiber whose purpose is to move any type of information on the campus. This may include data, video, voice, fire alarm, security, access control, and other low-voltage networks. The Information Transport System is not limited to Johns Hopkins-owned cabling, but includes copper and optical fiber, and equipment owned by outside providers carrying Johns Hopkins information. Pathways are not limited by Johns Hopkins ownership, but include those owned by the City of Baltimore and other third parties. The Information Transport

System may be referred to as “the network” within this document. Elements of the Information Transport System to be handled uniquely within the overall Information Transport System will be specifically addressed (e.g. fire alarm cabling). This term replaces telecommunication network in any code, standard, or methodology.

2. Inside Cable Plant: That part of the Information Transport System running within a building. This document does not apply to Inside Cable Plant elements passing through any element of the outside cable plant pathway. It includes the workstation outlet assembly, cabling to the workstation from the network rooms, backbone cabling within a building, backbone cabling running between physically contiguous buildings that does not pass through Outside Cable Plant elements, network racks and hardware (routers, switches, hubs, firewalls, etc.), patch panels, any punch blocks not terminating cable from outside the building, fiber distribution panels not terminating optical fiber from outside the building, patch cords, and cross-connect cables/wires. The Inside Cable Plant will be referenced to as “ISP” within this document. The ISP is managed by the Enterprise Network Architecture & Design and Telecommunication groups.

3. Outside Cable Plant: That part of the Information Transport System running between buildings, from a building to a definable exterior point, between definable exterior points, or from a non-Johns Hopkins source to a Johns Hopkins building or definable exterior point. It includes the termination hardware at both ends of the cable, including protection modules, telecommunication punch blocks, fiber distribution panels, interior splices for outside to inside optical fiber transition, and any other initial device into which an outside cable attaches.

4.. The Outside Cable Plant does not include backbone cable running between physically contiguous buildings unless the cabling enters and OSP pathway element (e.g. OSP conduits, maintenance holes, etc.). The Outside Cable Plant includes underground cabling and aerial cabling. The Outside Cable Plant may be referred to as “OSP” within this document and the phrase and abbreviation are used interchangeably.

B. Homewood Campus Controlling Interests

1. Networking: Networking refers to the Enterprise Network Architecture & Design group of Information Technology @ Johns Hopkins. This group manages the data network hardware/software. Networking sets installation standards for data cabling within buildings.

2. Telecommunications: Telecommunications refers to the Telecommunication group of Information Technology @ Johns Hopkins. This group manages the voice network hardware/software. Telecommunications sets installation standards for voice cabling within buildings.

3. Other entities have controlling interest at other Johns Hopkins campuses and should be consulted prior to design and installation of cabling infrastructure.

C. Specific Elements

1. Cable: An assembly of one or more insulated conductors or optical fibers, within an enveloping sheath.

2. Campus: Includes all buildings owned or leased by Johns Hopkins with a direct physical cable connection to the contiguous campus through Johns Hopkins-owned or leased conduits, including those pathways.

3. Dead pairs: Unused copper pairs terminating within a splice case, but without being spliced to an outgoing cable.

4. Grounding electrode: A conductor, usually a rod, pipe or plate (or group of conductors) in direct contact with the earth for the purpose of providing a low-impedance connection

to the earth.

5. Grounding electrode conductor: The conductor used to connect the grounding electrode to the equipment grounding conductor, or to the grounded conductor of the circuit at the service equipment, or at the source of a separately derived system.
6. Hand box: A rectangular or square underground pathway element similar to a small maintenance hole, which cannot be fully entered, that allows for a pulling point or splice point in a pathway.
7. Handhole: A round underground pathway element similar to a hand box, which cannot be fully entered, that allows for a pulling point in a pathway.
8. Identifier: An item of information that links a specific element of the Information Transport System infrastructure with its corresponding record.
9. Infrastructure (Information Transport System): A collection of those Information Transport System components, excluding equipment, that together provides the basic support for the distribution of all information within a building or campus.
10. Linkage: A connection between a record and an identifier or between records.
11. Maintenance holes: An underground pathway element large enough for a person to fully enter and work, used to provide access to underground cables to pull, splice, and maintain. Former known as a manhole.
12. Media (Information Transport System): Wire, cable, or conductors used for the Information Transport System.
13. Outlet box: A metallic or nonmetallic box used to hold Information Transport System outlets/connectors or transition devices.
14. Outlet/connector (Information Transport System): A connecting device in the work area on which horizontal cable or outlet cable terminates.
15. Pathway: A facility for the placement of Information Transport System cable.
16. Record: A collection of detailed information related to a specific element of the Information Transport System infrastructure.
17. Report: A presentation of a collection of information from the various records.
18. Space (information Transport System): An area used for housing the installation and termination of Information Transport System equipment and cable, e.g., equipment rooms, network rooms, work areas, and maintenance holes/hand boxes/handholes.
19. Splice: A joining of conductors in a splice closure, meant to be permanent.
20. Splice box: A box, located in a pathway run, intended to house a cable splice.
21. Splice closure: A device used to protect a splice.
22. Termination position: A discrete element of termination hardware where Information Transport System conductors are terminated.
23. Work Area (Workstation): A building space where the occupants interact with Information Transport System terminal equipment.

1. 6 ACRONYMS AND ABBREVIATIONS

A. ACR: Attenuation-to-Crosstalk Ratio

B. ADA: Americans with Disabilities Act

C. AFF: Above finished floor

D. ANSI: American National Standards Institute
E. ASTM: American Society for Testing and Materials (ASTM International)
F. AWG: American Wire Gauge
G. BICSI®: Building Industry Consulting Service International, Inc.
H. BTU: British Thermal Unit
I. CATV: Community Antenna Television (cable television)
J. CD: Campus distributor
K. dB: Decibel
L. EF: Entrance Facility
M. EIA: Electronic Industries Alliance
N. EIDF: Equipment Intermediate Distribution Frame (Medical Facilities Only)
O. ELFEXT: Equal Level Far-End Crosstalk
P. EMC: Electromagnetic Compatibility
Q. EMI: Electromagnetic Interference
R. ER: Equipment Room
S. FCC: Federal Communications Commission
T. FDDI: Fiber Distribution Data Interface
U. FEXT: Far-End Crosstalk
V. FOTP: Fiber Optic Test Procedure
W. Freq: Frequency
X. GE: Grounding equalizer (replacing TBBIBC)
Y. Gnd: Ground
Z. HB: Hand box
AA. HH: Handhold
BB. HVAC: Heating, Ventilation, and Air Conditioning
CC. Hz: Hertz
DD. IC: Intermediate Cross-Connect
EE. IDC: Insulation Displacement Connectors
FF. IDF: Intermediate Distribution Frame
GG. IEEE: Institute of Electrical and Electronics Engineers
HH. ISO: International Organization for Standardization
II. ISP: Inside Cable Plant
JJ. JH: Johns Hopkins Institutions
KK. JHU: Johns Hopkins University
LL. Mbps: Megabits per second
MM. MDF: Main Distribution Frame

NN. MH: Maintenance Hole

OO. MHZ: Megahertz

PP. NEC: National Electrical Code, NFPA 70

QQ. NESC: National Electric Safety Code, C2-1997

RR. NFPA: National Fire Protection Association

SS. NR: Network Room

TT. OSHA: Occupational Safety and Health Administration

UU. OSP: Outside Cable Plant.

VV. OTDR: Optical Time Domain Reflectometer

WW. PR: Pair

XX. RCDD®: Registered Communications Distribution Designer

YY. RFI: Radio Frequency Interference

ZZ. RH: Relative Humidity

AAA. SM: Single Mode

BBB. TBB: Telecommunication Bonding Backbone

CCC. TBBIBC: Telecommunication Bonding Backbone Interconnecting Bonding Conductor (replaced by grounding equalizer “GE”)

DDD. TGB: Telecommunications Grounding Busbar

EEE. TIA: Telecommunications Industry Association

FFF. TMGB: Telecommunications Main Grounding Busbar

GGG. TR: Telecommunications Room

HHH. UL: Underwriters Laboratory

III. UPS: Uninterruptible Power Supply

JJJ. WAO: Work Area Outlet

1. 7 UNITS OF MEASURE

A. dB: Decibel

B. ft: Foot or feet

C. in: Inch(es)

D. nm: Nanometer

1. 8 SYSTEM DESCRIPTION

A. This specification addresses network pathways, spaces, media, grounding, and identification requirements to support the network infrastructure.

B. Areas covered by this specification are:

1. Definition of the inter-building pathway and cabling requirements necessary to connect the project building(s) to the incoming service facilities as well as each other.

2. Definition of an intra-building pathway and space system to house the network cabling system and associated electronic transport equipment. This pathway and space system

shall be designed to support the known and anticipated systems and cables that may be utilized within the spaces.

3. Definition of backbone cables and their distribution and termination methods.
4. Definition of horizontal distribution cables and work area outlet configuration. This definition will also include termination methods to be utilized.
5. Definition of patch cables and their requirements.
6. Definition of the network grounding infrastructure.
7. Definition of the administration and labeling system.

C. Cable Plant

1. Any exception to this specification must be approved prior to installation. Any deviation from this specification must be approved prior to installation. Any questions on interpretation shall be resolved by Johns Hopkins Personnel, Networking, and/or Telecommunications prior to installation.
2. Designers shall design an Information Transport System with approved cable/connectivity hardware and cables. The SCS shall be capable of providing a minimum 20-year written Manufacturer Performance Warranty.
3. Designers shall prepare all drawings and specifications to allow for competitive bids by two ITS manufacturers for inside cable plant. Specifications shall be written in such a way as to provide a Belden/CDT or Legrand/Superior Essex solution. A Contractor shall use a single manufacturer's copper or fiber solution (cables and components) for any given installation. The Contractor shall determine which solution shall be bid based on costs and availability of the competing product lines.
4. In renovations areas, the Designer may specify a single product line consistent with other products in the existing network rooms servicing the area.

1. 9 DESIGN REQUIREMENTS

A. Major building renovations should include improvement to the building network infrastructure as detailed by the Information Network Infrastructure Master Plan for Outside Copper and Fiber Cable Plant Implementation Plan for the Homewood Campus. Improvements to entrance facilities are addressed by this plan. When needed to provide service to a renovated area, renovations to entrance facilities may be necessary prior to the planned renovation under the above plan.

B. In Many buildings, OSP cable is placed in violation of current codes, standards, methodologies, and specifications. Renovations of a part of a building may require correcting these violations and may add substantially to the cabling portion of the renovation in cost and effort.

1. 10 SUBMITTALS

A. See Architectural Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. See Section Requirements - Submittals, for section specific submittal requirements, shop drawings, test reports, procedures, as-builts and warranties.

C. Closeout Submittals: Prepare and submit final shop drawings, termination schedules, test results, as-built drawings, and component documentation as described within these specifications for review by the Johns Hopkins Infrastructure Project Team prior to final acceptance. If variations from approved shop drawings and samples occur during installation, submit final as-built documentation indicating such variations to the Johns

Hopkins Infrastructure Project Team.

1. 11 QUALITY ASSURANCE

A. The Contractor shall have extensive experience (3+ years) with the specified manufacturers' hardware and cabling.

B. All installers shall have had experience with the specified manufacturers' hardware and cabling. BICSI Installer Level I experience may be limited to class-based training using the manufacturers' hardware and cabling.

C. All installers shall be BICSI-registered installers. Seventy-five percent or more of installers shall be BICSI Installer Level II. Up to twenty-five percent of installers may be BICSI Installer Level I. Workers not involved in installing cable elements (e.g. laborers delivering/moving materials, installing grounding by an electrician, or workers installing pathway elements) do not have to be registered.

D. All team leads shall be BICSI-registered Technicians. The Contractor shall provide statements in the bid documents of experience for all proposed team leads. The statements shall include industry-specific training and certifications (with dates verifying active status on registrations/certifications), project experience, experience with Category 6A and shielded cabling, and experience as a team lead. The Contractor may provide additional material.

E. Only installers trained and certified by the manufacturer shall be allowed to install copper products. Installers must possess the highest level of certification available by the manufacturer for the specific structured cable solution being installed.

F. Only installers trained and certified by the manufacturer shall be allowed to install firestop products. Firestopping at the Johns Hopkins Hospital is done by the owner.

G. Only installers trained and certified by the manufacturer shall be allowed to terminate and test optical fiber. Others specified above may pull / place optical fiber cable under the supervision of an installer trained and certified by the manufacturer.

H. The Contractor may provide proof of registration/certification of planned installers in bid documents. If not included in the bid documents, the Contractor shall provide a narrative on the levels of registration/certification of their installers within the bid documents. The Contractor shall provide proof of registration/certification for the final list of installers prior to the start of work.

I. Johns Hopkins reserves the right to reject any unregistered or uncertified installers performing work for which they are not registered/certified. The Contractor shall be responsible for any loss of work, delays in schedules, or extra costs as a result of the use of registered/uncertified workers. Additional effort on the part of the Contractor to maintain the installation schedule as a result of the above-mentioned loss time shall be the Contractor's responsibility and at the Contractor's additional expense.

J. The Contractor shall provide the above required documentation to Johns Hopkins for any Worker on this project brought in after the submittal of initial documentation on installers. Johns Hopkins shall periodically check installer identification and registrations/certifications during the installation.

1. 12 PROJECT CONDITIONS

A. Worker safety at Johns Hopkins is controlled by Johns Hopkins Office of Health, Safety & Environment (Safety Office). Safety officers have final authority over working conditions, required permits, and required equipment and its proper use. Contractors shall be responsible to coordinate their activities with the Safety Office.

B. Johns Hopkins shall not be responsible for delays in work because of shutdowns due to unsafe working practices by Contractors. Delays enforced by the Safety Office caused by unforeseen environmental conditions in the work area may be out of Contractors' control. Contractors shall contact the Johns Hopkins primary project manager immediately if delays are incurred for safety reasons.

C. Johns Hopkins facilities are health care, administrative, research, and educational facilities. As such, activities in all buildings are critical to the objectives of Johns Hopkins, its administration, faculty, staff, and student body. These objectives shall not be interrupted by the Contractor's work activities. The active cable plant associated with specific work and active cable plant beyond the construction area will not be disrupted at any time. Unusual circumstances (e.g. voice cutovers) can occur and shall be declared and scheduled with as much notice as possible. Service disruptions, if needed, shall be at JH's convenience and schedule.

D. Access within student housing is restricted to the immediate work areas. Contractors shall not enter other areas of the building without JHU escort, including hallways, loading dock areas, or other common areas. The Contractor shall coordinate access to work areas in which students reside with JHU and its housing office. Designers and Contractors may be required to have additional Contractor supervision and/or JHU supervision when working in student residences. Work in residential buildings that produce noise likely to be heard beyond the work area shall not take place prior to 8 AM. During exam periods, noise likely to be heard beyond the work area shall not be permitted.

E. Access within the medical campus is restricted. Contractors and designers shall coordinate all activities with health care areas with Johns Hopkins. Designers and Contractors may be required to have additional supervision and/or JH supervision when working in health care residences. The active cable plant associated with specific work and active cable plant beyond the construction area will not be disrupted at any time. All Contractors shall be prepared at all times to conduct emergency repairs to the cable plant in case of accidental disruption of the cable plant.

F. Asbestos

1. IMPORTANT NOTICE: Many areas may have asbestos present. This includes tiles, floor adhesive, pipe insulation, sprayed-on fire-proofing and other sources. Designers and Contractors SHALL NOT assume an area is free from hazard. Designers and Contractors SHALL NOT move ceiling tiles unless the area has been confirmed to be free of asbestos above drop ceilings by JH Safety officers. Significant costs are associated with working around existing asbestos and must be anticipated either in the form of abatement costs or in alternate routing to avoid contamination.

G. Lead Cables/Splices

1. IMPORTANT NOTICE: Older voice backbone cables may be lead-encased. Splice cases may be coated in lead. The Contractor shall adhere to all federal, state, district, and local requirements for the handling of lead. Demolition of lead cables and splice cases shall produce hazardous lead waste that must be handled by the Contractor.

H. IMPORTANT NOTICE: Contractors must adhere to confined space requirements. All Contractors found to be in violation of confined space procedures will be ordered to stop all work until proper procedure can be followed. In addition, Johns Hopkins Personnel may restrict contractors in violation of confined space procedures from all future work involving confined space.

I. Security at Johns Hopkins is controlled by the Johns Hopkins Security Department (Security). Security officers have final authority over access and security at work areas.

J. Contractors may require parking spaces to be cordoned off in advance of work to access

maintenance holes, handholes, hand boxes, utility poles and/or underground spaces and pathways. Contractors shall contact the Parking Office or Security to arrange for this.

K. Contractors shall provide traffic control, signage, etc. as needed to maintain a safe working environment. All work area access, road closures, parking space closures, and work outside of normal Johns Hopkins operating hours and days shall be coordinated by Contractors as far in advance as possible with Johns Hopkins Security Department. Johns Hopkins Security shall determine if closures of roads or spaces are possible at proposed dates and times. Work at any location may be restricted by day or time, depending on the location of the area, the need for road closures/traffic control, and/or concurrent events in the area or on campus. Contractors should contact Security well in advance to determine scheduling of access to work areas.

L. Work outside of normal Johns Hopkins operating hours and days shall be coordinated with Johns Hopkins Security Department.

M. Emergency calls should be placed through the Security Department for 911 responses. Security escorts City emergency vehicles through the Homewood campus.

N. Emergency procedures are detailed in the appendix for confined space emergencies. When speaking with Security or a 911 operator from a cellular telephone, inform the dispatcher that a confined space emergency exists and request Rescue Company 1 be dispatched.

1. 13 PROJECT MANAGEMENT

A. The Contractor shall provide management-level project management.

B. The Contractor shall submit a project management plan for the installation. Included in this plan shall be a statement on the underlying support structure for project managers within the Contractor’s company.

C. The Contractor shall provide a statement of experience in the bid documents for the proposed project manager. The statement shall include PM-specific and industry-specific training, registrations, certifications, project experience as a PM. The Contractor may provide additional documentation on any added support resources available to the PM within the Contractor’s company.

D. The Contractor shall attend progress meetings (weekly, or less often) as required by Johns Hopkins leading up to and during the installation. The Contractor Project Manager shall be in attendance. On rare occasion, a team lead or other supporting engineer may attend in the Contractor Project Manager’s place, if pre-approved 24 hours in advance by Johns Hopkins. Emergencies and unforeseen events shall be approved on shorter notice, as determined by Johns Hopkins.

E. The Contractor shall provide written weekly update reports to Johns Hopkins during installation through the completion.

1. 14 WARRANTY

A. The Contractor shall adhere to the warranty requirement for all installations.

B. The Contractor shall install all copper components of the installed manufacturer’s system-wide solution to the specifications and requirements needed to extend the longest and most extensive performance warranty available under the installed solution(s). Voice and Data cabling shall adhere to the warranty requirements of either the Belden or Legrand/Superior Essex solutions.

C. The Contractor shall install all fiber components of the installed manufacturer’s system-wide solution (25 year Sumitomo Premium Warranty for air-blown fiber, 25 year Corning LANscape Extended Warranty) to the specifications and requirements needed to extend

the longest and most extensive performance warranty available under the installed solution(s). The Contractor shall coordinate the Premium warranty for the OSP air-blown channel noting the use of Corning connectors and housing as part of the fiber channel.

D. Johns Hopkins Personnel has arranged for Sumitomo Electric Lightwave to carry a 25-year Sumitomo warranty on air-blown fiber systems using Corning connectors and housings.

E. The Contractor shall submit in the bid documents any additional, contractor-specific warranties or guarantees to be offered on the project.

F. The Contractor shall provide any and all necessary documentation needed to implement this warranty and to verify the solution installation.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

27 05 01 - MINOR COMMUNICATIONS DEMOLITION

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Minor communications demolition.

1. 2 RELATED SECTIONS

A. Section 27 00 00: Communications General.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

PART 2 PRODUCTS

2. 1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3. 1 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Beginning of demolition means installer accepts existing conditions.

3. 2 PREPARATION

A. Coordinate utility service outages with IT Infrastructure Project Team.

B. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable the system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Johns Hopkins IT Infrastructure Project Team at least 48 hours before partially or completely disabling system.

C. Existing Data Network System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Networking at least 48 hours before partially or completely disabling system.

3. 3 DEMOLITION AND EXTENSION OF EXISTING SYSTEMS

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of termination. If removal of cable at termination point empties termination hardware, hardware shall be removed as well.

C. All existing cables to remain must be properly supported and fire-stopped per these specifications.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Dispose of all hazardous material in accordance with federal, state/district, and local requirements.

END OF SECTION

27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1. 2 RELATED SECTIONS

A. Section 27 00 00: Communications General.

1. 3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

B. Soares Book on Grounding, 2002

1. 4 DEFINITIONS

A. Section 27 00 00: Communications General.

1. 5 DESIGN REQUIREMENTS

A. Historically, proper protection, grounding, and bonding has not taken place at Johns Hopkins campuses. Any design of new cable to a building shall trigger upgrades to all cable plant elements in the area to address any violations to current codes. This may include the design of lightning protectors, grounding busbars, and bonding backbones.

B. Establishing a suitable network ground is critical in grounding network equipment. A network ground is always required. Refer to ANSI-J-STD-607-A standard.

C. The telecommunications grounding system shall have a single point of attachment at the main electrical grounding electrode conductor. Other attachments to the system are made (to electrical service panels, etc.), but these only serve as supplemental connections and shall not be considered primary connections.

D. Without electrical service, specify a driven ground rod which is a minimum of ½” in diameter and 8 ft long. (Refer to NEC section 800-40.)

E. All grounding and bonding systems shall be carefully reviewed and pre-approved by Johns Hopkins Personnel. Any design may need to be enhanced for additional capacity beyond the scope of a current project to address the overall building needs.

F. Busbars

1. Specify a TMGB at the entrance facility or the main electrical room, and a TGB for all other network rooms.
2. The TMGB shall be bonded to an approximately sized Bonding Conductor for Telecommunications (BCT) and TBB with two-hole lugs or exothermic welds. Exothermic welds are preferred for these bonds.
3. Specify a TMGB with insulated mounting brackets.
4. Specify a TGB with insulated mounting brackets.
5. Do not connect the BCT to the grounding electrode conductor or to the electrical service ground. Design for adequate slack in a coil at the electrical service or at the grounding electrode for Johns Hopkins electricians to make the connection. On new construction, the electrical contractor may make this connection.
6. Specify a rack-mount grounding busbar in each rack.
7. Specify a rack-mount busbar on the back of the rack, just below the fiber housing, or at a similar height for racks without housings.

8. Specify the position of the TMGB/TGB such that it is protected from physical damage from moving equipment, foot traffic, floor cleaning, etc.

G. Conductors

1. The TBB and BCT shall be the same size cable.
2. Size and specify the TBB as a continuous cable from the TMGB to the farthest network room. Specify the use of pigtails to connect TGBs to the TBB. Pigtails shall attach to the TBB with irreversible compression connector (H-tap) or exothermic weld. Specify that the TBB is not to be cut, with both ends bonded directly to the busbar. The end of the TBB farthest from the TMGB may be bonded directly to the TGB.
3. Network bonding relies on short direct paths that have minimum resistive and inductive impedance. Specify the following:
    a. Bonding conductors shall be routed with minimum bends or changes in direction.
    b. Bonding connections shall be made directly to the points being bonded.
    c. Unnecessary connections or splices in bonding conductors shall be avoided, but when necessary, use an approved connection and position it in an accessible location.
4. Busbars may be bonded to structural steel as a telecommunications bonding backbone. Steel within buildings is not necessarily structural steel and, therefore, properly bonded to the building ground. Impedance testing shall be required to confirm potential steel within entrance facilities and network rooms as being properly grounded and available for use as a grounding conductor.
5. Structural steel used as lightning down-conductors shall not be used as a TBB.
6. Where possible, design a conductor from the EF busbar to structural steel within the same room or one within close proximity. Bonds to structural steel shall be exothermic welds. Vertical structural steel used a lightning down-conductors shall not be bonded to the telecommunications bonding system. In this instance, other structural steel (e.g. horizontal members) shall be bonded to the EF busbar.
7. Specify a conductor from any busbar to any electrical service panel within the room. Do not connect the conductor to the panel, rather provide adequate slack in a small coil.
8. Specify a conductor from the any busbar to any metallic cold-water pipes within the room.
9. Specify grounding equalizer as required by BICSI methodologies for multiple TBBs.

H. Bonding.

1. Specify bonding all telecommunications busbars to any electrical service panel and structural steel within the network room or entrance facility.
2. **IMPORTANT - Explicitly warn installers not to bond to gas piping and to confirm all potential cold-water pipes.**
3. Specify all necessary grounding hardware to properly ground the equipment in the network room per codes, standards, methodologies, and specifications.
4. Self-tapping screws, or any other type of screw, shall not be specified to form bonds or attach grounding hardware. All specified bonds shall be irreversible compression connectors, exothermic welds, or bolts.
5. Specify the bonding the EF busbar to an appropriately sized TBB with a two-hole lug or an exothermic weld.

1. 6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each system component specified in this section.

1. 7 PROJECT CONDITIONS

A. Contractors shall not attach grounding conductors from the telecommunications busbar or protectors to the main electrical building grounding busbar, grounding electrode conductor, or any element of the main electrical service distribution panel. Contractors shall provide the conductor and connector in a position to allow a Johns Hopkins electrician to make the final connection of an Information Transport System grounding system to the electrical grounding system.

B. Contractors shall not make modifications to the telecommunications grounding system without notifying Johns Hopkins Personnel, Networking, and Telecommunications in advance.

C. Contractors shall not attach grounding conductors to aerial (utility pole) grounding systems. Contractors shall notify the appropriate utility or Johns Hopkins Personnel for Johns Hopkins poles with an existing grounding system) to make the connection, unless otherwise instructed by the utility company. Contractors installing aerial grounding systems for a Johns Hopkins pole without an existing grounding system shall provide all connections at the pole and shall notify Johns Hopkins Personnel of any other ungrounded cables in need of remedial grounding.

D. Protectors and grounding and bonding hardware shall be of manufacturers specified by this document.

E. All grounding conductors shall be sized such that if the maximum current possible for the electrical grounding electrode conductor passes through the telecommunications grounding system, the voltage drop over the grounding conductors shall not exceed 40 volts. Contractors shall provide the sizing calculations based on the grounding electrode conductor to Johns Hopkins or shall request these calculations from Johns Hopkins.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Busbars

1. Manufacturers
    a. Harger TMGB kit (#TGBI14420TMGBKT), or individual component.
    b. Harger TGB kit (#TBGI14220TGBKT), or individual components.
    c. Chatsworth BICSI & ANSI/TIA/EIA Grounding Busbars, 20" TMGB (40153-020), with prior approval.
    d. Chatsworth BICSI & ANSI/TIA/EIA Grounding Busbars, 12" TGB (13622-012) for small network rooms, with prior approval
2. Rack-mount busbar
    a. Ortronics Grounding Strip (OR-GBH19KIT – horizontal, OR-GBV72 - vertical)
    b. Chatsworth Horizontal Rack Busbar, 19" (10610-019)

B. Conductors

1. Bare copper conductor, stranded

2. Insulated copper conducted, insulated, green, stranded or solid

C. Exothermic weld materials

1. Manufacturers

a. Erico; Cadweld products

b. Continental Industries; Thermoweld products

D. Connectors

1. Two-lug connectors, UL-listed, irreversible compression

2. Single-lug connectors, UL-listed, irreversible compression

3. Exothermic weld connectors, UL-listed

E. Stand-off Insulators

1. Harger

2. Chatsworth

F. Other materials as needed to form a complete grounding system.

PART 3 EXECUTION

3.1 INSTALLATION

A. Entrance Facility Installations.

1. Contractors shall position the TMGB such that it is protected from physical damage from moving equipment, foot traffic, floor cleaning, etc.

2. Contractors shall install the TMGB with stand-off insulators.

3. If building TMGB is located in another room, the Contractor shall install a TGB with stand-off insulators.

4. The TMGB shall be bonded to an appropriately sized grounding conductor with a two-hole lug or an exothermic weld. An exothermic weld is preferred for this bond.

5. Contractors shall not connect the TMGB to the grounding electrode conductor or to the electrical service ground. Contractors shall leave adequate slack in a coil at the electrical service or at the grounding electrode for Johns Hopkins electricians to make the connection.

6. Contractors shall bond the entrance facility busbar to an appropriately sized TBB with a two-hold lug or an exothermic weld. TBB sizing is specified under the section on ISP grounding.

7. Where possible, Contractors shall install a conductor from the entrance facility busbar to structural steel within the same room or one within close proximity. Bonds to structural steel shall be exothermic welds.

8. Contractors shall install a conductor from the entrance facility busbar to any electrical service panel within the room. Contractors shall not connect the conductor to the panel, but shall provide adequate slack in a small coil.

9. Contractors shall install a conductor from the entrance facility busbar to any metallic cold-water pipes within the room.

B. Network Room Installations

1. The Contractor shall install a grounding busbar in each rack. The Contractor shall install

a busbar on the back of the rack, just below the fiber housing, or at a similar height for racks without housings.

2. The Contractor shall prepare all painted or non-conductive surfaces as necessary to achieve a sufficient bond. Star washers may be used to penetrate painted surfaces, if a sufficient bond can be achieved.
3. The Contractor shall provide and install all necessary grounding hardware to properly ground the equipment in the network room per codes, standards, methodologies, and specifications listed in this document. Self-tapping screws, or any other type of screws, shall not be used to form bonds or attach grounding hardware.
4. Within each network room, the Contractor shall provide and install an insulated (green), stranded #6 copper ground wire from a network room busbar to each of any:
    a. Racks
    b. Ladder rack
    c. BETs
    d. Electrical service panels- The Contractor shall provide and install two-lug connectors or exothermic bonds to the busbar and shall provide small service loops at the electrical service panels. The connection to any panel shall be made by others.
    e. Metallic cold-water pipes- The Contractor shall verify the identification of the water pipe with JHU prior to bonding to it. The Contractor shall provide and install two-lug connectors or exothermic bonds to the busbar and shall provide and install appropriate grounding connectors for the water pipes, if present.
5. The Contractor shall not bend the grounding conductor wires into tight angles. Changes in direction shall be of the highest radius possible.

C. Large Telecommunications Enclosures Installations

1. The Contractor shall install a grounding busbar in any enclosure housing networking or other active equipment. The Contractor may install the busbar at any accessible and reasonable location. The busbar may be a rack-mount busbar attached to rails or a backboard.
2. The Contractor shall prepare all painted or non-conductive surfaces as necessary to achieve a sufficient bond. Star washers may be used to penetrate painted surfaces, if a sufficient bond can be achieved.
3. The Contractor shall provide and install all necessary grounding hardware to properly ground the equipment in the network room per codes, standards, methodologies, and specifications listed in this document. Self-tapping screws, or any other type of screws, shall not be used to form bonds or attach grounding hardware.
4. The Contractor shall connect the enclosure to a TBB with no more than 30 feet of insulated (green) stranded #6 copper ground wire.
5. The Contractor shall not bend the grounding conductor wires into tight angles. Changes in direction shall be of the highest radius possible.

D. Testing

1. The Contractor shall test the impedance of all bonds of the grounding system, including cable armor bonding to ground. The impedance of a two-point bonding test across any bond shall not exceed 0.1 ohm. The Contractor shall remediate any bond(s) over this limit or which contribute to a total impedance exceeding 0.1 ohm from any point in the

network room to the busbar in that room.

2. All bonds installed by the contractor shall be tested for impedance with an earth ground resistance test in its two-point setup, such as a LEM and GEO tester. Place a QA label (with date and inspector) in proximity to each bond tested.
3. Test all grounding conductors, once installed, for current. Measure AC and bi-directional DC current. Report any AC current over 1 Amp. Report any DC current, in either direction, over 500 milliamps.

END OF SECTION

27 05 28 - INTERIOR PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Section 27 05 28.02 - Systems Furniture

B. Section 27 05 28.10 - Conduit

C. Section 27 05 28.11 - Surface Metallic Raceways

D. Section 27 05 28.12 - Surface Nonmetallic Raceways

E. Section 27 05 28.13 - Communication Systems Furniture Poles

F. Section 27 05 28.14 - Cable Trays for Communications

G. Section 27 05 28.15 - Boxes

H. Section 27 05 28.29 - Hangers and Supports for - Communications

1. 2 REFERENCES

A. See Architectural Section - Reference Standards

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. Communications cabling shall be pulled through a combination of open space, conduits and cable trays. These conduits and cable trays shall be used to route cabling between the building Network rooms and to each work area location. The pathway shall be designed to provide the capacity to properly install high performance UTP and Fiber Optic cabling for present and future use.

B. In most cases, cabling shall be installed within building provided conduit and cable tray. In instances where conduit or cable tray is not used, it is imperative that all new cable installed be appropriately supported so that no cable rests directly on ceiling tile, mechanical ductwork, or other structures. Cables shall be neatly routed and bundled above the drop ceilings in bundles containing fifty (50) cables or less, and be properly supported to minimize pair distortion. The use of cable tray is most appropriate. High performance sling-type supports may be used for adds/moves/changes or low cable count pathways. Supports shall be selected following manufacturers recommendations for cable counts installed.

C. The support wire and rods for the suspended ceilings shall not be used for cabling support. Cables shall not be laid directly on ceiling tiles or rails. Cables placed in hangers in the ceiling area shall be routed high and away from all other electrical and mechanical systems so as to avoid contact with light fixtures, ventilation ducts, sprinkler system or plumbing piping, motors or any other electrical devices. The cable shall not be run in parallel with any high voltage electrical wiring. The maximum separation between support points for all cabling shall be five (5) feet.

D. All cable pathway material elements shall be certified by the manufacturer for a high-performance twisted pair installation, when applicable. In all cases, support products shall be approved for the support of Category 6A or higher cables, including optical fiber.

E. When existing sleeves or shafts between floors are not adequate, design for a core and sleeve. Specify sealing the new holes as required.

F. Specify a nylon pull string in all cable trays, conduits, MaxCell, innerducts, raceways, and sleeves. Secure the pull string in neat and professional manner within outlet boxes and raceways, or tie loosely to a cable bundle existing a sleeve.

G. Specify the necessary hardware to ensure the minimal bend radius as cables enter/exit conduits, sleeves, and cable trays. Specify bushings for all stub-out conduits, sleeves, etc. as necessary. Sharp edges and points are to be avoided on all pathway elements, including “all thread” support rods.

H. Electrical non-metallic tubing (innerduct or “Smurf tube”) and flexible metallic tubing shall not be used within the horizontal cable system.

PART 2 PRODUCTS

See individual sub-sections

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer’s instructions to ensure a manufacturer certified solution.

B. Cable pathways shall include: surface-mounted conduits, sleeves/conduits from hallways to laboratory and office spaces, cable trays in hallways and pedestrian tunnel, double gang boxes within walls, raceways above laboratory counters, and raceways suspended from laboratory ceilings.

C. The Contractor shall leave a nylon pull string in all cable trays, conduits, raceways, and sleeves upon completion of the work. The Contractor shall secure the pull string in neat and professional manner within the outlet box or raceway or tied very loosely to a cable bundle exiting a sleeve.

D. The Contractor shall confirm locations of supports and cable pathways above concealed with Johns Hopkins during installation to maximize conflicts with other building systems in the ceiling spaces.

E. The Contractor shall install necessary hardware to ensure the minimal bend radius as cables enter/exit conduits, sleeves, and cable trays.

F. The Contractor may need to coordinate exact placement of pathway elements with other trades.

G. The Contractor shall maintain the bend radii for optical fiber cables and copper cables when transitioning to/from cable support system.

H. Install minimum of 6 inches away from any light fixture or other source of electromagnetic interference (EMI).

END OF SECTION

27 05 28.02 - SYSTEMS FURNITURE

PART 1 GENERAL

1. 1 NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General

1. 3 DESIGN REQUIREMENTS

A. COMMUNICATIONS CABLING

B. Communication cables in modular furniture must be routed in internal pathways dedicated to communication cables. Modular furniture communication pathways shall not have power cabling or flexible metallic conduit containing power cabling.

1. Design all modular furniture pathways to support a maximum of 50% cable fill. The design shall consider this value at the tightest point in the pathway, and should also consider the projection of modular outlets into the raceway space and their impact on the overall raceway cross-section.
2. Specify flush work area outlet adapters. Surface-mount boxes are not to be used on modular furniture.
3. Modular furniture may be cabled directly from network rooms. Cable all work areas directly to the network rooms where the installation of modular furniture is intended to be a long-range installation.
4. Surface-mount raceways installed beneath the work surface may be used.

PART 2 PRODUCTS - Not Applicable

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Contractors shall not install network cabling in the same pathway as power cabling, even if the power cabling is in flexible metallic conduit.

C. Contractors shall not exceed 50% cable fill. The Contractor shall consider cable routing from attached modular panels when calculating cable fill.

D. The Contractors shall install work area outlet into flush adapters. Full size single- or double-gang boxes with faceplates shall not to be used on modular furniture. Surface-mount boxes with side outlet locations may be used if flush bezels cannot be used.

E. Contractors shall install bezels or bushings, as needed, to eliminate edges that may damage modular cords.

F. Surface-mount raceway and boxes shall be attached to fabric panels or other vertical partitions in such a way as to prevent detachment. Adhesive tape shall not be used.

END OF SECTION

27 05 28.10 – CONDUIT

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Conduit, fittings and conduit bodies.

1. 2 REFERENCES

A. ANSI C80.1 - American National Standard Specification for Rigid Steel Conduit – Zinc Coated; 1994

B. ANSI C 80.3 - American National Standard Specification for Electrical Metallic Tubing – Zinc Coated; 1994

C. ANSI C80.5 - American National Standard Specification for Rigid Aluminum Conduit; 1994.

D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2001.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies; National Electrical Manufacturers Association; 2003.

G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80); National Electrical Manufacturers Association; 2003.

H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.

I. FNPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN CONSIDERATIONS

A. Design all enclosed pathways to support a maximum of 50% cable fill.

B. A minimum of four (4) EZ Path Series 44+ Fire Rated Pathway shall be specified with device mounting bracket between stacked communications rooms. (Or Approved Equal) Sleeves shall extend 4" above and below the floor and be no farther than 4" from the wall. In a larger building, follow BICSI guidelines (40,000 sq. ft. rule) for additional penetrations based on total square footage serviced.

C. With regard to non-stacked rooms, conduit turns shall be designed with sweeping radii having no more than two (2) 90° bends. The inside radius of the conduit bends shall never be less than 10 times the internal diameter of the conduit. Pull boxes cannot be used in place of a 90° bend.

D. Conduits used as stub-outs shall be sized at a minimum of 1.5 inch in diameter.

E. Cables in mechanical spaces or lab environments requiring more stringent physical protection of cables shall be run in conduit.

F. All conduits shall be specified with pull string (200 lbs. or equivalent) and fire stopped at all rated partitions. Any used conduit shall be filled with MaxCell or Johns Hopkins IT Infrastructure Project Team approved substitute.

G. Firestopping at the Johns Hopkins Hospital is done by the owner. All conduits must be

installed per JHH Standard Specification so the owner, not the contractor, can perform the firestopping unless otherwise noted within the design documents.

H. The use of conduit bodies or condulets (e.g. LB, LL, LR, C, X, T, TB) is prohibited.

I. A minimum of one 4" conduit is required between network rooms on the same floor of a building. If cable tray or other support structured connect the two rooms, a dedicated conduit is not required.

J. Electrical nonmetallic tubing shall not be used within the horizontal cable system.

K. Flexible metallic tubing (“Greenfield”) shall not be used within the horizontal cable system.

L. OSP cables shall be installed within rigid metallic conduit or intermediate metal conduit over the entire pathway, if extending over 50 feet to the entrance facility.

M. OSP cable shall not be run in electrical metallic tubing (EMT), unless the total length of the cable within the building is below 50 feet and the conduit is used for mechanical protection or as a sleeve between the floor with the entrance point and the next floor in either direction.

1. 5 SUBMITTALS

A. Product Data: Provide the metallic conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies data.

B. Project Record Documents: Accurately record actual routing of conduits 2 inches (51 mm) or larger.

1. 6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. As suitable for purpose specified and shown.

1. 7 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2. 1 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.

1. Minimum Size: 1.5 inch (25 mm) unless otherwise specified.

B. Underground Installations:

1. More than Five Feet (1.5 Meters) from Foundation Wall: Use rigid steel conduit, thick-wall non-metallic conduit, or thin-wall non-metallic conduit.
2. Within Five Feet (1.5 Meters) from Foundation Wall: Use rigid steel conduit.
3. In or Under Slab on Grade: Use rigid steel conduit or thick-wall non-metallic conduit.
4. Minimum Size: 4 inches (254 mm).

C. Outdoor Locations Above Grade: se rigid steel conduit or intermediate metal conduit.

D. In Slab Above Grade:

1. Use rigid steel conduit or thick-wall nonmetallic conduit.
2. Maximum Size Conduit in Slab: 1.5 inch (25 mm)

E. Wet and Damp Locations: Use rigid steel conduit or thick-wall nonmetallic conduit.

F. Dry Locations:

1. Concealed: Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing, or thick-wall nonmetallic conduit.
2. Exposed: Use rigid steel conduit, intermediate metal conduit electrical metallic tubing, or thick-wall nonmetallic conduit.

2. 2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2. 3 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2. 4 NON-METALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2. 5 NONMETALLIC TUBING (EXTERIOR USE)

A. See Section 33 8126 - Communications Underground Ducts, Tunnels, Maintenance Holes, and Handboxes

PART 3 EXECUTION

3. 1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3. 2 INSTALLATION

A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install steel conduit as specified in NECA 101.

C. Install no more than equivalent to two 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

D. Provide suitable pull string in each empty conduit except sleeves and nipples.

E. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

3.3 INTERFACE WITH OTHER PRODUCTS

F. Install conduit to preserve fire resistance rating of partitions and other elements.

G. Route conduit through roof openings for piping and ductwork wherever possible. Where

separate roofing penetration is required, coordinate location and installation method with roofing installation.

END OF SECTION

27 05 28.11 - SURFACE METALLIC RACEWAYS

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Surface Metallic Raceways.

B. Fittings.

C. Device Brackets and Plates.

D. Cover Brackets and Face Plates.

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

B. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).

C. UL 5 - Surface Metal Raceways and Fittings; Underwriters Laboratories Inc.; 1996.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN CONSIDERATIONS

A. Throughout Johns Hopkins there are locations that preclude the installation of communications cables inside the walls. In those areas where the wall is not accessible, specify a communications management raceway system. These systems shall be available in multiple sizes with all of the required components such as, raceways, high performance twisted pair rating fittings (tees and elbows) and junction boxes. Raceway components shall match the color and finish of WAO faceplates exactly.

B. The use of dual channel raceway (power and communications) is allowed. All products shall be UL-listed for this application. Proper connectors and fittings shall be specified to ensure separation of utilities.

C. In dormitories and student areas, raceway shall be metallic or high-impact resistant plastic. Raceway must be very securely anchored at all points. Raceways in these areas shall anticipate considerable physical abuse.

D. Surface mounted raceways shall be available in one piece latching cover, or two-piece snap-fit design. Raceways shall accommodate all required fittings and boxes with no modification. Raceways shall be UL listed and meet NEC Article 386 requirements. Raceway shall be available with or without adhesive backing and should have optional backing for use on cinder block, stucco and wood. Adhesive backing is NOT the preferred method of attachment and should only be used when fasteners cannot be used.

E. Surface mounted boxes shall be available in single or dual gang configurations. Boxes shall be UL listed and match the color of faceplates and raceway exactly. The faceplate shall attach directly to the surface mount box without requiring the use of any adapters.

F. The use of surface-mount raceway shall be pre-approved by Johns Hopkins. All surface-mount raceways shall be designed to maintain required copper and fiber bend radii. All surface-mount raceways shall anticipate the future installation of up to six category 6 UTP cables. Raceways must be sized accordingly and include the use of fiber-ready corners.

G. IMPORTANT: JHMI Facilities department requires full disclosure of project locations due to restrictions imposed by Infectious Disease Control. In some locations, especially as they relate to some patient areas, cabling installed above the accessible ceiling is not allowed.

In these locations, appropriately sized surface mounted raceway shall be installed to facilitate the installation of the cable. The location of this surface mounted raceway shall be approved by NTS prior to installation. Other locations may require isolated work areas and air filters.

1. 5 SUBMITTALS

A. Product Data: Manufacturer's descriptive literature for each system component specified in this section.

B. Shop Drawings: Indicate raceway layouts, each system component required for complete system, raceway lengths, device types, and locations; identify all circuits.

C. Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1. 6 DELIVERY, STORAGE, AND HANDLING

A. Store products of this section in manufacturer's unopened packaging until installation.

B. Maintain storage area conditions for products of this section in accordance with manufacturer's instructions until installation.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Surface Metallic Raceways:

1. Acceptable product: Wiremold 4000 System or Owner accepted substitute.
2. Produce description: Two-piece system of galvanized steel, nominal 0.050-inch (1.27 mm) metal thickness, having total assembled cross-section dimension 4.75 inches (120 mm) high by 1.75 inches (44 mm) deep, having cross-section area 7.5 square inches (4838 sq. mm), consisting of base, snap-on cover, and removable longitudinal barrier, dividing raceway interior into two equal spaces. Other sizes may be used based on project requirements.
3. Finish: Ivory polyester topcoat over ivory primer, capable of being field-painted.

B. Fittings:

1. Factory-formed units to complete indicated configuration of raceway systems, including, but not limited to, the following:
   a. External corner units.
   b. Internal corner units.
   c. Flat units.
   d. Blank end units.
   e. Elbows.
   f. Couplings: One per raceway joint location.
   g. Wire clips: One for every 2 linear feet (609 mm) of indicated raceway configuration.
   h. Replacement longitudinal barrier: One section for every 8 linear feet (2438 mm) of indicated raceway configuration.
2. Material: Same material and metal thickness as linear raceway components.
3. Finish: Matching linear raceway components.

C. Device Brackets and Plates:

1. Factory-formed brackets and plates allowing installation of indicated power, data, and communications devices, both single-gang and two-gang, either vertically or horizontally in raceways.

2. Finish: Color matching linear raceway components.

D. Cover Brackets and Face Plates:

1. Plastic device mounting brackets and trim plates allowing installation of indicated power, data, and communications devices horizontally in raceways; trim cover size to overlap device cut-out in raceway, concealing seams.

2. Finish: Color matching linear raceway components.

2. 2 DESIGN REQUIREMENTS

A. The design shall not allow the use of single gang, surface-mount box with a standard faceplate. Surface-mount locations shall use shallow, wall-mounted boxes with outlets on the side not on the face, of the box.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that substrates are prepared to receive products specified in this section.

3.2 INSTALLATION

B. IMPORTANT - JHMI Facilities department requires full disclosure of project locations due to restrictions imposed by Infectious Disease Control. In some locations, especially as they relate to some patient areas, cabling installed above the accessible ceiling is not allowed. In these locations, appropriately sized surface mounted raceway shall be installed to facilitate the installation of the cable. The location of this surface mounted raceway shall be approved by NTS prior to installation. Other locations may require isolated work areas and air filters.

C. Install components of raceway system in accordance with shop drawings and manufacturer’s installation instructions.

D. Raceway shall be mounted in an unobtrusive manner. Horizontal raceway shall be used at the baseboard elevation, under or over chair rails, or along the ceiling. Where possible, raceway shall extend down from a WAO. The Contractor shall discuss placement of raceway prior to installation with the JH project manager.

E. Contractors firmly secure surface-mount raceway. Raceway should not be attached with adhesive mounts.

F. Installation of wiring for communications devices is specified in Section 27 15 00.

G. Contractors shall not exceed 50% cable fill.

END OF SECTION

27 05 28.12 - SURFACE NON-METALLIC RACEWAYS

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Surface Non-Metallic Raceways.

B. Fittings.

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002

B. TIA/EIA-569 - Commercial Building Standards for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN CONSIDERATIONS

A. Throughout Johns Hopkins there are locations that preclude the installation of communications cables inside the walls. In those areas where the wall is not accessible, the design shall specify a communications management raceway system. These systems shall be available in multiple sizes with all of the required components such as, raceways, high performance twisted pair rated fittings (tees and elbows) and junction boxes. Raceway components such match the color and finish of TO faceplates exactly.

B. The use of dual channel raceway (power and communications) is allowed. All products shall be UL-tested for this application. Proper connectors and fittings shall be specified to ensure separation of utilities.

C. In dormitories and student areas, raceways shall be metallic or high-impact resistant plastic. Raceway must be very securely anchored at all points. Raceways in these areas shall anticipate considerable physical abuse.

D. Surface mounted raceways shall be available in one piece latching cover, or two piece snap-fit design. Raceways shall accommodate all required fittings and boxes with no modification. Raceways shall be UL® listed (5A) PVC-rated up to 600 volts and meet NEC Article 388 requirements. Raceway shall be available with or without adhesive backing and should have optional backing for use on cinder block, stucco and wood. Adhesive backing is NOT the preferred method of attachment and should only be used when fasteners cannot be used.

E. Surface mount boxes shall be available in single or dual gang configurations. Boxes shall be UL® listed and match the color of faceplates and raceway exactly. The faceplate shall attach directly to the surface mount box without requiring the use of any adapters.

F. The use of surface-mount raceway shall be pre-approved by John Hopkins. All surface-mount raceways shall be designed to maintain required copper and fiber bend radii. All surface-mount raceways shall anticipate the future installation of up to six category 6 UTP cables and/or 2-strand optical fiber cable. Raceways must be sized accordingly and include the use of fiber-ready corners.

G. IMPORTANT: JHMI Facilities department requires full disclosure of project locations due to restrictions imposed by Infectious Disease Control. In some locations, especially as they relate to some patient areas, cabling installed above the accessible ceiling is not allowed. In these locations, appropriately sized surface mounted raceway shall be approved by NTS prior to installation. Other locations may require isolated work areas and air filters.

1. 5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate raceway layouts, raceway lengths, device types, and locations; identify all circuits.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1. 6 DELIVERY, STORAGE, AND HANDLING

A. Store products of this section in manufacturer's unopened packaging until installation of products.

B. Maintain storage area conditions for products of this section in accordance with manufacturer's instructions until installation.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Surface Nonmetallic Multi-channel Raceway System or Owner accepted substitute.

1. Acceptable Product: Wiremold Access 5000 System.
2. Corner Units:
    a. Supply factor-formed cover and trim cover units for internal and external corners of indicated raceway layouts:
    b. Finish corner units to match linear cover and trim cover units.
3. Fittings:
    a. Supply factory-formed fittings specified in manufacturer's product data for indicated configurations and service requirements.

B. Surface Nonmetallic Single Channel Raceway System

1. Acceptable Product: Wiremold Eclipse PN03, PN05, PN10 Series, and Panduit LD series.
2. Surface mount boxes
    a. Wiremold Large Data Box, four port, PDB4TJ
3. Corner Units:
    a. Supply factory-formed cover and trim cover units for internal and external corners of indicated raceway layouts:
    b. Finish corner units to match linear cover and trim cover units.
4. Fittings:
    a. Supply factory-formed fittings specified in manufacturer's product data for indicated configurations and service requirements.
    b. Finish: White.

PART 3 EXECUTION

3. 1 INSTALLATION

A. IMPORTANT - JHMI Facilities department requires full disclosure of project locations due to restrictions imposed by Infectious Disease Control. In some locations, especially as they relate to some patient areas, cabling installed above the accessible ceiling is not allowed. In these locations, appropriately sized surface mounted raceway shall be installed to facilitate the installation of the cable. The location of this surface mounted raceway shall be approved by NTS prior to installation. Other locations may require isolated work areas and air filters.

B. Install components of raceway system in accordance with manufacturer's installation instructions.

C. Raceway shall be mounted in an unobtrusive manner. Horizontal raceway shall be used at the baseboard elevation, under or over chair rails, or along the ceiling. Where possible, raceway shall extend down from a WAO. The Contractor shall discuss placement of raceway prior to installation with the JH project manager.

D. Contractors firmly secure surface-mount raceway. Raceway should not be attached with adhesive mounts.

E. Installation of wiring for communications devices is specified in Section 27 15 00.

F. Contractors shall not exceed 50% of cable fill.

END OF SECTION

27 05 28.13 - COMMUNICATION SYSTEMS FURNITURE POLES

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Utility columns.

1. 2 REFERENCES

A. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN CONSIDERATIONS

A. Utility poles must be approved by the Johns Hopkins IT Infrastructure Project Team. Utility poles shall be approved for power and communications cabling, with separate pathways. Architectural columns should be considered in place of standard utility poles.

B. Utility poles shall have pre-manufactured knock-outs for work area outlets. WAOs shall be installed flush or with the minimal profile. Surface-mount boxes shall not be used on utility poles.

1. 5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on materials, finishes, receptacle and connector configuration, and attachment details.

PART 2 PRODUCTS

2. 1 MANUFACTURERS

A. The Wiremold Company: www.wiremold.com

2. 2 UTILITY COLUMN COMPONENTS

A. Main Body: Steel.

B. Cover Plates: Steel or Plastic.

C. Convenience Receptacle Configuration: NEMA WD 6; Type 5-15. Furnish 4 per column.

D. Foot: Suitable for floor finish as indicated.

E. Provide concealed top clamp to fasten pole to inverted “T” grid ceiling suspension member.

2. 3 ACCESSORIES

A. Trim plates for closing ceiling opening.

B. Flexible cable assembly with connector for branch circuit connections.

2. 4 FABRICATION

A. Provide full-sized opening at top of pole.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Install utility columns plumb and fasten supports to structure.

C. Contractors shall use pre-manufactured knock-outs for work area outlets. WAOs shall be installed flush or with the minimal profile. Surface-mount boxes shall not be used on utility poles.

D. Neatly cut openings in ceiling panels. Install trim plate.

END OF SECTION

27 05 28.14 - CABLE TRAYS FOR COMMUNICATION

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Cable trays and accessories.

1. 2 REFERENCES

A. NEMA VE 1 - Metallic Cable Tray Systems; National Electrical Manufacturers Association; 2002.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN CONSIDERATIONS

A. Shall be installed to allow open space above and to one side of the tray. Actual dimensions of cable tray shall be determined by the volume of cable planned for installation at the time of construction, and account for future growth. The cable tray shall not be filled more than 50% of its capacity. Cable tray shall extend into the communications room providing access to racks and walls in a “T” design. Small rooms may use a single, straight cable tray in line with the rack, provided it extends parallel to the face of the rack.

B. Cable trays shall be installed only in corridors, hallways, and communications rooms, and not above individual offices, conference rooms, restrooms, etc.

C. A minimum of (2) 4" conduits shall be used in place of cable tray when installation involves passing over inaccessible ceilings. Additional conduits may be required as cable volume dictates. Determination of conduit requirements shall be coordinated with the Johns Hopkins Infrastructure Project Team.

D. Design the cable tray products within network rooms for vertical strain relief as needed while maintaining 50% additional capacity within the support structure. Nothing shall be attached to tray without written approval by the Owner, JHH IT Personnel.

E. Specify appropriate hardware and part to attach the tray to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting the cable tray). Parts shall be specifically designed and where possible UL-listed for their final installed configuration.

1. 5 SUBMITTALS

A. Product Data: Provide data for fittings and accessories.

B. Shop Drawings: Indicate tray type, layout, dimensions, support points, and finishes.

C. Closeout Submittals: If variations from approved shop drawings occur during installation of cable tray, submit final as-built drawings indicating such variations.

1. 6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. As suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2. 1 MANUFACTURERS

A. Cablofil, Inc.: www.cablofil.com

1. Wire Cable Tray

B. GS Metals Corp.: www.flextray.com

1. FLEXTRAY Cable Management System

C. Cable Management Solutions, Inc.

1. Floor and Overhead Snake Tray
2. Snake Canyon
3. Wall Snake
4. Ladder Snake

2. 2 LADDER-TYPE CABLE TRAY (MDF & NR LOCATIONS)

A. Description: Universal cable Runway; 18”W x 1.5”H x 9.96’L; Glacier White.

A. Material: Made of 3/8” x 1-1-½" x .065” (9.53 mm x 38 mm x 1.65 mm) wall rectangular steel tubing.

B. Cross members welded at 12” (300 mm) intervals

C. Manufacturer: Chatsworth (10250-E18) or approved equal

D. Mounting accessories finish/color: Gold Chem

2. 3 TROUGH-TYPE CABLE TRAY

A. Description: NEMA VE 1, Class 20C trough type tray.

B. Material: Formed aluminum or sheet steel.

C. Covers: Flanged, solid, flush cover.

2. 4 WIRE MESH/BASKET METAL CABLE TRAY

A. Description: NEMA VE 1, wire mesh/basket metal cable tray.

B. Material: Formed sheet steel, hot-dip galvanized after fabrication in accordance with ASTM A 123/A 123M.

C. Wire diameter: 0.175 inches minimum

D. Minimum of two horizontal (length-wise) wires on the vertical sides.

2. 5 ACCESSORIES

A. Provide manufacturer’s standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.

B. Provide bushings or rubber edge trim as needed. All products shall be free of sharp edges or points that may damage cables.

2. 6 WARNING SIGNS

A. Engraved/Printed Nameplates: ½ inch (13 mm) black letters on yellow laminated plastic nameplate, engraved/printed with the following wording: ‘WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!”

PART 3 EXECUTION

3.1 INSTALLATION

A. Install cable tray securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install cable tray in accordance with manufacturer’s instructions. Cut cable tray using

manufacturer’s equipment, if available from the manufacturer. Deburr all edges and points.

C. Arrange supports to prevent misalignment during wiring installation.

D. Fasten supports to building structure and surfaces.

E. Cable tray elements shall be supported with manufacturer’s hardware to provide a minimal profile. Suspension shoes and brackets shall be used in place of trapeze struts. Sharp corners and threaded rod shall not extend below the basket creating a hazard.

F. Clearances: Install cable tray maintaining a minimum of:

1. 12 inches of unobstructed clearance above the cable tray’s highest plane
2. 6 inches from any source of EMI
3. 12 inches from any heat source exceeding 104 degrees F

G. If cables rise to the ceiling space of the floor above a network room (a vertical rise of 12 feet or more), the Contractor shall install cable tray in such a way as to relieve the vertical weight from the cables on all floors. The Contractor shall secure the cables with Velcro-type straps as needed to relieve vertical weight strain.

H. Continuous support elements shall be bonded to ground to TMGB/TGB with a grounding wire. Sections may be bolted together or tied together with grounding jumpers, if the support structure is approved by the manufacturer as a grounding conductor.

I. Innerduct shall not be placed in cable trays when extending horizontally from a network room.

J. Solid bottom cable tray must provide for the continual release of any trapped moisture within the cable tray.

K. Provide suitable pull; strings in all cable trays.

L. Provide suitable fittings or gaps with bonding jumpers to accommodate expansion and deflection where cable tray crosses expansion joints.

M. Cable tray shall not penetrate fire-rated barriers. Cable tray shall end within 18 inches of fire-rated barriers. Cables shall use firestop assemblies or sleeves to penetrate fire-rated barriers.

N. Identify cable tray under provisions of Section 27 05 43 - Identification for Communications Systems.

O. Ladder tray in MDF & NR locations will be mounted a minimum of 6” above network racks and cabinets.

END OF SECTION

27 05 28.15 – BOXES

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Outlet boxes.

B. Poke-thru(s)

C. Floor boxes.

D. Pull and junction boxes.

1. 2 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.

B. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2003.

C. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2003.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN CONSIDERATIONS

A. Outlet Boxes

1. Specify oversize (4-11/16 in X 4-1//16 in X 2-1/8 in) outlet boxes for work area outlet boxes with a single gang raised cover. Knockouts need to be specified for the appropriate feeder conduit.
2. Work area outlet boxes on opposite sides of a fire-rated wall shall not share the same stud space.
3. Work area outlet box elevations shall be designed in accordance with ADA requirements.

B. Poke-Thru(s)

1. In-floor conduit systems are allowed and are preferred over poke-thru penetrations, especially for work areas in open spaces without utility poles.
2. The use of poke-thru(s) shall be limited as much as possible. Where necessary, UL-tested, pre-firestopped products shall be used.

C. Floor Boxes

1. Floor boxes shall be sized to accommodate up to 6 UTP cables and 2 strands of optical fiber. It is likely AC power will be required in these boxes as well. Specify a box that can house communications cables in openings designed for communication outlets. Communication outlets are not to be installed in standard AC outlet shaped opening.

D. Pull and junction boxes

1. Design pull boxes as necessary. Pull boxes are not to be used to change direction of a conduit or cable run. All cables shall pass straight through pull boxes.
2. Pull boxes are required for long conduit runs. Place pull boxes every 98 feet (30 meters) or less and after two 90 degree bends or 180 degrees of total bend.

3. Size pull boxes according to BICSI methodologies. For example, a 1 inch conduit shall have a 4" (W) x 16"(L) x 3"(D) pull box.

1. 5 SUBMITTALS

A. Project Record Documents: Record actual locations and mounting heights of outlet, pull and junction boxes on project record documents.

B. Closeout Submittals: If variations from approved shop drawings occur during installation of boxes, submit final as-built drawings indicating such variations.

1. 6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Outlet Boxes

1. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
2. Nonmetallic Outlet Boxes: NEMA OS 2.

B. Poke-Thru(s)

1. Two 20A duplex receptacles and up to four communication devices
   a. Wiremold RC4 Flush Poke - Thru
2. One 20A duplex receptacle and up to two communication devices
   a. Wiremold RC7 Flush Poke - Thru
3. Owner approved substitute.

C. Floor Boxes

1. Wiremold Evolution Series Raised Floor Boxes
2. Other Wiremold floor boxes, as appropriate for application and as pre-approved by Johns Hopkins

D. Pull Boxes and Junction Boxes

1. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

C. Set wall mounted boxes at elevations to accommodate mounting heights as 18 inches above finished floor, unless otherwise noted.

D. Set wall mounting boxes for wall phones at 46 inches to the center of the box, if installed over a counter or other low obstruction.

E. Set wall mounting boxes for wall phones at 48 inches to the center of the box, if unobstructed access is available.

F. Boxes are shown on Drawings in approximate locations unless dimensioned.

1. Adjust box locations up to 3 feet (1 m) if required to accommodate intended purpose.

G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

I. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

J. Work area outlet boxes on opposite sides of a fire-rated wall shall not share the same stud space.

K. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

L. Use flush mounting outlet box in finished areas.

M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

N. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.

O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

P. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

Q. Do not fasten boxes to ceiling support wires.

R. Support boxes independently of conduit.

S. Use gang box where more than one device is mounted together. Do not use sectional box.

T. Contractors shall not install work area outlets in standard AC outlet shaped opening within floor boxes.

U. Set floor boxes level.

V. Large Pull Boxes: Use enclosure with removable cover in interior dry locations, surface-mounted cast metal box in other locations. Hinged lids may be used, if provided with a means to fasten securely open.

3. 2 ADJUSTING

A. Adjust floor boxes and poke-thru(s) flush with finished flooring material.

3. 3 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

27 05 28.29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1. 2 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN CONSIDERATIONS

A. Specify Erico CableCat Adjustable Cable Support (CAT425 series slings). The design may specify the use of other sling-style hangers, provided they are metal components to hold the sling closed and to secure the sling to the support structure. All plastic supports are not acceptable (e.g. Arlington Loops). Design slings to be spaced at 4 ft to 5 ft intervals. The interval must vary in a single run to prevent a standing wave induction on the cable.

B. Specify Erico CableCat Cable Supports (CAT64 series). The design may specify the use of other J-hook style hangers, provided they are metal and should be spaced at 4 ft to 5 ft intervals.

C. Specify appropriate hardware and parts to attach the supports to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting the cable supports). Parts shall be specifically designed and where possible UL-listed for their final installed configuration.

D. Design J-hooks, sling or trays to accommodate the manufacturers' recommendation of quantity of cables.

E. Specify cable supports above concealed ceilings using a rigid support to a structural element, or by attaching directly to a structural element.

F. Specify to "close" J-hook supports with manufacturer provided bars and not with cable ties.

G. Specify that J-hook supports can be attached to suspended ceiling grid-type wire with manufacturer clamps, provided:

1. The wire is painted orange prior to installation, to differentiate it from ceiling grid support wires,
2. The wire is attached to the ceiling grid with breakaway clips as required by the NEC.
3. The wire is not used to support the ceiling grid, as required by NEC.
4. The local authority having jurisdiction understands they are not supports for the ceiling grid.

1. 5 SUBMITTALS

A. Product Data: Provide manufacturer's catalog data for fastening systems.

1. 6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. As suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2. 1 MANUFACTURERS

A. ERICO International Corporation: www.erico.com

1. Caddy HP system

B. Substitutions: Owner approved substitute.

2. 2 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Anchors and Fasteners:

1. Obtain permission from Architect before using powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions; Use toggle bolts or hollow wall fasteners.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.
8. Wood Elements: Use wood screws.

PART 3 EXECUTION

3. 1 INSTALLATION

A. The Contractor shall install cable supports above concealed ceilings using a rigid support to a structural element or by attaching directly to a structural element.

B. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
2. Contractors may use existing threaded rods for other utilities, if pre-approved by JH and capable of supporting the additional load. Clearances must be maintained.
3. Obtain permission from Architect before drilling or cutting structural members.

C. The Contractor may install J-hook type or sling-type supports by attaching to suspended ceiling grid-type wire with manufacturer clamps, provided:

1. The wire shall be painted prior to installation, to differentiate it from ceiling grid support wires.
2. The wire is attached to the ceiling grid, as required by the NEC.

3. The wire is not used to support the ceiling grid, as required by the NEC, and
4. The local authority having jurisdiction understands they are not supports for the ceiling grid.

D. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

E. J-hook and sling-type supports must be installed every 4-5 feet at on irregular interval. Installation of supports at a repeating interval (i.e. every 4 feet exactly) will establish a standing wave induction of interference on the cable. Attaching supports to alternating sides of structural steel can accomplish this as can a non-linear installation.

F. The Contractor shall “close” J-hook supports with manufacturer provided clips and not with cable ties.

END OF SECTION

27 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 31 81 26 - Communications Underground Ducts, Manholes, and Handholes

B. This Section includes earthwork information in the absence of Division 31 specifications. Conflicts between this section and Division 31 specifications shall be resolved by the architect/engineer / designer in consultation with JH.

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code.

B. IEEE C2 - National Electric Safety Code.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 SAFETY AND RESTRICTIONS

A. See specific elements within this document for safety and restrictions information. Contractors shall bear all responsibility and cost to locate existing underground utilities including, but not limited to, electricity, natural gas, domestic water, steam and condensate, chilled water, sewer, storm drainage, and telecommunications. Most of these utilities are owned and maintained by Johns Hopkins. In many cases, utilities have been plastic pipe without metallic (detectable) elements. Contractors shall have all underground utilities clearly marked prior to any excavation.

B. Maryland’s Underground Facilities Protection Organization, Miss Utility, does not locate utilities within the boundaries of the Johns Hopkins University Campus. Locate contractors shall be pre-approved by Johns Hopkins Personnel.

C. Contractors shall contact Johns Hopkins immediately if unmarked utilities are discovered. Contractors shall stop all work in the area until the utility can be identified by Johns Hopkins. Contractors may be required to recall the originally pre-approved locator to trace the utility to an identifiable point. Contractors shall contact Johns Hopkins immediately if a utility is damaged in any way. Contractors shall stop all work in the area until directed by Johns Hopkins. If unable to reach Johns Hopkins Personnel, Contractors shall contact the Johns Hopkins Security Department.

D. Areas of the campus are restricted from heavy equipment, including but not limited to backhoes, concrete trucks, utility and work trucks, and other full-size vehicles. Contractors shall contact Johns Hopkins IT Infrastructure Project Team for specific restrictions based on the location of the work area.

E. During construction of all pathways, Johns Hopkins Security shall determine if closures of Johns Hopkins-controlled roads or spaces are possible at proposed dates and times. When on non-Johns Hopkins property, Contractors shall coordinate all activities with interested parties.

F. Locating done by another trade or a general contractor in the same work area and for the same overall project does not need to be repeated by the Contractors, provided 1) the entire cabling work area was recently covered, 2) the markings are bold and undisturbed, and 3) the geographic scope of the work area can be confirmed by the locating company.

G. Information from Johns Hopkins on underground utility placement does not waive Contractors from confirming the presence and location of all underground utilities in the

work area.

H. There are no specific safety information or restrictions for direct-buried pathways.

I. Contractors shall provide all necessary equipment to safely excavate and construct conduit/duct pathways. Contractor shall comply with all federal, state, and Johns Hopkins regulations regarding working in this environment. Appropriate personal protective equipment is required and shall be the responsibility of the Contractors.

J. Contractors shall provide all necessary equipment to safely excavate and construct tunnel penetrations. Contractor shall comply with all federal, state, and Johns Hopkins regulations regarding excavation and working in this environment. Personal protective equipment is required and shall be the responsibility of the Contractors.

K. See Section 27 00 00: Communications General.

1. 5 DESIGN REQUIREMENTS

A. New construction or other circumstances may require the relocation of existing OSP elements. Relocating OSP elements requires improving those elements to meet current codes, standards, methods, and specifications.

B. During the relocation of OSP elements, services provided by or through the elements shall be minimally impacted. Service outages are to be minimal and during off-hours. Extra effort may be required to accommodate the service users (e.g. using half-taps on a replacement voice backbone cable). All service outages must be pre-approved by Johns Hopkins IT Infrastructure Project Team.

C. The location of pathways shall be coordinated with Johns Hopkins Personnel early in the design process. Pathways should anticipate future campus growth with respect to placement and sizing. Pathways are likely to be oversized for a given project where the pathway is in a growth area or may have a foreseeable additional use.

D. Pathway design shall avoid older, established trees. In very rare cases, small ornamental trees that can be moved or replaced may be so treated with prior approval. Planting beds and shrubs can be disrupted as needed, provided they are fully restored to original condition.

E. Walkways and roadways can be crossed as needed, provided there is full restoration. Empty conduits have been placed under newer brick walkways to minimize walkway disruption. Designers should consult with the Office of Facilities Management to review existing site plans to locate these conduits.

F. Where possible, new conduits installed along the same pathway as an existing pathway shall be installed as part of the existing ductbank. This physical arrangement minimizes the campus area occupied by network ductbanks. Designers may design intercepting and accessing these existing pathway elements. Designers may expose the existing ductbank and use its vertical side to frame the space for the new conduits.

G. Security devices (alarms, sensors, cameras, etc.) may require dedicated cabling to specific, non-standard locations. These devices will be designed as required and may run independent of other pathways and requirements for this document. Johns Hopkins Personnel shall approve all pathway designs involving security or life-safety cabling.

H. Underground Pathways

1. Underground conduit structures are pathways used for placing network cable between access points such as MHs, HHs, HBs, and building entrances. Cable pathways should be underground, where possible. Underground pathways should be concrete-encased conduit, where possible. Special pathways may use conduits without concrete encasement or with the installation of a concrete cap. Clearances as required by NESC.

2. The conduits and fittings shall be a 4" ID PVC SCH 40. The conduits shall have bell ends and shall be joined with the appropriate adhesive for this type of conduit providing a permanent and watertight seal.
3. The diameter of a duct shall be at least 1.15 times the diameter of the cable, or one-half trade size larger in diameter than the diameter of the largest anticipated cable (whichever provides the greater clearance).
4. Underground pathways shall be designed for as minimal depth of 30" to the top of the pathway elements, where possible. Deviations from this shall be pre-approved by Johns Hopkins Infrastructure Project Team. Pathways may gradually slope up to 30" deep to enter HBs or HHs.
5. Design underground conduit elevations so that a slope exists at all points of the run to allow drainage. A drain slope toward the MH of no less than one percent grade is desirable.
6. Design for an aggregate bed of a minimum of 12 inches of compacted aggregate, under the same guidelines as MH installation, for the first 6 feet of any ductbank exiting a MH.
7. Design for conduit spacers beneath each conduit three times for every 20 linear feet of conduit with an additional support at the end. The spacers shall be evenly distributed over each 20-foot segment (e.g. one at each 20-foot joint and two evenly spaced over the middle). Each horizontal row of spacers (in cross-section) shall be designed with a 6" minimum horizontal distance from any other row of spacers so as to eliminate weak vertical shear planes.
8. Design conduit formations to facilitate orderly cable racking within the MH and ensure minimal change in the formation when entering a MH. The following recommendations allow for the design of the most efficient cable formation.
    a. The main conduit formations should enter the end walls of the MH at a point approximately halfway between the floor and roof.
    b. For wall racking considerations, design splayed duct bank entrances at the end walls rather than center placement.
    c. If the total number of conduits being places is significantly less than the capacity of the terminating MH or cable entrance, conduits should enter at the lower level. The upper space should be reserved for future conduit additions.
    d. The conduit entrance into the MH should be sized for the ultimate number of conduits to prevent the need for future wall breakouts.
9. Refer to the current BICSI CO-OSP manual for conduit bend radii. Curved sections shall be pre-manufactured. Curved segments shall have minimum of 15 ft radii. Sweeps to enter utility tunnels may be less. Any sweep below 15 ft radius shall be pre-approved by Johns Hopkins Infrastructure Project Team.
10. Duct bank configuration shall vary, depending on the spaces into which the conduits end.
11. All buildings shall have a minimum of four 4-inch conduits accessing the entrance facility. Two 4-inch conduits shall include 3 x 3” 3 Cell MaxCell.
12. Compacted aggregate to be used to backfill may be crushed stone or gravel fill provided the percent composition by dry weight as determined by laboratory sieves (U.S. series) conforms to the following grading when measured in accordance with ASTM C136-01 (Test Method C136-01 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates):
13. Lesser-grade material to be used to backfill. This backfill material may be material

removed from the original excavation. All backfill materials shall be free from boulders, large rock, asphalt, concrete, bricks, wood blocks or roots, and other debris. High quality top-soil shall be used.

14. Match sod of the same origin as the surrounding area.
15. Design for all materials to prevent erosion of seeded areas.
16. Johns Hopkins shall approve materials necessary to minimize erosion and soil run-off.
17. Design for a level layer of compacted aggregate over each encased duct bank. The bed shall extend 1 foot above the surface of the duct bank. The first 6 inches of the aggregate bed shall be compacted to not less than 95% density compared to maximum laboratory tests by weight per ASTM D1557-64T method. A. The second six inches of the aggregate bed shall be compacted to not less than 85% density compared to maximum laboratory tests by weight per ASTM D1557-64T, method A.
18. Horizontal conduits shall end flush with the interior surface of the wall. Vertical conduits ending in eaves shall be designed such that they extend a minimum of 4" above the final floor. Cut the conduits square with the conduit and not necessarily level to the floor. Bushings shall be installed on conduit ends.
19. 4" compression-type duct plugs (Condux, Nonmetallic Eye Nut Plug- 08067840), or equivalent., Universal or “push-in” type plugs (e.g. Condux, Universal Plug- 08047601) are not an acceptable substitute.
20. Install warning tape to be provided by Johns Hopkins (Empire Level Mfg. Corp. 25 071 Orange FO cable MegaStretch Underground Marking Tape) or equivalent.
21. Provide #10 copper, green insulated tracer wire.
22. Specify the installation of 3/8" or greater Neptco Polyester Muletape pull strings.
23. Once built, the conduit system should remain usable for 75 to 100 years and fulfill design specifications.

I. Encasement

1. When fully encasing in concrete, 4" ID PVC type EB-35 conduits and fittings are acceptable. The conduits shall have bell ends and shall be joined with the appropriate adhesive for this type of conduit providing a permanent and watertight seal.
2. Ductbanks shall be designed to be encased in concrete. All interbuilding pathways shall be encased. The concrete shall be 3/8" aggregate with a nominal compressive strength of 3000 PSI. Concrete surrounding the conduits shall be at least 3 inches around all sides of the conduit for complete encasement.
3. Fully encase any ductbanks that penetrate a MH or building for the first 6 feet beyond the structure.
4. When transitioning from an encased ductbank to a capped ductbank, it is not necessary to frame the transition in cross-section, provided the required area is encased to a minimum of 3 inches. The concrete may slope down into the area to be capped. If framing a transition point, the frame shall be removed prior to installing aggregate around the conduits and installing the cap.
5. Shape the top of the concrete in such a way as top slope water away from the ductbank-structure seams.
6. Design for steel reinforcing bars, vertically and horizontally, to form a vertical box framing the conduits. The vertical bars shall be driven a minimum of 6 inches deep to prevent the conduits from floating during concrete pouring. The horizontal bars shall be secured to the vertical bars to prevent movement. The vertical bars shall extend 3 inches above the top conduit row. Alternately, the bars may be less than 3 inches

above the top conduit row, if an inverted spacer is placed on the top row to provide a 3 inches depth gauge for pouring concrete.

7. The design may use “U”-shaped bars to straddle the conduits, if driven into the trench as specified above. The design may use a single horizontal bar or an upward pointing “U”-shaped bar in this configuration. The upward pointing “U”-shaped bar shall extend 3 inches over the top conduit or use an inverted spacer to provide a 3-inch depth gauge for pouring concrete.
8. Design for reinforcing bars, longitudinally. The bars shall be secured to each vertical reinforcing bar box. The longitudinal bars shall overlap 12 inches, unless welded together, and shall be secured to each other in a way to prevent movement.

J. Capping

1. Designers may propose a “capped” ductbank for certain pathways. These pathways may include parking lift gate cable or other low count cables to specific field devices. When capping a ductbank, install filler sand around the conduits providing at least 3 inches of sand below and to the side of all conduits. Filler sand above the top of the conduit ductbank shall not be allowed.
2. Design the filler sand to fill to the side walls of the trench. Compact filler sand to the sides of the conduits.
3. The design may allow for framing on the compacted surface of the sand for pouring the concrete cap.
4. Design for a 3 inch thick concrete cap over the conduits.
5. Extend the cap horizontally to a minimum of 3" beyond the outer most conduits.
6. If the cap is framed, the design may show lesser-grade backfill material to cover the sand beyond the cap once the framing is removed.

K. Non-encasement

1. In special circumstances, the design may plan for conduits installed without concrete. These installations may include parking lift gates, information kiosks, and other non-critical devices as determined by Johns Hopkins Personnel.

L. Existing Ductbanks

1. The designers may use conducts and/or innerducts within existing ductbanks as directed by Johns Hopkins Personnel. Where possible, used conduits with available innerducts or space shall be used.

M. Existing Ductbanks

1. The designers may use conducts and/or innerducts within existing ductbanks as directed by Johns Hopkins Personnel. Where possible, used conduits with available innerducts or space shall be used.
2. When designing optical fiber into a 4" conduit without existing innerduct or cable, design for three (3) MaxCell 3” 3-Cell.
3. When designing for a 200-pr. copper cable, or less into a 4” conduit, design for three (3) MaxCell 3” 3-Cell.
4. The design shall specify ribbed innerduct. Corrugated innerduct may be used only when necessary to make tight bends and then only as much as needed before making a transition to ribbed innerduct.
5. Specify Muletape in all innerducts.
6. Specify pre-formed duct plugs around innerducts and smaller compression-type duct

plugs in the innerducts.

7. Seal used conduits (when pre-formed plugs are not feasible) with a non-hardening, removable sealant (PT Tech DuckSeal Sealant). Expanding foam products designed specifically for duct sealing (e.g. 3M Part #4416 Duct Sealant Kit) may only be used on conduits considered to be at capacity by Johns Hopkins Personnel. Innerducts shall not extend beyond six inches from the end of the conduit.

N. Tunnels

1. As a pathway, the tunnels are available for use from buildings with existing tunnel access. The tunnel shall not be penetrated by minor pathways. Major pathways may penetrate the tunnel when designed to maintain the integrity of the tunnel structure.
2. The design may need to address past poor practices within the tunnels in order to use them. This could involve the installation of support mechanisms for new cabling and existing cabling in the same area.
3. When selecting media for installation, the design should ensure that it meets heat and steam requirements to ensure protection of the network physical plant, where necessary.

O. Direct-buried

1. Direct-buried pathways shall not be used. All pathways shall include the use of conduit.

1. 6 DELIVERY, STORAGE, AND PROTECTION

A. Store all materials under cover and elevated above grade. Prevent water, dirt, and debris from entering conduits and tubing.

1. 7 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of underground ducts and raceways, submit final as-built drawings indicating such variations.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Conduits

1. Manufacturers
   a. IPEX, Inc.: TerraCon PVC raceway for directional boring and open trenching
   b. Carlon: PVC Bore-Gard for directional boring and open trenching
2. PVC SCH 40
   a. Manufactured to NEMA TC2 (Electrical Polyvinyl Chloride (PVC) Tubing and Conduit) specifications
   b. Bell ends
   c. Appropriate adhesive for this type of conduit providing a permanent and watertight seal

3. PVC SCH 40 Fittings
    a. Manufactured to NEMA TC3 (PVC Fittings for Use with Rigid PVC Conduit and Tubing) specifications.
    b. Appropriate adhesive for this type of fitting providing a permanent and watertight seal
4. PVC SCH 40 Pre-Manufactured Sweeps
    a. 6 ft radius, 90-degree sweeps
    b. 45-degree sweeps of >6 ft radius
5. PVC type EB-35
    a. For use only when fully encased in concrete
    b. Manufactured to NEMA TC8 (PVC Plastic Utilities Duct for Underground Installations) specifications
    c. Bell ends
    d. Appropriate adhesive for this type of fitting providing a permanent and watertight seal
6. PVC type EB-35 Fittings
    a. For use only when fully encased in concrete
    b. Manufactured to NEMA TC9 Fittings for PVC Plastic Utilities Duct for Underground) specifications
    c. Appropriate adhesive for this type of fitting providing a permanent and watertight seal

B. Conduit Spacers
1. Manufacturers
    a. Underground Devices, WUNPEECE spacers- 4W20-2
    b. Other acceptable manufacturers offering equivalent products

C. Conduit plugs
1. Compression-type plug
2. Manufacturers
    a. Condux, Nonmetallic Eye Nut Plug- 08067840
    b. Other acceptable manufacturers offering equivalent products
3. Universal or “push-in” type plugs (e.g. Condux, Universal Plug- 08047601) not acceptable

D. Conduit Seals
1. Non-hardening, removable sealant- PT Tech DuckSeal Sealant, or equivalent
2. Expandable sealing bags, Tyco T-DUX
3. Expanding foam, 3M Part #4416 Duct Sealant Kit, or equivalent product designed specifically for duct sealing (expanding foam for insulation (e.g. Great Stuff) is not acceptable)

E. Fabric Innerduct
1. Manufacturers

a. MaxCell

F. Pull tape

1. 3/8" or larger
2. Manufacturers
   a. Neptco
      1) Polyester Muletape, 2500 lbs minimum
      2) Detectable Muletape, 22 AWG, 2500 lbs minimum
   b. Other acceptable manufacturers offering equivalent products

G. Warning tape

1. High stretch polymer, orange tape, blank print
2. Marked “Optic Fiber” or “Communications”
3. Manufacturers
   a. Empire Level Mfg., 25-071, Orange FO Cable MegaStretch
   b. Other acceptable manufacturers offering equivalent products

H. Tracer Wire

1. Green, insulated wire
2. #10 copper conductor

I. Concrete

1. 3/8" maximum size
2. Nominal compressive strength: 3000 PSI at 28 days

J. Steel reinforcing bars

1. Size- standard size #5

K. Sand for filler

1. Clean and graded
2. All passing a #4 U.S. sieve
3. Conforming to ASTM C33-01a (Standard Specification for Concrete Aggregates) for fine aggregates.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Digging and Trenching

1. In general, underground pathways shall be at a minimal depth of 30" to the top of the pathway elements, where possible. Deviations from this specification must be pre-approved by Johns Hopkins Personnel. Pathways may gradually slope up to under 30" deep to enter hand boxes or handholes.
2. Digging and trenching shall be in accordance with codes and requirements established by all applicable local, state, and federal agencies and departments.
3. All trenching and digging shall be done in a neat and workmanlike manner. All methods of construction and details of workmanship shall be subject to the control and approval of Johns Hopkins.

4. Contractors shall protect from direct damage during construction and damage resulting from construction all surrounding environments, including, but not limited to, existing roadways, sidewalks, curbing, trees and shrubs, open grass areas, and planting beds. Contractors shall use planking and ramps as needed to protect these areas.
5. Contractors shall provide and install all necessary barriers to prevent unauthorized entry into the construction area. Contractors shall provide temporary walkways to divert pedestrian traffic safely around the construction area. Contractors shall contact the Johns Hopkins Security Department for approval of all temporary walkway locations.
6. Contractors shall provide traffic control, signage, plating, etc. as necessary to maintain the safe flow of vehicular traffic as deemed necessary by Johns Hopkins. Contractors shall contact the Johns Hopkins Security Department for approval of any changes to normal flow of vehicular traffic in and around the construction area and to arrange road closures, if necessary.
7. Contractors shall restore, repair, rebuild, or replace any items including, but not limited to, adjacent property, existing fences, trees and shrubs, roadways and curbs, sidewalks, and surface utilities and parts damaged during construction. Damaged items shall restore, repair, rebuild, or replace to their original condition and to the satisfaction of Johns Hopkins. Johns Hopkins may waive this requirement for specific items if within the construction area and/or if scheduled for eventual demolition or replacement and at Johns Hopkins discretion.
8. Contractors shall secure all necessary permits, as required. Contractors shall contact Johns Hopkins to ascertain the existence of established permits covering this work.
9. Contractors shall coordinate construction schedules and all work on the construction site with Johns Hopkins. Other Contractors may be working in the area. Contractors shall coordinate construction schedules with any general contractor or construction manager hired by Johns Hopkins when working as a subcontractor or when required by Johns Hopkins.
10. Contractors shall provide a detailed photographic survey of all pathways and areas to be disturbed prior to construction. Contractors shall deliver a set of these photographs to Johns Hopkins prior to construction.
11. Contractors shall locate and stake all pathways and spaces to be installed. Contractors shall confirm with Johns Hopkins and the project engineers all staked pathways and spaces. Contractors shall notify Johns Hopkins of any discrepancies in the site plan and the existing conditions.
12. Contractors shall protect, support, and maintain all existing utilities in the work area as they are encountered during excavation. Shallow utilities to light posts or other devices may be temporarily re-routed or disconnected if pre-approved by Johns Hopkins.
13. Contractors shall install erosion control measures as needed to minimize erosion and to prevent soil run-off from the construction area.
14. Contractors shall provide and install bracing, shoring, and sheathing as necessary to protect personnel and surrounding conditions. Contractors shall adhere to all local, state, and federal requirements for safe excavations.
15. Contractors shall hand remove and stack all paving bricks and marble pavers in the construction pathway for re-installation later. Contractors shall remove granite or other stone ore brick curbing pavers in the construction pathway for re-installation later.
16. Contractors shall saw cut all paved area encountered during excavations. Cuts shall be neat and straight.
17. Contractors shall remove all material excavated including soil, rubble, debris, or other materials encountered during excavation. Contractors may store excavated material on

site at the discretion of Johns Hopkins and at the location designated by Johns Hopkins. Contractors shall not anticipate storing excavated material on site. Excavated material from ductbank trenches may be left near the trench to be used as backfill, if adhering to later backfilling specifications. Contractors shall properly dispose of any material taken from the construction area per local disposal requirements.

18. Contractors shall remove only the material necessary to safely install ductbanks as specified. Contractors shall contact Johns Hopkins immediately if the trench or hole bottom is wet, unstable, or otherwise unable to support the infrastructure to be installed.
19. Contractors shall provide pumps, as necessary, to keep water out of the excavation. Contractors shall direct effluent towards the nearest storm drain only if the effluent is free from dirt and debris. Otherwise, the effluent shall be diverted to an area free from vehicular and pedestrian traffic and other construction areas.
20. Contractors shall notify Johns Hopkins of any rock that cannot be excavated by a ¾ cubic yard power shovel or broken sufficiently by an air hammer to clear the space required for infrastructure installation. Johns Hopkins shall determine the appropriate course of action.

B. Restoration

1. Contractors shall contact Johns Hopkins prior to any backfilling which will conceal an installed pathway element to enable Johns Hopkins to document and photograph the pathway.
2. Contractors may backfill in stages, when necessary to complete trenching and ductbank installation.
3. Contractors shall use pre-excavation photographs to restore the existing conditions, including brick walkway placement and pattern. Contractors shall restore brick walkways in the same pattern and arrangement as originally installed.
4. Contractors shall provide and install a level layer of compacted aggregate over each encased ductbank. The bed shall extend 1 foot above the surface of the ductbank. The first 6 inches of the aggregate bed shall be compacted to not less than 95% density compared to maximum laboratory tests by weight per ASTM D1557-64T, method A. The second six inches of the aggregate bed shall be compacted to not less than 85% density compared to maximum laboratory tests by weight per ASTM D1557-64T, method A.
5. Contractors shall remove all remaining excavated material from the construction area.
6. Contractors shall remove any erosion control devices no longer needed, not including those in and around seeded areas.
7. Restoration of disturbed landscaping shall be to the satisfaction of Johns Hopkins grounds keepers.

C. Conduit/Duct Pathways

1. During construction, Contractors shall use appropriate personal protective equipment to work safely within trenches and excavated areas. Contractor shall provide all appropriate safety equipment as needed to extract disabled workers or as otherwise needed to provide a safe work environment and to provide immediate support in emergency situations.
2. Contractors shall store all conduits and fittings in a manner to prevent dirt, rain, and other debris from entering the conduits. All conduits and fittings shall be free from dirt, water, and debris before installation.
3. Contractors shall locate each ductbank as specified by this document and subsequent

documentation provided by Johns Hopkins.

4. Contractors shall install an aggregate bed of a minimum of 12 inches of compacted aggregate under the same specifications as maintenance hold installation (Section 7.3.2) for the first 6 feet of any ductbank exiting a maintenance hole.
5. Contractors shall mechanically tamp the bottom of all trenches to provide a firm surface. If a solid base is not achievable given soil or other conditions, the Contractors shall install a minimum 4" bed of compacted aggregate under the same specifications as maintenance hole installation (Section 7.3.2). Contractors shall excavate as needed to install this aggregate bed while maintaining 30" of minimal cover over the final ductbank. Johns Hopkins shall determine the need for an aggregate base prior to the placement of any framing and laying of conduit in place.
6. Contractors shall obtain Johns Hopkins permission to proceed prior to the laying of conduits into the trench.
7. When possible, the vertical trench walls shall be used as the vertical frame for pouring concrete. When necessary, the sides of trenches shall be framed to maintain a straight and neat cross-section for areas completely encased by concrete. Contractors shall not use framing in areas to be filled with sand.
8. Contractors shall use exterior maintenance hole walls, utility tunnel walls or roof, and/or building structure as framing into which the concrete is to be poured where possible.
9. When penetrating a MH or building, Contractors shall core-drill, shall use a pre-manufactured knock-out window, or shall sawcut a window to penetrate the structure. Contractors shall confirm with the MH manufacturer or a structural engineer that the proposed method to access a structure and the final configuration of conduits per Johns Hopkins shall not compromise the structural integrity of the structure. Contractors shall provide Johns Hopkins with written documentation to this effect.
10. Contractors shall provide and install framing as necessary to prevent the penetration of concrete into the interior space of a structure. Contractors shall remove this framing when the concrete has properly set and after backfilling is complete.
11. Contractors shall install horizontal conduits ending in structures flush with the interior surface of the wall. Contractors shall install vertical conduits ending in entrance facilities such that they extend a minimum of 4" above the final floor. Contractors shall cut the conduits square with the conduit and not necessarily level to the floor. Contractors shall provide and install bushings on conduit ends.
12. Contractors shall provide and install conduit spacers beneath each conduit three times for every 20 linear feet of conduit. The spacers shall be evenly distributed over each 20 segment (e.g. one at each 20 foot joint and two evenly spaced over the middle). Each horizontal row of spacers shall be installed with a 6" minimum horizontal distance from any other row of spacers so as to eliminate weak vertical shear planes.
13. Contractors shall provide and install steel reinforcing bars, vertically and horizontally, to form a vertical box framing the conduits. The vertical bars shall be driven a minimum of 6 inches deep to prevent the conduits from floating during concrete pouring. The horizontal bars shall be secured to the vertical bars to prevent movement. The vertical bars shall extend 3 inches above the top conduit row. Alternately, the bars may be less than 3 inches above the top conduit row, if an inverted spacer is placed on the top row to provide a 3 inches depth gauge for pouring concrete.
14. Contractors may use “U”-shaped bars to straddle the conduits, if driven into the trench as specified above. Contractors may use a single horizontal bar or an upward pointing “U”-shaped bar in this configuration. The upward pointing “U”-shaped bar shall extend 3 inches over the top conduit or the Contractors shall use an inverted spacer to provide a 3-inch depth gauge for pouring concrete.

15. Contractors shall provide and install reinforcing bars, longitudinally, as detailed in the drawings. The bars shall be secured to each vertical reinforcing bar box. The longitudinal bars shall overlap 12 inches, unless welded together, and shall be secured to each other in a way to prevent movement.
16. When abutting a MH or building. Contractors shall provide dowel holes in each structure to enable the longitudinal reinforcing rods to penetrate the structure far enough as to prevent vertical and horizontal shearing of the ductbanks from the structure. Contractors shall not penetrate the wall with these holes. Contractors may need to provide and install additional reinforcing rods to provide this type of anchoring around MH window knock-outs.

D. Concrete Encasement

1. When encasing a ductbank, Contractors shall provide and install concrete around the conduits providing at least 3 inches of concrete around all sides of the conduit ductbank for the areas indicated on the drawing for complete encasement.
2. Contractors shall use appropriate methods to remove air pockets from the concrete and to provide 100% fill around all conduits and spacers.
3. Contractors shall fully encase any ductbanks that penetrate a MH or building for the first 6 feet beyond the structure.
4. When transitioning from an encased ductbank to a capped ductbank, Contractors do not have to frame the transition in cross-section, provided the required area is encased to a minimum of 3 inches. The concrete may slope down into the area to be capped. If the Contractors frame a transition point, the frame must be removed prior to installing aggregate around the conduits and installing the cap.
5. Contractors shall shape the top of the concrete in such a way as to slope water away from the ductbank-structure seams.

E. Cap Preparation and Installation

1. When capping a ductbank, Contractors shall provide and install filler sand around the conduits providing at least 3 inches of sand below and to the side of all conduits. Contractors shall not install filler sand above the top of the conduit ductbank.
2. Contractors shall use appropriate methods to remove air pockets from the sand and to provide 100% fill around all conduits and spacers.
3. Contractors may provide and install framing on the compacted surface of the sand for pouring the concrete cap.
4. Contractors shall provide and install a 3-inch-thick concrete cap over the conduits for the areas indicated on the drawing. Contractors shall use appropriate methods to remove air pockets from the concrete.
5. Contractors shall extend the cap horizontally to a minimum of 3" beyond the outer most conduits.
6. If the cap is framed, Contractors may use lesser-grade backfill material to cover the sand beyond the cap once the framing is removed.

F. Final Installation of New Pathway

1. Contractors shall clean all conduits by pulling cylindrical brushes until all dirt is removed. Contractors shall blow all conduits dry.
2. Contractors shall install Muletape pull strings into all conduits.
3. Contractors shall install a tracer wire in one of the conduits of a new pathway. In maintenance holes, handboxes, and entrance facilities, the tracer wire shall be bonded

to ground. The wire shall be clearly labeled.

4. In maintenance holes, the tracer wire shall loop up to the neck such that it can be reached without entering the hole. The wire shall be securely anchored along the neck, ceiling and wall.
5. Contractors shall install duct plugs at both ends of all conduits.

G. Existing Ductbanks

1. Contractors may use conducts and/or innerducts within existing ductbanks as directed by Johns Hopkins Personnel. Where possible, used conduits with available innerducts or space shall be used.

2. When installing optical fiber into a 4" conduit without existing innerduct or cable, Contractors shall install three (3) MaxCell 3” 3-Cell.
3. When installing a 200 pr. copper cable, or less into 4” conduit, Contractors shall install three (3) MaxCell 3” 3-Cell.
4. Contractors shall use ribbed innerduct. Contractors may use corrugated innerduct only when necessary to make tight bends and then only as much as needed before making a transition to ribbed innerduct.
5. Contractors shall install Muletape pull strings in all innerducts.
6. Contractors shall install pre-formed duct plugs around innerducts and smaller compression-type duct plugs in the innerducts.
7. Contractors shall seal used conduits (when pre-formed plugs are not feasible) with a non-hardening, removable sealant (PT Tech DuckSeal Sealant) or with an expandable sealing bag (Tyco T-DUX). Expanding foam products designed specifically for duct sealing (e.g. 3M Part #4416 Duct Sealant Kit) may only be used on conduits considered to be at capacity by Johns Hopkins Personnel.
8. Innerducts shall not extend beyond six inches from the end of the conduit.
9. Contractors shall replace any Muletape pull strings installed in conduits subsequently removed during installation, including outside of newly installed innerducts. Muletape pull strings in innerducts used to pull a cable does not need to be replaced.

H. Tunnel Pathways

1. Tunnel pathways are considered spaces under this specification. Refer to the latter section for specifications.

I. Direct-buried Pathways

1. Direct-buried pathways shall not be used for permanent installations.

END OF SECTION

27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1. 1 SUMMARY

A. Minimum composition requirements and/or installation methods for following materials and work are included in this section:

1. 2 REFERENCES

A. Reference Standards: See Section 27 05 00 - Common Work Results for Communications.

1. 3 SUBMITTALS

A. General: Submit in accordance with Section 27 05 00 - Common Work Results for Communications.

1. Product Data: Include data on features, ratings, and performance for each component specified.
2. Shop Drawings: Include dimensioned plan and elevation views of components. Show access and workspace requirements.
    a. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.
3. Samples: For workstation outlet connectors, jacks, jack assemblies, and faceplates for color selection and evaluation of technical features.

B. Informational Submittals: Submit following packaged separately from other submittals:

1. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
2. Qualification Data: For firms and persons specified in Quality Assurance Article. Provide evidence of applicable registration or certification.

C. Closeout Submittals: If variations from approved shop drawings and samples occur during installation and testing, submit final as-built documentation indicating such variations.

PART 2 - PRODUCTS

2. 1 MATERIALS

A. Labels: preprinted or laser printed type.

1. Legibility, Defacement, Exposure and Adhesion: UL 969.
2. Where insert type labels used provide clear plastic cover over label.

B. Cable Marking: Vinyl substrate with white printing area and clear tail that self laminates printed area when wrapped around cable. If cable jacket white, provide cable label with printing area colored other than white, preferably orange or yellow - so that labels easily distinguishable.

C. Confirm color of labels, font, and size with owner prior to labeling. Confirm placement of label on faceplates without windows with owner prior to labeling.

D. Acceptable Label Manufacturers:

1. Brother P-Touch.
2. Deal.
3. Dymo.

4. Brady.

E. Label Tape & Font

1. Label Tape 3/8”
2. Font Size: 12 Point
3. Bold

PART 3 - EXECUTION

3. 1 IDENTIFICATION

A. Confirm specific labeling requirement with Owner’s Representative prior to cable installation or termination. Owner-specific labeling requirements shall take precedence over TIA requirements and methodologies.

B. Labeling Scheme for the Johns Hopkins shall be as follows unless authorized by the Owner: (see Appendix C)

1. Each outlet shall have one line AB-CD-E/F.
   a. A is the Building Designator (See Appendix C)
   b. B is IT Room Designator
   c. C is Rack Designation Number
   d. D is Patch Panel Designation Letter
   e. E & F is the 2-Digit Patch Panel Port Number. 01 – 48
   f. **EXAMPLE = RU1A-1A-01/02**
2. Patch Panel Labeling
   a. The Patch Panel shall be labeled with a letter designation A-Z. No patch panels will have the same letter designator. The Contractor will be responsible for labelling the existing patch panels if not already labeled with the A-Z designator when performing moves, ads, and changes in existing IT rooms.
   b. Each terminated patch panel port shall be labeled with the room number matching the 2-Diget number designator on the outlet faceplate
   c. The wireless access point and camera patch panel ports shall be labeled with WAP or CAM below the room number.

      (Wireless Access Point) EXAMPLE = 1025
      (Camera) EXAMPLE = 1025 WAP
      CAM

C. Workstation: Label cables within outlet boxes.

D. Distribution Racks and Frames: Label each unit and field within that room.

E. Within Connector Fields, in Wiring Closets and Equipment Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware.

F. Cables, General: Label each cable within 4 inches of each termination and tap, where it is accessible in cabinet or junction or outlet box, and elsewhere as indicated.

G. Cable Schedule: Post in prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations. Provide electronic copy of final comprehensive schedules for Project, in software and format selected by Owner.

END OF SECTION

27 11 00 - COMMUNICATIONS EQUIPMENT ROOMS

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Section 27 11 13 - Communications Entrance Protection

B. Section 27 11 16 - Communications Cabinets, Racks, Frames, and Enclosure

C. Section 27 11 19 - Communications Termination Blocks and Patch Panels

D. Section 27 11 26 - Communications Rack Mount Power Protection and Power Strips

1. 2 RELATED SECTIONS

A. Section 07 84 00 - Firestopping

B. Section 08 74 11 - Electronic Locking Hardware

C. Section 09 67 17 - Floor Coatings

D. Section 09 69 00 - Access Flooring

E. Section 27 00 00 - Communications General.

1. 3 REFERENCES

A. See Section 27 00 00 - Reference Standards.

1. 4 DEFINITIONS

A. Main Distribution Frame (MDF): A room from which intrabuilding backbone cables distribute to IDF's. May also be an IDF if horizontal cables terminate within the room, and may also be an equipment room if PBX or core network electronics are present.

B. Building: All structures that include an OSP element that are not defined as spaces. These may include structures not normally occupied, such as storage sheds and athletic field grandstands

C. Entrance Facility (EF): A room into which inter-building backbone cables enter. Cables may or may not terminate in this room. Most often the EF is the MDF.

D. Equipment Room: A room containing voice and data electronics. Reserved for rooms with enough electronics to impact space and cooling requirements (rooms with PBX hardware or core network electronics).

E. Intermediate Distribution Frame (IDF): A room into which horizontal cable terminates. May be any of the above rooms as well.

F. Network Room (NR): A generic term for any of the above terms. The preferred term, unless a more specific term is needed to better define specific requirements for the room.

G. See Section 27 00 00: Communications General.

1. 5 DESIGN REQUIREMENTS

A. Size / Critical Dimensions: Use the following dimensions as guidelines for the minimum size of a Network Room. The actual dimensions will vary depending upon attaining the minimum critical dimensions and accommodating building elements. These are the minimum critical dimensions for equipment and clearances for rooms to house floor-standing equipment racks:

1. Width: 12'-0"
2. Depth: 10'-0" for the first rack and UPS**, 30"** for each additional rack (recommend

three racks for typical floor)

3. Height: 9’-6” from finished floor to the lowest clearance (such as fireproofing on steel beam).
4. Door: The door shall be 36” wide by 84” tall, minimum
    a. Swing: The door should swing outward to maximize the usable area within the room, though egress codes may dictate an inward swing (for example, if the Network Room were to be located on a main egress corridor). If the door swings into the room, the door shall swing into the clearance space.
5. If area is encroached by building elements such as columns, critical dimensions must still be adhered to and the room dimensions appropriately adjusted.
6. Serving Area
    a. If the floor serving area is less than 8,000sqft, size the room 10’X12’ and a minimum 2 horizontal rack management layout design.
    b. If the floor serving area is 8,000sqft to 10,000sqft, size the room 10’X16’, and a minimum 3 horizontal rack management layout design
    c. If serving over 10000sqft an additional NR is required.
    d. If a second NR is required to manage the horizontal cable placement run distance limit of 90 meters, size the second NR per the guidelines above.

B. Location and Adjacencies

1. Where possible, Telecommunications Rooms should be centrally located on the floor plate and should be vertically adjacent / stacked.

C. Network Equipment Power Reqiurement

1. Network Rooms shall contain two (2) 50Amp circuits, CS8369 receptacles per active network equipment rack.
2. Source A (Circuit 1) will be designated house power.
3. Source B (Circuit 2) will be designated UPS/Generator/Emergency power.
4. The Source A & B CS8369 receptacles will be supported from the ladder tray above the rear of the equipment racks.
5. In each Network Room one (1) spare source A and Source B 50Amp circuit shall be included in the design for future growth and power demand.

D. Network Equipment Cooling Reqiurement

1. Calculations should be made based off of power capacity of a 10KW/rack. 10KW=34,121.42 btu/12000 = 2.84 tons of cooling for each energized rack.

E. Acceptable Technologies in Network Room

1. Networks Rooms shall contain network and telecommunications equipment, cable terminations, and associated cross-connect cabling. Network Rooms shall be dedicated to the network and telecommunication functions and related support facilities.
2. They shall not be shared with electrical installations other than those required for provisioning network or telecommunication services.
3. Equipment not related to the support of the network rooms (e.g., piping, ductwork, pneumatic tubing) shall not be installed in, pass through, or enter the Network Room.
4. For exact equipment types or specific project conditions, please consult a representative of the Johns Hopkins IT Infrastructure project team.

1. 6 PROJECT CONDITIONS

A. Johns Hopkins entrance facilities are not classified as permit-required confined spaces by the Johns Hopkins Safety Office. Entrance facilities in mechanical spaces may pose dangers related to other utilities within the room (e.g. high voltage and steam). Personal protective equipment is strongly recommended and shall be the responsibility of the Contractors.

B. There are often other utilities or pre-existing communication services in entrance facilities. Contractors shall not disturb other utilities or pre-existing communication services.

1. 7 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of of Communications Equipment Rooms, submit final as-built drawings indicating such variations.

PART 2 PRODUCTS

2. 1 Plywood

A. ¾" unpainted, fire-rated plywood

1. Class 1 (or A) per ASTM E84-01 Standard Test Method for Surface Burning Characteristics of Building Materials
2. Treated with:
    a. DRICON (Arch Wood Protection, Inc.)
    b. D-Blaze (Chemical Specialties, Inc.)
    c. FirePRO (Osmose, Inc.)
3. Allowable substitutions must not be significantly more corrosive to metals than untreated plywood under AWPA E12-94 Standard Method of Determining Corrosion of Metal in Contact with Treated Wood.

B. ¾" A/C-grade, void-free plywood

2. 2 Paint

A. Intumescent

1. ASTM E84(UL 723) "Surface burning characteristics of building materials" Class "A" rating
2. ASTM E119 (UL 263) "Fire tests of building construction and materials" certified.
    a. Hy-Tech Flame Guard Additive for the interior flat latex paint
    b. PPG Pittsburgh Paint Firetex
    c. Benjamin Moor 220 Latex Fire Retardant Coating
    d. Sherwin Williams Flame Control

2. 3 Conduit

A. Galvanized rigid steel conduit and fittings,

1. 4" trade size, manufactured to:
    a. ANSI C80.1 (Specification for Rigid Steel Conduit, Zinc Coated)
    b. Underwriters Laboratories Standard 6 (Electrical Rigid Metal Conduit - Steel)

B. Galvanized intermediate metal conduit and fittings,

1. 4" trade size, manufactured to:
    a. ANSI C80.6 (Intermediate Metal Conduit (IMC) Zinc Coated)
    b. Underwriters Laboratories Standard 1242 (Type IMC threaded and unthreaded conduit, nipples, bends, and couplings in 1 to 4 inch trade size)
    c. Underwriters Laboratories Standard 797 (Electrical Metallic Tubing - Steel)

2. 4 LADDER-TYPE CABLE TRAY

a. Description: Universal cable Runway; 18”W x 1.5”H x 9.96’L; Glacier White.
b. Material: Made of 3/8” x 1-1-½" x .065” (9.53 mm x 38 mm x 1.65 mm) wall rectangular steel tubing.
c. Cross members welded at 12” (300 mm) intervals
d. Manufacturer: Chatsworth (10250-E18) or approved equal
e. Mounting accessories finish/color: Gold Chem

PART 3 EXECUTION

3. 1 INSTALLATION

A. Entrance Facilities

1. OSP cables entering buildings shall adhere to NEC (1999) 800.50 (or its successor) requirements for conduit, if OSP cables need to extend beyond 50 feet or one floor.

B. Network Rooms

1. Network rooms shall be prepared with respect to power, entry pathways (cable tray, inter-floor sleeves, and building entrance conduits), plywood backboards, and other environmental conditions.
2. Plastic or metal cable ties shall not be used in the network rooms. Velcro cable ties shall be used.
3. Service loops shall be secured to the wall in each location in an unobtrusive manner. Service loops shall not block access to other cables, utilities, or otherwise accessed structures (e.g. shut-off valves, meters, etc.). Service loops shall not rest horizontally on cable trays.
4. Fire-rated plywood shall not be painted. The plywood shall be anchored every two feet around the perimeter of the board only (no anchors greater than 6" from an edge) with galvanized or stainless-steel anchors.
5. A/C-grade plywood shall be painted on both sides and all edges, twice, before mounting. Paint with a light-colored intumescent paint.

C. Pathways

1. MaxCell containing backbone cabling shall end with two feet of cable tray in network rooms. The MaxCell may be shortened as needed to accommodate service loops.
2. Secure the MaxCell in network rooms to prevent horizontal movement (D-rings are acceptable). Secure the cables to the wall in a non-deforming manner to prevent vertical movement of the cable. Plastic cable ties with screw-mounted (not adhesive-

mounted) wall mounts are acceptable in this application.

END OF SECTION

27 11 13 - COMMUNICATIONS ENTRANCE PROTECTION

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 05 26: Grounding and Bonding for Communications Systems.

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

B. See Section 27 00 00: Communications General.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. All OSP cables entering any building shall be properly protected and bonded to ground. Johns Hopkins does not accept the exceptions to NEC (1999) 800.30(A) (or its successor) in that all communications circuits are to be considered potentially exposed. Special circuits to external devices may be exceptions, if pre-approved by Johns Hopkins Personnel.

B. The design shall specify building entrance terminals (BET) and protector modules of the type and manufacturer specified by this document.

C. Design for multiple BETs such that grounding conductors connecting them are straight. Design BETs such that grounding conductors connecting them to the TMGB are as straight as possible.

D. Do not specify BETs to be inter-connected with horseshoe-shaped conductors. For multiple columns or rows of BETs, each column or row shall be connected to the EF busbar in as straight a fashion as possible.

1. 5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of of system components, submit final as-built drawings indicating such variations.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Building Entrance Terminals

1. 710 module or 110-style block on the “in” side
2. 110-style block on the “out” side
3. Fully enclosed housing covering terminations and modules
4. Manufacturer
    a. Circa

b. No substitutions

B. Building Entrance Terminal Modules

1. PTC (positive temperature coefficient) version

2. Manufacturer

a. Circa, C4B1E (PTC)

b. No substitutions

C. Other materials as needed to connect to the telecommunications grounding system.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Contractors shall install multiple BETs such that grounding conductors connecting them are straight. Contractors shall install BETs such that grounding conductors connecting them to the TMGB are as straight as possible.

C. Contractors shall not inter-connect connect BETs with horseshoe-shaped conductors. For multiple columns or rows of BETs, each column or row shall be connected to the entrance facility bus bar in as straight a fashion as possible.

D. The Contractor shall not connect more than BET to another BET beyond the TBB connection. Manufacturer requirements shall be followed and allow for a single BET to act as a "hub" for other BETs, but not beyond a second tier.

E. The contractor shall extend the same copper pair count from the BET to a wall mount 110 block in a location determined by the JH. No backbone or horizontal copper cabling shall be terminated directly to the BET.

END OF SECTION

27 11 16 - COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURE

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 11 00 - Communications Equipment Room

B. Section 27 11 19 - Communications Termination Blocks and Patch Panels

C. Section 27 11 26 - Communications Rack Mount Power Protection and Power Strips

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. Prepare rack layouts showing the placement of all equipment within each rack.

B. Typical racks shall be 7 ft. high and have 19" rail spacing. Create network room layouts based on actual dimensions of approved products. The preferred equipment rack is the Ortronics Mighty-Mo 20 rack (16.25 inch depth). The preferred equipment cabinet is the Chatsworth TeraFrame. Racks to contain core switches or other large equipment requiring forward and rear attachment points to an open rack should be mounting into Ortronics racks. This equipment can be mounted in Chatsworth cabinets.

C. Security cabinets for video surveillance or access control systems shall be in a dedicated rack.

D. Smaller installations may be designed to use wall-mount cabinets or enclosures, provided the initial installation does not exceed 50% of the vertical rail space.

E. Equipment rooms needing higher security may be designed to use Chatsworth Cabinets.

F. Equipment cabinets require one full louver door on front and back, with minimum one fan rack unit and two 5 inch grommet holes in each side and top protected with plastic or rubber edging.

G. Ground equipment racks as specified under Section 27 05 26 Grounding and Bonding for Communications Systems.

H. Specify all wire management rings, ladder rack, brackets and wire management panels which, in the sole judgment of Johns Hopkins shall be required for a neat and workmanlike installation.

I. Plastic or metal cable ties shall not be used in the network rooms. Velcro cable ties shall be used.

J. Specify the use of vertical and horizontal wire management on rack configurations. When configuring multiple racks in a line, the vertical cable management between racks shall be the larger size, while the smaller channels may be used at the ends. If future racks are anticipated, do not down-size the end likely to receive another rack.

K. Equipment cabinets require one full louver door on front and back, a minimum one fan rack unit and two 5 inch grommet holes in each side and top protected with plastic or rubber edging.

L. Ground equipment racks as specified under Bonding and Grounding.

1. 5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of of system components, submit final as-built drawings indicating such variations.

PART 2 PRODUCTS

2.1 RACKS AND ACCESSORIES

A. Racks and Rack Accessories

1. Ortronics

1) Rack

Might-Mo 20, 7' high, 19" rails, 16.25" deep channel, White

(MM20716-W)

2) Horizontal cable management:

Cable Management Panel with Cover, White, 2U

(MM20HMF2RU-W)

3) Vertical cable management:

(a) Ortronics MM20 Vertical Cable Management “Cage”, with door, 10" x 13" x 7', white (OR-MM20VMD710-W)

(b) Ortronics MM20 Vertical Cable Management “Cage”, with door, 6" x 8" x 7', white (OR-MM20VMD706-W)

B. Short Racks and Rack Accessories

1. Chatsworth

a. Short Rack- Universal Rack

1) Height below 7 feet (3 feet to 6 feet-6)

2) 19" rails

3) Black or white

2.2 CABINETS

A. Cabinets

1. Chatsworth Products

a. TeraFrame Cabinet

b. 36, 40 or 48" deep

c. 19" rails

d. Size as needed, not to exceed 50% initial capacity

e. Black or white

B. Wall-mount Cabinets

1. Full-depth Cabinets

a. Ortronics

1) SWM Series Wall-Mount Cabinets

2) 12, 18, or 26 U rails

3) Black or white

4) Size as needed, not to exceed 50% initial

b. Chatsworth Products

1) M-Series 48" MegaFrame Cabinet

2) 24", 30", or 36" deep

3) 19" rails

4) Size as needed, not to exceed 50% initial

5) Black or white

2.3 ENCLOSURES

A. Shallow enclosures

1. Hubbell REBOX

a. Model RE2 - 2U for switches, 2U for patch panel

b. Model RE4 - 5U for switches, 4U for patch panels

c. Fan kit (2 for RE4; 1 for RE2)

d. Fitted with standard locking hasp to receive full size padlock

2. Chatsworth Wall-Mount Enclosure

a. Part number: AAT-AWM-H

b. Size 42"W x 24"H x 7.5"D

c. Space for a single 100 pair 110 style termination block, a single 6-port fiber optic adapter panel, two 19" x 2U spaces for patch panels or other panel mount termination hardware and one 19" x 3Uspace for active components up to 18" in depth

2.4 ACCESSORIES

A. Specify the appropriate grommet per manufacturer and cable type and quantity requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. The Contractor shall install open racks as shown in drawings by securely fastening the rack to the deck.

B. The Contractor shall provide horizontal cable management above and below the housing, as needed for a single management unit above and below the housing, dependent on final placement of the housing.

C. The Contractor shall securely fasten side-by-side racks to each other using rack

manufacturer hardware.

D. The Contractor shall provide and install rack parts as shown on drawings provided.

E. The Contractor shall bag and leave attached to the tray any unused mounting screws or other hardware upon completion.

F. Provide vertical and horizontal cable management sized for no more than 40 percent fill.

G. Mount with minimum of 36 inches clear access behind and in front of rack/cabinet.

H. Ground rack/enclosure to TMGB / TGB with Grounding Wire.

END OF SECTION

27 11 19 - COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 GENERAL

1. 1 REFERENCES

A. NFPA 70 - National Electrical Code: National Fire Protection Association; 2002.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 DESIGN REQUIREMENTS

A. Horizontal Copper Rack Terminations

1. All horizontal cables shall be terminated in the T568B pin/pair configuration. All four pairs shall be terminated.
2. Cables shall be neatly dressed in bundles of 48 to their respective patch panel and within rack cable management using Velcro cable ties and/or rack cable management loops.

B. Fiber Rack Terminations

1. Terminate the fiber on a rack mounted patch panel. All fiber-optic connecting hardware shall support individually terminated fibers onto the connectors. Adapter panels shall be limited to a single type of fiber (multimode or single mode).
2. Optical fiber cable shall be terminated in an appropriately sized, rack mountable enclosure. These enclosures shall be lockable (if room access is not controlled). All optical patch panels shall meet all requirements set forth in the ANSI EIA/TIA-568-A wiring standard for connecting hardware. Termination panels shall be mounted in the top of the rack or cabinet.
3. The preferred fiber distribution housing is the Corning Edge housing line.

C. Wall Mounted Terminations

1. Specify the installation of 110 blocks for wall field terminations. No wall-mounted hardware, including cable management, shall be above 5'6" from the finished floor.
2. Cable management troughs shall be installed such that all cross-connect wires may be installed within the troughs.
3. Provide a detailed wall field layout to JH Infrastructure Project Team prior to installation.
4. Cable management may move as needed to accommodate conditions.
5. A clear space of 5" or 6" above and below the top and bottom of the connecting hardware shall be maintained for cable handling.
6. Service loops shall be secured to the wall as needed and in an unobtrusive manner. Service loops shall not block access to other cables, utilities, or otherwise accessed structures (e.g. shut-off valves, meters, etc.). Service loops shall not rest horizontally on cable trays.
7. Wall fields shall be designed to minimize the need to work behind equipment racks. Busbars and BETs can be readily located behind equipment racks while 100 block should be more accessible.
8. Wall field elements shall be 3 ft or more from any electrical service panels. Pathways within the space shall keep this clearance when possible.

1. 4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each system component specified in this section.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Copper Terminations

1. Category 6 patch panels.
    a. Belden/CDT
        1) CAT6+ REVConnect Patch Panel 48-port, White, 2U (Preloaded) (RV6PPF2U48WH)
    b. Ortronics
        1) Clarity Category 6 Patch Panels, 48 port, 6 port modules, White (OR-PHD66U48-W)
2. Category 6 A patch panels. Standard.
    a. Belden/CDT
        1) 10GX REVConnect Patch Panel 48-port, 2U, White (Preloaded) (RVAPPF2U48WH)
    b. Ortronics
        1) Clarity Cat6A Patch Panel, 48 Port, 2U, 6 port modules, White (OR-PHD6AU48-W)
3. Wall Terminations
    a. Belden/CDT
        1) Category 5e 110 Wiring Block with legs (100-pair- AX100691-S; 300-pair- AX100692-S; kits with connection block have other part numbers)
        2) Connector Blocks (C4- AZ100707-S, C5- AX100708-S)
        3) Cable Management Trough with legs (AX100706-S)
    b. Ortronics
        1) Ortronics Category 5e 110 Wiring Blocks with Legs (100 pair- OR-110ABC5E100; 300 pair- OR-110ABC5E300)
        2) Ortronics Connector Blocks
        3) 110 Jumper Trough with legs (OR-30200140)

B. Fiber Terminations

1. Intrabuilding Backbone Cabling
    a. Corning Cable Systems
        1) Rack Mount housing, Corning Edge Housing, sized appropriately for cable

counts

EDGE™ Housing, 4 rack units, 576-fiber LC, 2304-fiber MTP® Capacity (48 modules/panels)	**EDGE-04U**
EDGE™ Housing, 2 rack units, 288-fiber LC, 1152-fiber MTP® Capacity (24 modules/panels)	**EDGE-02U**
EDGE™ Housing, 1 rack unit, 144-fiber LC, 576-fiber MTP® Capacity (12 modules/panels)	**EDGE-01U-SP**
EDGE™ Housing, 1 rack unit, 96-fiber LC, 384-fiber MTP® Capacity (8 modules/panels)	**EDGE-01U**

2) The following products are acceptable but only with a written approval from JHMCIS. JH IT department and will only be used in certain legacy applications: Rack-mount housing, Corning Pretium Housing, sized appropriately for the cable counts. Only 12 fiber LC connector panels are acceptable, nothing larger.

3) Wall-mount housing, Wall-Mountable Building Terminal (WBT), lockable (WBT-024-L)

b. Adapter Modules – All adapter modules are to match the fiber housings designated in section a.

1) Corning Cable Systems, Edge cassettes

EDGE™ Splice Cassette, 12 F, LC duplex, OM4, single-fiber	**EDGE-CS12-AD-P00QE**
EDGE™ Splice Cassette, 12 F, LC duplex, OM4, Ribbon, Straight Through	**EDGE-CS12-AD-P00QJ**
EDGE™ Splice Cassette, 12 F, LC duplex, Single-mode UPC, single-fiber	**EDGE-CS12-AE-P00RE**
EDGE™ Splice Cassette, 12 F, LC duplex, Single-mode UPC, Ribbon, Straight Through	**EDGE-CS12-AE-P00RJ**
EDGE™ Splice Cassette, 12 F, LC duplex, Single-mode APC, single-fiber	**EDGE-CS12-AF-P00RE**
EDGE™ Splice Cassette, 12 F, LC duplex, Single-mode APC, Ribbon, Straight Through	**EDGE-CS12-AF-P00RJ**
EDGE™ Adapter Panel, 12 F, Single-mode UPC, LC Duplex	**EDGE-CP12-AE**
EDGE™ Adapter Panel, 12 F, OM3/4 UPC, LC Duplex	**EDGE-CP12-AD**
EDGE™ Adapter Panel, 12 F, Single-mode APC, LC Duplex	**EDGE-CP12-AF**

2) The following adapters are only to be used when previously approved by JH IT staff and are to only be used in designated legacy projects.

(a) Corning Cable Systems, 12 LC duplex adapters, single-mode, ceramic insert, composite housing (CCH-CP24-A9)

(b) Corning Cable System, 12 LC cassettes, 50 Micron multimode (CCH-CS12-A9-P00RE).

(c) Corning Cable System, 12 LC cassettes, Single Mode (CCH-CS12-E4-P00QE)

(d) Corning Cable System, 24 LC cassettes, 50 Micron multimode (CCH-CS24-A9-P00RE)

(e) Corning Cable System, 24 LC cassettes, Single Mode (CCH-CS24-E4-P00QE)

c. All additional materials needed to properly terminate and secure cables, including but not limited to panel/plate connectors, grounding kits, strain-relief hardware, break-out kits, blank panels/plates, etc.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Horizontal Cable Rack Terminations

1. All horizontal cable shall be installed per manufacturer instructions to ensure a manufacturer certified solution.
2. The Contractor shall provide and install modular patch panels as shown on the attached drawings.
3. The Contractor shall terminate all horizontal cables in the T568B pin/pair configuration. All four pairs shall be terminated.
4. The Contractor shall neatly dress cables to their respective patch panel and within rack cable management using Velcro cable ties and/or rack cable management loops. Cables shall not be bundled outside of a rack but shall be loose and random in cable tray.
5. Provide identification labels for each cable.

B. Optical Fiber Rack Termination

1. The Contractor shall provide and install rack-mounted optical fiber housing as shown on the attached drawings.
2. The Contractor shall terminate all fibers using dual LC connector panels/plates and fiber connectors.
3. The Contractor shall place all fiber slack neatly in the fiber housing.
4. The Contractor shall secure cable strength members to cable strain relief brackets or attachment points within the fiber housing.
5. The Contractors shall install additional materials needed to properly terminate and secure the inter-building and intra-building optical fiber cables, including but not limited to panel/plate connectors, grounding kits, strain-relief hardware, break-out kits, blank panels/plates, etc.
6. Provide identification labels for each adaptor.

C. Wall Termination Fields

1. All wall field terminations shall be installed per manufacturer instructions to ensure a manufacturer certified solution.
2. The Contractor shall install 110 blocks and protectors as shown in the attached drawings. No wall-mounted hardware, including cable management, shall be above 5'6" from the finished floor.
3. Cable management troughs shall be installed such that all cross-connect wires may be installed within the troughs. Final installed locations may change during installation. Wire management shall be adjusted appropriately during installation.

4. The Contractor may move cable management as needed to accommodate conditions. Cable management will remain continuous from cross-connects between protectors and 110 blocks.

END OF SECTION

27 11 26 - COMMUNICATIONS RACK MOUNT POWER PROTECTION AND POWER STRIPS

PART 1 GENERAL

1. 1 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 DESIGN REQUIREMENTS

A. Coordinate type of power strip with Networking based on their anticipated equipment.

B. Coordinate Power Distribution Unit/power strip, HVAC cooling, and Environmental monitoring with Networking based on anticipated equipment quantities and needs.

C. Rack Mount - All Network equipment/gear being installed will have two separate and distinct power supplies, using 200-240v A/C. Each power supply is required to have its independent power source as follows, in an A-source, B-source configuration. Each rack to be energized will need an independent pair of circuits and PDU. Please note: localized rack power transfer switches are no longer being deployed.

1. Source A: power source/circuit (three phase power based on Networking needs) should be building utility power, which will energize the first power distribution unit identified in “2.1 Materials” below.

2. Source B: power source/circuit (three phases based on Networking needs) must be building based ups/generated power, which will energize the second power distribution unit identified in “2.1 Materials” below.

D. Wall Field Mount - All Network equipment/gear, ancillary systems, and power strips being installed on telecom wall field shall require surge protection.

1. Power Strips shall be commercial grade and approved in writing by the Johns Hopkins Infrastructure Project Team prior to installation.

2. Provide transient surge protection on the AC power feeds to all equipment. This protection shall include equipment with switches, hubs, and similar devices. Ground surge protection devices as required by the equipment manufacturers and comply with UL, ANSI, NEC, State and local agencies.

1. 4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of of system components, submit final as-built drawings indicating such variations.

PART 2 PRODUCTS

2. 1 MATERIALS

A. All units to be supplied by John’s Hopkins Central IT.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Coordinate with the IT Infrastructure Project Team and networking for placement.

B. Power Distribution Units (PDU) and uninterrupted power supplies shall be mounted such that the receptacles face the rear of the rack.

C. No power cords shall exit an enclosure through a door opening. Power cords shall exit through knockouts on top or from underneath the enclosure, provided the cord and plug can pass beneath the enclosure sides and/or door frame without having to lift the enclosure.

D. Power cords shall be secured such that they do not pose a trip hazard and cannot otherwise be accidentally disconnected.

E. Power strips and surge protection mounted in wall field shall be secured such that they do not pose a hazard and cannot otherwise be accidentally disconnected.

F. Power strips and surge protection mounted in wall field shall not be connected in anyway to power that terminates in rack.

G. Environmental monitoring/surveillance device should be surface mounted or use packaged option to hang from ceiling grid if available, facing the access door to the room. Fluid spot detector, and external Temperature humidity sensors will be installed and configured by IT staff.

END OF SECTION

27 13 13 - COMMUNICATIONS COPPER INTRABUILDING BACKBONE CABLING

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 00 00: Communications General.

B. Section 33 82 13: Copper Communications Distribution Cabling

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. The Information Transport System backbone cabling system shall be designed to conform to the requirements of ANSI/TIA/TIA-568-B. In conformance with this standard, the cabling system shall be designed in a hierarchical star topology.

B. Copper cables from BETs to termination wall fields are considered intrabuilding backbone cables.

C. Minimum 25 pair Category copper backbone cable per Network Room.

D. Copper backbone cables shall be Category 3 multi-pair copper cable, 24 AWG, ARMM riser-rated cable. This shielded cable shall consist of solid-copper conductors insulated with expanded polyethylene covered by a PVC skin, be conformance tested to meet EIA/TIA 568A for Category 3 cables, be UL® tested and UL® listed as CMR. The sheath shall have improved frictional properties, allowing it to be pulled through conduit without the use of lubricants. The cable shall be available in 25, 50, AND 100 pair counts.

E. For all cables, specify plenum rate as required.

F. Secure all copper backbone cables to the network room wall to prevent horizontal movement of the cable (D-rings are acceptable). Secure the cables to the network room wall in a non-deforming manner to prevent vertical movement of the cable. Use of the cable tray is permitted to route the ARMM cable to the 110 termination blocks.

G. Unless otherwise specified or noted, size backbone/tie cables based on 1.5 pairs/connected voice outlet plus 20 percent spare. Round up to next available pair sizing when doing calculations. Minimum 25 pair Category copper backbone cable per Network Room. Any deviations to standards need to be directed to and approved prior to the bid process by the Johns Hopkins IT Infrastructure Project Team.

H. Copper intra-building backbone cables run entirely with stacked network rooms or within conduit can be unarmored. Otherwise, the cables shall be armored, including cables run in open raceways.

1. 5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of of system components, submit final as-built drawings indicating such variations.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Specify plenum rated as required.

B. Intrabuilding voice cable

1. 24 AWG copper
2. Manufacturers
    a. Superior-Essex
        1) Category 3, CMR, ARMM
        2) Category 3, CMR/CMP
    b. Other acceptable manufacturers offering equivalent products.
    c. A minimum 25-Pair Copper Backbone Cable will be installed for new projects unless specified otherwise.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. The Contractor shall use common vertical sleeve(s) for all copper intra-building backbone cables.

C. In the MDF/IDF, the Contractor shall provide a 10-foot service loop wall-mounted above the cable tray.

D. In large telecommunications enclosures, the Contractor shall provide a service loop/coil of up to 10 feet as able to contain within the enclosure.

E. The Contractor shall secure all copper backbone cables to the network room wall to prevent horizontal movement of the cable (D-rings are acceptable). The Contractor shall secure the cables to the network room wall in a non-deforming manner to prevent vertical movement of the cable. The Contractor may use the cable tray to route the cable to the 110 termination blocks.

F. The cable shall be continuous and without splices, except to attach the BETs.

G. Cables may be installed in conduit, cable support system, or in cable hangers 4 to 5 feet OC.

H. The Contractor shall not install backbone cables such that they lay on suspended ceilings, ceiling support structures, or other utilities within the ceiling (electrical conduit, HVAC ductwork, plumbing, etc.). Anchor cables to not interfere with other services or space access.

I. The Contractor shall bond to ground all cable shields and drain wires at each end.

J. The Contractor shall label all Copper Intrabuilding Backbone Cabling in 15-foot increments.

END OF SECTION

27 13 23 - COMMUNICATIONS OPTICAL FIBER INTRABUILDING BACKBONE CABLING

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 00 00: Communications General.

B. Section 33 82 23: Optical Fiber Communications Distribution Cabling.

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. The Information Transport System backbone cabling system shall be designed to conform to the requirements of ANSI/EIA/TIA-568-B. In conformance with this standard, the cabling system shall be designed in a hierarchical star topology.

B. Minimum 48 Strand Single Mode is required from Building MDF to Network Room.

C. The preferred fiber cable is Corning MIC optical fiber cable. This cable shall be armored or shall be routing in conduit, Fabric innerduct or steel raceway. Substitutions to this cable shall be pre-approved by Johns Hopkins. Submit all specifications for substitution candidate to the Johns Hopkins contact prior to specification.

D. Optical fiber cables shall meet or exceed all applicable national and local building fire code requirements. Fiber cables used in a return air plenum environment shall have an Underwriters Laboratories rating that meets or exceeds the requirements of NFPA 262-1985 and UL®-910. (OFNP) and (UL®) shall be printed every two (2) feet on the cable jacket. The optical fiber riser cable shall have an Underwriters Laboratories rating that meets or exceeds the requirements of UL®-1666 (OFNR) and (UL®) shall be printed every two (2) feet on the cable jacket.

E. All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical and environmental requirements of this specification. The attenuation specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable. No nominal values will be acceptable.

F. Johns Hopkins does not follow the industry standard practice of reversing pairs in optical fiber termination. In all cases, the first strand of a termination module is blue. The complexity of the Johns Hopkins infrastructure and the past practices makes this requirement necessary.

G. Connections between any fiber optic patch panels shall be made with a pre-manufactured, fiber optic patch cord. All fiber optic jumper assemblies shall comply with the standards for both fiber optic cables and fiber optic connectors.

H. Fiber shall be installed with strain relief as outlined by BISCI methodologies.

I. A service loop of 20 feet is required at each MDF and ER location. A service loop of 10 feet is required at all IDF locations. Service loops shall be neatly secured to wall with appropriately sized cable slack ring above the ladder tray on an adjacent wall within the communications room.

J. Secure the cable to the cable tray using Velcro cable ties.

K. Secure the cable to the wall to prevent horizontal movement of the cable (D-rings are acceptable). Secure the cables to the wall in a non-deforming manner to prevent vertical movement of the cable.

L. Optical fiber intra-building backbone cables run entirely within stacked network rooms, within metallic conduit can be unarmored. Otherwise, the cables shall be armored, including cables run in open raceways.

M. Multi-Mode Fiber Characteristics

1. All specified multi-mode fiber optic cable shall meet the following grade, attenuation and bandwidth characteristics.

a. 50/125 micron, OM4 grade, Graded Index

(1) 3.0 dB/km @ 850 nm Maximum attenuation

(2) 1.0 dB/km @ 1300nm Maximum attenuation

(3) 500 MHZ km @ 850nm Minimum bandwidth

(4) 500 MHZ km @ 1300nm Minimum bandwidth

N. Single mode Fiber Characteristics

1. All specified single-mode fiber optic cable shall meet the following grade, attenuation and bandwidth characteristics.

a. 8.3 to 9/125 micron

b. 1.0 dB/km @ 1310 nm and 1550nm Maximum attenuation

2. The termination panels/connectors for single mode fiber shall be blue in color.

O. Terminations and Connectors for Fiber Optic Cable

1. Each strand of optical fiber cable shall be terminated with factory installed, LC connectors with field fuseable or Uni-cam pigtails. Terminate the fiber on a rack mounted patch panel.

2. Typical loss shall not exceed 0.2 dB with a maximum loss of 0.4 dB per connector using LC type connectors. Durability shall not be less than 0.2 dB change over 100 rematings.

PART 2 PRODUCTS

2. 1 MATERIALS

A. For all cables, specify plenum rated as required.

B. Cable may be single mode-multimode hybrid cables where both fiber types are in a common outer sheath.

C. Multimode, 50/125 micron, OM4 tight buffered, plenum:

1. Corning Cable Systems

a. Premise Distribution Tight Buffered, MIC, aqua

b. Premise Distribution Tight Buffered, MIC, interlocking armored, aqua

D. Single mode, 9/125 micron, tight buffered, plenum:

1. Corning Cable Systems

a. Premise Distribution Tight Buffered, MIC, yellow

b. Premise Distribution Tight Buffered, MIC, interlocking armored, yellow

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Minimum 48 Strand Single Mode is required from Building MDF to Network Room.

C. In the MDF/IDF the Contractor shall provide at least 10 feet of cable in a wall mounted service loop just above the cable tray.

D. In large telecommunications enclosures, the Contractor shall provide a service loop/coil of up to 10 feet as able to contain within the enclosure.

E. The Contractor shall secure the cable to the cable tray using Velcro cable ties.

F. The Contractor shall secure the cables to the wall to prevent horizontal movement of the cable (D-rings are acceptable). The Contractor shall secure the cables to the wall in a non-deforming manner to prevent vertical movement of the cable.

G. The Contractor shall install fiber optic cable in conduit, cable tray or supported from building structure at 3 feet OC.

H. Johns Hopkins does not follow the industry standard practice of reversing pairs. In all cases, the first strand of a termination module is blue.

I. All optical fiber cables are to be continuous and without splicing. Optical fiber based MUTOAs are not considered splices.

J. Comply with manufacturers' recommendations regarding pulling tension and allowable lubricants.

K. The Contractor shall be responsible for verifying actual footages and distances identified on attached prints (i.e. wall-to-wall, pullbox-to-pullbox and ER to network room).

L. The Contractor shall be responsible for verifying that conduits and raceways are ready for occupancy before cable placement.

M. The Contractor shall assume responsibility for difficulties or damage to cable during placement.

N. Where fiber optic cable passes through vertical riser space or network rooms, secure fiber to wall vertically every 36 inches. Review fasteners, strain relief and routing with owner.

O. The Contractor shall label all Fiber Intrabuilding Backbone cables in 15-foot increments.

END OF SECTION

27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1. 1 SECTION INCLUDES

A. Section 27 15 33 - Communications Coaxial Horizontal Cabling

B. Section 27 15 43 - Communications Work Areas, Faceplates, and Connectors

1. 2 RELATED SECTIONS

A. Section 27 00 00 - Communications General.

1. 3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 4 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 5 SYSTEM DESCRIPTION

A. A single copper channel solution shall be installed for the entire project selecting either an Ortronics or a Belden/CDT IBDN solution.

B. A single Corning optical fiber channel solution shall be installed for the entire project.

C. See Section 27 00 00 - Communications General for specific substitutions and conditions when designing and installing at APL facilities. These facilities use other manufacturers for horizontal cable systems.

1. 6 DESIGN REQUIREMENTS

A. For all cables, specify plenum rated as required.

B. Horizontal cable shall be installed in a star topology. Each WAO shall be cabled directly to an MDF/IDF. The horizontal cabling shall be terminated in a room on the same floor as the WAO.

C. All cable, WAO, and network room equipment installation shall be in strict accordance with the methodologies contained in the latest BICSI Telecommunications Distribution Methods Manual, unless specifically noted by this document or other JH documentation specific to the project. This includes, but is not limited to cable attachments, firestopping, cable routing, equipment rack grounding & bonding, pulling tensions, and EMI protection methods.

D. All cables placed in a conduit shall not exceed the fill capacities as listed in the ANSI/EIA/TIA-569, even though the maximum fill quantities as listed in ANSI/NFPA 70 are less strict.

E. Upon entering the telecom equipment room, the cabling should be separated according to service application (voice, data, and video), extended around the interior perimeter of the room via the specified cabling tray, and then routed to the rack or wall mounted termination location. Smaller network rooms with cable tray extending directly from the wall penetration to the rack does not need to encircle the room. All added cables shall follow the established path.

F. Specify new cables, equipment, and supplies to provide a complete system. All products specified within this document by catalog/part numbers are for reference only. The design shall not deviate from structured cabling components with respect to cable, connectors, or termination devices. Designers may substitute products of very similar nature with respect

to support structure and other “non-conductor” elements of the cable plant. However, products that are substituted shall meet the electrical, mechanical, and safety characteristics of the specified product. Approved products within this document have undergone careful selection. Samples of the proposed substitutions shall be submitted prior to design and all materials shall be approved in advance by the Johns Hopkins Project and Network Managers. Only written approval of substitutions will be allowed. Any substitutions without written approval are done at the risk of the designer. Unacceptable substitutions will be rejected without explanation or appeal.

G. All cables shall be one continuous piece without splices.

H. During renovations or MAC work, cables shall be installed within existing conduit, wire-ways or spaces when possible, and terminate at existing WAO locations. While the pathways should be re-used where possible the cabling components shall be new.

I. Voice and data cables shall be defined by color and consistent throughout the building. Standard voice cables shall be white. Standard data cables shall be blue.

J. Specify a terminated Category 6 cable to analog emergency phone location. Specify a terminated Category 6 cable to the elevator machine room. These cables shall be terminated in the network room with other voice cables. Additional cabling may be necessary for these systems.

K. Specify installing pull strings with horizontal cables as the cables are pulled.

L. Specify placement of horizontal cables in cable trays in a random overlapping fashion. Cable ties in the cable tray shall not be used, except as needed to maintain bend radii when changing directions.

M. Specify all horizontal cable free of surface damage, kinks, excessive twists, and visible anomalies.

N. All horizontal cables shall be installed per manufacturer instructions to ensure a certified channel solution.

O. All cables shall be installed, tested, labeled and documented as specified in this document.

P. Copper horizontal cable lengths:

1. Horizontal cables from the IDF to the WAO, shall be no longer than 260 ft. (80 m).
2. Horizontal cables used for patch cords and cross-connect jumpers in the IDF, shall be no more than 16 ft (5 m) long.
3. There is a 33 ft (10 m) allowance for the combined length of patch cords and cables used to connect equipment at the WAO and IDF.
4. The combined sum of all the above components shall be no longer than 310 ft (95 m).

Q. The horizontal data cables provided to each individual WAO shall consist of min. one 4-pair 100-ohm, Category 6A, UTP cable and any of the following depending on the needs of the occupants:

1. 2-fiber 50/125-micron multimode optical fiber cable
2. 75-ohm RG-6 cable for Video/CATV
3. A second 100-ohm, Category 6, UTP cable
4. A second 100-ohm, Category 6A, UTP cable
5. If specific applications require other types of cabling, the other types may be installed.

R. If there are optional horizontal voice cables provided to individual WAO it shall consist of one 4-pair, 100-ohm, Category 6 rated cable. Single cable locations may be allowed for

guest phones and wall phones.

1. 7 PROJECT CONDITIONS

A. Schedule work in a manner to complete above ceiling work/below raised floor work prior to tile/panel installation. In the event the contractor is required to remove tiles/panels, coordinate with Contractor and do not break or disturb grid.

1. 8 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of of system components, submit final as-built drawings indicating such variations.

E.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Unshielded twisted pair, 4-pair 100-ohm, Category 6A, plenum, blue:

1. Belden/CDT
    a. 10 GX series (Category 6A)
2. Superior Essex
    a. 10 Gain XP (Category 6A)

B. Unshielded twisted pair, 4-pair 100-ohm, Category 6, plenum, blue:

1. Belden/CDT
    a. 3600 Series (Category 6)
2. Superior Essex
    a. Data Gain (Category 6)

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions to ensure a manufacturer certified solution.

B. The Contractor shall provide and install pull strings with horizontal cables as the cables are pulled.

C. The Contractor shall only support horizontal cable by approved cable support devices specified above.

D. The Contractor shall install all cables such that they do not rest on any structure other than approved cable support devices specified above.

E. The Contractor shall install all horizontal cable free of surface damage, kinks, excessive twists, and visible anomalies. Damaged cable shall be replaced at Contractor expense. Horizontal cables damaged by others during construction shall be replaced by the Contractor under unit pricing specified in bid documents.

F. No cabling shall be exposed, except when in cable tray or within a MDF/IDF. Raceway or

conduit shall be used in the WAO spaces.

END OF SECTION

27 15 33 - COMMUNICATIONS COAXIAL HORIZONTAL CABLING

PART 1 GENERAL

1. 1 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 SYSTEM DESCRIPTION

A. A single copper channel solution shall be installed for the entire project selecting from either a Berk-Tek solution, Belden/CDT or Superior Essex solution.

B. See Section 27 00 00 - Communications General for specific substitutions and conditions when designing and installing at APL. These facilities use other manufacturers for horizontal cable systems.

1. 4 DESIGN REQUIREMENTS

A. For all cables, specify plenum rated as required.

PART 2 PRODUCTS

2. 1 MATERIALS

A. 75-ohm, coax cable for video, plenum, white:

1. Berk-Tek
    a. CATV grade, RG-6 Quad Shield Coaxial Cable
2. Belden/CDT
    a. Broadband COAX CATV cable, quad shield
3. Superior Essex
    a. COAX CATV cable, quad shield

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer’s instruction.

B. COAX cables shall be white.

C. Replace cables that do not pass testing, as required by the cable type.

D. Horizontal cables shall not exceed 90 m. Installation to remote locations in excess of 90 m may be allowed with a de-rated capacity. Such installation must be pre-approved by Johns Hopkins.

E. The Contractor shall make use of raceways built into furniture for open office furnished work areas, when conditions previous described are met.

F. The Contractor shall not install cable in common cable hangers with speaker cables.

G. The Contractor shall maintain following clearances from EMI sources:

1. Power Cable: 6 inches
2. Fluorescent Lights: 12 inches

3. Transformers: 36 inches

H. Do not install cable with more than 50 pounds (220 N) pull force. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on: long pulls inside conduit, pulls of multiple cables into single small-bore conduit, on conduit runs greater than 100 linear feet with bends of opposing directions, and in conduit runs that exceed 180 degrees of accumulated bends. Use tensile rated cords (i.e. fishing line) for difficult or questionable pulls- to judge to go/no-go condition of conduit and pulling setup.

I. The Contractor shall firestop all openings and penetrations through fire and smoke rated wall and floor assemblies.

END OF SECTION

27 15 43 - COMMUNICATIONS WORK AREAS, FACEPLATES, AND CONNECTORS

PART 1 GENERAL

1. 1 RELATED SECTIONS

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 SYSTEM DESCRIPTION

A. A single copper and fiber channel solution shall be installed for the entire project selecting an Ortronics solution or a Belden/CDT IBDN GigaFlex solution.

B. See Section 27 00 00 - Communications General for specific substitutions and conditions when designing and installing at APL facilities. These facilities use other manufacturers for horizontal cable systems.

1. 5 DESIGN REQUIREMENTS

A. Design all work area outlets to ensure a manufacturer certified solution.

B. The typical WAO installation in an office environment shall incorporate two Category 6A, 8P8C outlet for data near an office desk. Larger offices may include a two Cat6A data outlet for use at a conference table.

C. General locations shall use faceplates with 2,4 or 6-port capacity, using blank modules as needed. Specify the layout of all outlets within a faceplate to ensure consistency in the installation. New projects the cables should be in the top two positions in the faceplate. For renovations, the designer should match the faceplate layout of the existing conditions in that it does not violate this specification. Single port specialty faceplates for all phone locations are allowed.

D. Specify color-coded (white voice and blue data) outlets.

E. Specify all 8P8C outlets to be terminated in the T468B pin/pair configuration. All four pairs shall be terminated.

F. Optical fiber shall be designed for termination on LC connectors.

G. The design shall not allow the use of single gang, surface-mount box with a standard faceplate. Surface-mount locations shall use shallow, wall-mount boxes with outlets on the side not on the face, of the box.

H. When specifying the Belden/CDT solution, specify Interface plates exclusively, for voice and data locations- excluding coax and wall phone locations. Specify one faceplate style for installation in the material list.

1. 6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Faceplates

1. Belden/CDT
    a. 6-Port, with ID Windows, Sigle-gang, White, (AX102251) or Smaller
    b. MediaFlex, for Keyconnect Modules, white, 6-port (AX102431)
    c. Stainless Steel plate, (AX1042xx; 2-port xx=31, 4-port xx=32, 6-port xx=33)
    d. Blank Insert, as needed
2. Ortronics
    a. Ortronics single gang, fog white, 6-port, TracJack faceplates (OR-40300545) or smaller
    b. Ortronics single gang, stainless steel TracJack faceplates (OR-4030045x; 2-port x=4, 4-port x=6, 6=port x=7)
    c. TracJack blank modules, as needed

B. Wall phone faceplates

1. AllenTel
    a. Wall jack, 4 conductors, steel with studs (PT-630AD-4)

C. Surface mount interface box

1. Belden/CDT
    a. KeyConnect Side-Entry box, 2-port (AX102652)
    b. 6-Port Keyconect Termiantion Media Box (AX106512-EW)
2. Ortronics
    a. TracJack surface mount interface box, 2-port (OR-40400054)
    b. Surface mount box, Fog White, 6-port (OR-40400056)

D. Connector Modules

1. Belden/CDT
    a. REVConnect 10GX UTP Modulaer Jack, Blue (RVAMJKUBL-S1) for Data
    b. REVConnect Cat6+ UTP Modular Jack, Blue, (RV6MJKUBL-S1) for Data
    c. KeyConnect Video F, Coax, Surface (AX102907) for COAX
        e. KeyConnect LC dual fiber module, multimode
        f. KeyConnect LC dual fiber module, single mode
        g. KeyConnect Secure/Keyed LC modules, single mode, for secure installations
        H. KeyConnect Secure/Keyed LC modules, multimode, for secure installation

2. Ortronics
    a. Ortronics Clarity6A/10G Category 6A TracJack modules, blue, 8P8C, 180 exit (OR-TJ6A) for data
    b. Ortronics Clarity6 Category 6 TracJack modules, blue, 8P8C, 180 exit (OR-TJ600) for data
    c. Ortronics TracJack Module F Connector F/F (OR-63700006) for COAX
    d. LC connector modules
        1) Ortronics TracJack Module, 1-LC, 2 fiber, 180°
        2) Ortronics TracJack Module, 1-LC, 2 fiber, angled, 2 unit high, 45°
3. Icons
    a. Belden/CDT
        1) ID tab included with module; no extra parts required.

PART 3 EXECUTION

3. 1 INSTALLATION

A. When installing a Belden/CDT solution, install Interface or MediaFlex plates, exclusively, for voice and data locations excluding coax and wall phone locations. Specify one faceplate style for installation in the material list.

B. The Contractor shall provide 12" of cable slack. Some of the slack may be pulled back into junction boxes, raceways, cable trays, or concealed ceiling space provided the manufacturer's bend radius is not exceeded. Slack beyond the outlet box shall be easily pulled out of the box and shall not be secured with cable ties or otherwise secured beyond the box to prevent this.

C. The Contractors shall install outlet modules as shown on the drawings.

D. The Contractor shall install optical fiber outlet modules with the tab notch on top when mounting on a faceplate and with the tab in front when mounting on a surface mount box. Install two-strand optical fiber cable with the blue strand on the left when facing the faceplates module. Johns Hopkins does not follow the industry standard practice of reversing pairs in optical fiber termination.

E. The Contractor shall terminate all 8P8C outlets in the T468B pin/pair configuration. All four pairs shall be terminated.

F. The Contractor shall provide and install blank modules in faceplates, as needed.

G. The Contractor shall install color-coded (shall match outlet color) designation ID tabs on all data/voice work area outlets. The Contractor shall install color-coded icon tabs (shall match outlet color) on all work area outlets. The Contractor shall cap all fiber connectors.

H. Wall phone installations

1. Install the 4-conductor plate, connecting the blue conductor to the red terminal and the blue/white conductor to the green terminal. Wrap the remaining conductors around the cable jacket- do not trim these conductors back to the jacket.

2. Johns Hopkins acknowledges that this is a deviation from ASI/TIA/EIA and BICSI requirements and acknowledges that this installation is not within the parameters of any currently approved manufacturers' solutions for voice cabling. Johns Hopkins does not require a manufacturer's warranty on wall phone cable installations but does expect the

standard warranty of the installer with respect to workmanship and connectivity.

I. The Contractor shall cover all outlet openings with masking tape, if other construction is taking place in the area. Tape shall be applied with sufficient pressure to ensure up to 60 days of adhesion. Tape shall not wrap around the edges of faceplate or surface-mount box.

J. The Contractor shall install all outlets in a neat and professional manner to the satisfaction of JH.

K. The Contractor shall install outlets in layouts shown in the attached drawings.

L. The Contractor shall label outlets as shown on the drawings and specified below or per JHH Standard Specification.

M. Surface-mounted raceway and boxes are specified below.

N. All WAOs shall be installed per manufacturer instruction to ensure a certified channel solution.

END OF SECTION

27 16 19 - COMMUNICATIONS STATION CORDS, PATCH CORDS, & CROSS CONNECT WIRE

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 00 00: Communications General.

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 SYSTEM DESCRIPTION

A. A single copper and fiber channel solution shall be installed for the entire project.

1. 5 DESIGN REQUIREMENTS

A. Specify the inclusion of one copper work area modular cord for each copper network outlet installed, unless otherwise specified by the Owner.

B. Specify the inclusion of twelve optical fiber patch cords for each IDF and twelve optical fiber patch cords for the EIDF, per grade (Single mode) per closet. Specify LC-LC patch cords and that they be left in the network room servicing the work area.

C. Patch cords used to configure additions, moves, and changes shall meet the performance requirements described in ANSI/TIA/EIA-568-B. Jumpers, patch cords and equipment cords shall be rated at the same or higher performance category as the cabling to which it connects.

D. Copper Patch Cords

1. Specify sufficient patch cords (Category 6A) to activate all data ports Ortronics or Quiktron small diameter preferred.
    a. 60% of the patch cords, 5 ft. cords.
    b. 40% of the patch cords, 7 ft cords.
2. Verify the appropriate length and ratio based on the rack design and with the Owner.

E. Patch Cord Colors

1. Specify the following colors for projects:
    a. Blue - Data
    b. Green - Television Services
    c. Purple - Security
    d. Yellow - Physiological Monitoring
    e. Lime Green - Nurse Call
    f. Orange – RTLS
    g. Black – Wireless

F. Optical Fiber Patch Cord

1. Specify optical fiber patch cords, bagged or boxed in the network room, as follows:
    a. two-strand single mode, dual LC, Corning Uniboot
2. Specify sufficient patch cords.
    a. 33% of the patch cords, 2-meter cords
    b. 33% of the patch cords, 3-meter cords
    c. 33% of the patch cords, 4-meter cords
3. Verify the appropriate length and ratio based on the rack design and with the Owner.
4. A patch cord, as used here, is dual strand “zipcord.”

1. 6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver all station cords to project site and store in network room(s).

B. Deliver all patch cords to project site and store in network room(s).

1. 7 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Copper Work Area (Station) Cords:
1. Belden/CDT
    a. GigaFlex PS6+ Modular Cord,
    b. Category 6A 10GX Modular Cord, two per outlet.
2. Ortronics
    a. Clarity 6 Modular Cord Category 6,
    b. Clarity 10G Modular Cord Category 6A, two per outlet.

B. Copper Patch Cords
1. Belden/CDT
    a. GigaFlex PS6+ Modular Cord,
    b. Category 6A 10GX Modular Cord.
2. Ortronics
    a. Clarity 6 Modular Cord Category 6
    b. Clarity 10G Modular Cord Category 6A.

C. Optical Fiber Patch Cords
1. Single-mode patch cords:
    a. Corning
        1) Duplex LC connectors, yellow, 1 meter

2) Duplex LC connectors, yellow, 3 meters

PART 3 EXECUTION

3. 1 INSTALLATION

A. Copper Patch Cords

1. The Contractor shall provide sufficient copper station cords for the type/category matching the horizontal cable for all data parts. The Contractor shall leave the appropriate number of cords, boxed or bagged, in each network room, or with IT personnel.
2. Route patch cord from patch panel port, through horizontal cable management, into vertical cable management and into appropriate switch/patch panel.
3. Do not leave coil of excess cords in one place, rather find longer route to take up slack or use shorter patch cord.

B. Optical Fiber Patch Cords

1. The Contractor shall provide sufficient optical fiber station cords of the type/category matching the horizontal cable for all data ports. The Contractor shall leave the appropriate number of cords, boxed or bagged, in each network room.
2. The Contractor shall provide sufficient optical fiber patch cords to activate all workstation outlet fiber data ports, 2-strand zipcord, bagged or boxed in each network room.
3. Route patch cord from patch panel port, through horizontal cable management, into vertical cable management and into appropriate switch/patch panel.
4. Do not leave coil of excess cords in one place, rather find longer route to take up slack or use shorter patch cord.

END OF SECTION

27 18 00 - COMMUNICATIONS TESTING

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 00 00; Communications General.

1. 2 REFERENCES

A. See Architectural Section - Reference Standards.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 SUBMITTALS

A. The Contractor shall provide Johns Hopkins with printed and electronic forms of all test results. Test results shall be unedited and as presented by the tester software. With the test results, the contractor shall provide software from the tester manufacturer to enable viewing of test results in native format. If software is not available, test results may be provided in comma-delimited text format. This must be pre-approved by the Johns Hopkins Infrastructure Project Team.

1. 5 PROJECT CONDITIONS

A. Johns Hopkins reserves the right to be present during all testing.

B. Testing of existing and active connections may be restricted until after normal working hours. Johns Hopkins Personnel shall determine if testing can occur during normal business hours.

C. Testing shall take place only when the channel is fully installed. If channel components may be moved or re-positioned after testing, the Contractor shall delay testing until cables, faceplates, and other components are in their final positions. This includes any repositioning by other trades prior to occupancy by the owner.

PART 2 PRODUCTS

PART 3 EXECUTION

3. 1 GENERAL

A. The Contractor shall perform validation testing on all voice and data communications cable installed as part of any project. This testing shall verify that the cable has been installed properly and has the specific characteristics required by the project.

B. JH reserves the right to be present during any testing.

C. The Contractor shall provide all required test equipment and personnel necessary to support the certification and validation tests prescribed in this section.

D. The Contractor shall provide a listing of the test equipment proposed for use for all certification testing.

3. 2 HIGH PAIR COUNT COPPER CABLES

A. The Contractor shall provide a continuity test for all voice pairs. All voice grade copper cable shall be tested by toning-out each pair.

B. The Contractor shall provide Johns Hopkins with printed and electronic forms of all test results. Test results shall be unedited and as presented by the tester software.

3. 3 CATEGORY 6 COPPER CABLES (LEGACY)

A. All category 6 field testing shall be performed with an approved level III balanced twisted-pair field test device.

B. All installed category 6 channels shall perform equal to or better than the minimum requirements as specified by the current ANSI/TIA/EIA standards for Category 6. If the cable manufacturer has a separate, more stringent set of test standards required to certify the total solution being installed, the Contractor shall use the more stringent requirements.

C. Category 6 balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft.) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.2. Test parameters include wire map plus ScTP shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.

D. The Contractor shall provide JHU with printed and electronic forms of all test results. Test results shall be unedited and as presented by the tester software. With the test results, the contractor shall provide software from the tester manufacturer to enable viewing of test results in native format. If software is not available, test results may be provided in comma-delimited text format. This must be pre-approved by JH.

3. 4 CATEGORY 6A COPPER CABLES

A. All category 6A field testing shall be performed with an approved level III balanced twisted-pair field test device.

B. All installed category 6A channels shall perform equal to or better than the minimum requirements as specified by the current ANSI/TIA/EIA standards for Category 6A. If the cable manufacturer has a separate, more stringent set of test standards required to certify the total solution being installed, the Contractor shall use the more stringent requirements.

C. Category 6A balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft.) for the basic link, and 100 m (328 ft.) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.2. Test parameters include wire map plus ScTP shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.

D. The Contractor shall provide JHU with printed and electronic forms of all test results. Test results shall be unedited and as presented by the tester software. With the test results, the contractor shall provide software from the tester manufacturer to enable viewing of test results in native format. If software is not available, test results may be provided in comma-delimited text format. This must be pre-approved by JH.

3. 5 COAXIAL CABLES

A. The Contractor shall test all coaxial cables per ANSI/SCTE ANSI/SCTE 15 2001 (Formerly IPS SP 100). Tests shall include characteristic impedance, conductor resistance, velocity of propagation (VOP), structural return loss (SRL), and attenuation from 5 - 1000 MHZ.

3. 6 COPPER TEST EQUIPMENT

A. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.

B. The Contractor shall set the testers to the correct cable, by manufacturer and name, to ensure correct parameters are used during testing. Test settings selected from options

provided in the field testers shall be compatible with the installed cable under test.

3. 7 FIBER OPTIC TESTING

A. The Contractor shall test all optical fiber strands for insertion loss and length. The Contractor shall perform bi-directional OTDR tests on all OSP and ISP optical fiber strands.

B. The Contractor shall test insertion loss at 850 nm and 1300 nm for 50/125m multimode cabling bi-directionally using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.

C. The Contractor shall test insertion loss at 1310 and 1550 for single model cabling bi-directionally using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.

D. The Contractor shall determine and record length using an OTDR, optical length test measurement device or sequential cable measurement markings.

E. The Contractor shall calculate the allowable attenuated loss based on final installed length, attenuation coefficient, and connector loss.

F. The Contractor shall remediate any strands testing above calculated limit.

G. JHU reserves the right to have third party testing to confirm the test results. The Contractor shall remediate, at their expense, any strands exceeding this limit by third party testing.

H. The Contractor shall provide Johns Hopkins with electronic forms of all test results. Test results shall be unedited and as presented by the tester software.

3. 8 FIBER TEST EQUIPMENT

A. All optical fiber test equipment shall be factory calibrated as recommended by the field test equipment manufacturer. The calibration certificates shall be provided for review prior to the start of testing.

3. 9 BONDING AND GROUNDING

A. All bonds installed by the contractor shall be tested for impedance with an earth ground resistance test in its two-point setup, such as a LEM Handy GEO tester. The Contractor shall place a QA label (with date and inspector) in proximity to each bond tested.

B. The Contractor shall test all grounding conductors, once installed, for current. The Contractor shall measure AC and bi-directional DC current. The Contractor shall report any AC current over 1 Amp. The Contractor shall report any DC current, in either direction, over 500milliamps.

C. Test all bonds for a maximum impedance of 0.1 using a two-point impedance test. Contractors shall remediate any bond above 0.1 impedance.

D. Test all bonds for a maximum impedance of 0.1 using a two-point impedance test. Contractors shall remediate any bond above 0.1 impedance.

END OF SECTION

27 21 33 - DATA COMMUNICATIONS WIRELESS ACCESS POINTS

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 15 43: Communications Work Areas, Faceplates, and Connectors

1. 2 UNIT PRICES

A. Submit unit price for wireless access point. Includes enclosure, dual data copper Cat6A cables up to 90 meters, two-port surface mount box, and data cable modules

1. 3 REFERENCES

A. NFPA 70 – National Electrical Code; National Fire Protection Association; 2002.

1. 4 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 5 DESIGN REQUIREMENTS

A. Single 2-port surface-mount or recessed box shall be specified at locations for wireless node connectivity. The locations may be specified on the wall below he suspended ceiling as a surface-mount box or as a standard faceplate. Locations concealed above the ceiling shall be specified as a surface-mount box.

1. 6 BASELINE WIRELESS COVERAGE AND OPERATIONAL REQUIREMENTS

A. Wireless designs should be completed using the Ekahau predictive survey based upon the following criteria

1.) Minimum -65dBm RSSI

2.) 100% floor coverage for all new and renovated spaces

- All predictive designed should be submitted to the Network Wireless team for approval prior to final design acceptance
- All areas of the space will require 100% wireless coverage for all customer facing area as well as all HVAC areas, network closets, mail rooms, supply closets, etc. Expectation is that 100% of the space provides 100% wireless coverage. Johns Hopkins is rapidly deploying mobile device solutions that require persistent wireless connectivity for inventory, facilities and maintenance, and other non-clinical and non-administrative personnel, as well as ongoing support vendors.
- Johns Hopkins personnel are rapidly moving to wireless connectivity in order to conduct their daily work tasks to include Zoom meetings, wireless personal devices used for telephone calls, and other wireless applications that require real time voice quality networks.

PART 2 PRODUCTS

2. 1 MATERIALS

A. The JH wireless Access Points are in three categories, Indoor (full coverage), Indoor (Small Aspect) and Outdoor. These are deployed according to the requested coverage area within the JH enterprise. The generic standards for the different types of Access Points is shown in the table below.

	Indoor (Full Coverage)	Indoor (Small Aspect)	Outdoor
Mounting	Universal bracket	Wall Plate/Desk Mount	Universal bracket
Wi-Fi Standard	802.11b/g/n; Wi-Fi 6E 802.11ax	802.11b/g/n; Wi-Fi 6E 802.11ax	802.11b/g/n; Wi-Fi 6E 802.11ax
Frequencies Supported	2.4GHz	2.4GHz	2.4GHz
	5GHz	5GHz	5GHz
2.4 GHz Data Rate	802.11ax up to 1,148 Mbps	802.11b/g/n up to 400 Mbps; 802.11ax up to 575 Mbps	802.11ax up to 1,148 Mbps
5 GHz Data Rate	802.11ax up to 2,400 Mbps	802.11ax up to 1,200 Mbps	802.11ax up to 2,400 Mbps
6GHz Data Rate	802.11ax up to 4,800 Mbps		
Antenna Options	Internal/External	Internal	Internal/External
Power Options	802.3af / at PoE	802.3af / at PoE	802.3af / at PoE
Operating Temperature	Internal antenna: 0° to 40° C; External antenna: -10° to 50° C	Internal antenna: 0° to 40° C	-40° to 55° C with solar loading; -40° to 65° C without solar loading
Operating Humidity	10% to 90% maximum relative humidity, non-condensing	10% to 90% maximum relative humidity, non-condensing	10% to 90% maximum relative humidity, non-condensing
Mean Time Between Failures (MTBF) in Hours	999,958*	999,958*	265,318*
Warranty	Limited Lifetime	Limited Lifetime	One Year
Compliance Standards	CSA/UL 62368-1	CSA/UL 62368-1	CSA/UL 62368-1
	FCC Part 15.247, 15.407	FCC Part 15.247, 15.407	FCC Part 15.247, 15.407

B. Related materials for installation
   - Section 27 05 28.29 – Hangers and Supports for Communications
   - Sections 27 15 00 - Communications Horizontal Cabling.
   - Section 27 15 43 – Communications Work Areas,
   - Faceplates and Connectors

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install a dual data outlet for each wireless access point location. If installed within an enclosure box, use a 2-port surface mount box per Section 27 1543 - Communications Work Areas, Faceplates, and Connectors. Mount outlets on tray or above ceiling. Attach wireless access points to the ceiling grid whenever possible.
B. Coordinate final placement of wireless access points with Architect and Owner.
C. Wireless Access Points shall be provided by the Owner and mounted by the contractor.

3. 2 VENDOR INSTALLATION REQUIREMENTS

A. Vendor will be responsible for working with Network Wireless to obtain a Johns Hopkins login in order to complete the installations.
B. All APs will require installation, placement on a current floor plain (provided by the FD&C project manager to the network wireless team), and a photo indicating identifiable location by the contracted installers using the “Mist AI” app onto the vendor-provided “smart” device.
C. All MAC addresses will be recorded and appropriately named based upon the naming convention provided for each project.
D. Installation documentation will be provided for every project to include detailed installation process, naming convention specific to each project and a direct contact telephone number for the assigned Network Engineer responsible for the design of each project.

END OF SECTION

27 32 23 - ELEVATOR TELEPHONES

PART 1 GENERAL

1. 1 RELATED SECTIONS

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. Specify a single voice cable to the elevator machine room for use by the elevator installers.

PART 2 PRODUCTS

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install the Category 6 cable to the elevator machine room and in proximity to the elevator equipment. In the serving NR terminate on wall mount 110 Block.

B. The cable shall be installed within conduit or solid raceway within the elevator machine room. The cable shall not be exposed within the room. The conduit may end up to 12" from the elevator equipment. Coordinate pathway installation with the elevator contractor.

C. Leave a 20-foot coil of cable at the end of the pathway to be terminated by the elevator contractor.

D. Label the cable where it enters the room using a hang tag on the pathway.

E. The Contractor shall terminate the cable with a single voice module for testing purposes. The module will likely be removed by the elevator contractor. No faceplate or box need be installed at this location.

END OF SECTION

27 32 26 - RING-DOWN EMERGENCY TELEPHONES

PART 1 GENERAL

1. 1 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

B. IEEE C2 - National Electric Safety Code.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 DESIGN REQUIREMENTS

A. Designers shall consult with Telecommunications on emergency phone requirements, as these vary greatly based on location.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Inside emergency phones

1. ISP copper voice cable per Section 27 15 00: Communications Horizontal Cabling

B. Outside emergency phones

1. OSP copper voice cable per Section 33 82 13: Copper Communications Distribution Cabling
2. 6-pair, 24 AWG copper cable
3. Building Entrance Terminals
    a. Circa
    b. 110 in: 110 out
    c. Circa C4B1E (PTC) modules

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install the cable to the emergency phone location.

B. Inside emergency phones

1. The cable shall be installed within conduit or solid pathway. The cable shall not be exposed beyond the primary pathway elements.

C. Outside emergency phones

1. The cable shall be installed in OSP conduit per Section 33 81 26 - Communications Underground Ducts, Tunnels, Maintenance Holes, and Handholes.
2. All OSP cables to emergency phones shall terminate on a BET within the nearest building.

D. The Contractor shall terminate the cable with a single voice module for testing purposes. The module will be removed by Johns Hopkins Institutions. No faceplate or box need be installed at this location.

E. The Contractor shall coordinate the installation of any surface mount enclosure for emergency phones. Enclosures shall be provided by others.

F. Telephone units shall be provided and installed by others.

END OF SECTION

27 53 19 – DISTRIBUTED ANTENNA SYSTEM

PART 1 – GENERAL

1.1 PURPOSE

A. This specification is intended to define the standards, criteria, and assumptions to be used in the design, documentation and specification of an indoor Distributed Antenna System supporting Public Safety (PS), Paging, UHF Radio (UHF) and Wireless Service Providers (WSP) for cell/mobile phone technologies to support the Johns Hopkins enterprise. This specification shall form the basis for the design.

B. The UHF Service providers are; Baltimore City, Maryland FirstNetTM, Johns Hopkins Clinical Paging, and the Johns Hopkins Facilities Radio System, (Police/Safety and Facilities).

C. This specification is based on NFPA 70 (NEC), IEEE C2 (NESC). NSI/TIA/EIA Telecommunication Standards, and BICSI methodologies (TDMM and CO-OSP). The requirements within those documents are not superseded by this document unless specifically stated. As required, NEC and NESC code requirements cannot be superseded by this document at any time. ANSI/TIA/EIA standards and BICSI methodologies may be superseded, as specified, or may be made stricter by this document. Not all codes, standards, and methodologies are specifically addressed by this document. The absence of a specific reference to an element of those codes, standards, and methodologies does not relinquish compliance with those elements.

D. Unauthorized deviations from this specification may require re-design, re-construction, or re-installation of ISP/OSP elements at the Designers'/Contractors' expense. Designers and Contractors shall get prior approval to deviate from this specification or ANSI/TIA/EIA standards from both the Johns Hopkins Networking Wireless Team and the Johns Hopkins IT Infrastructure Team. Contractors cannot deviate from NEC and NESC requirements.

E. "Codes" refer to the NFPA 70 (National Electrical Code) and IEEE C2 (National Electric Safety Code). "Standards" refer to ANSI, ASTM, and UL standards. "Methodologies' refers to BISCI manuals for telecommunications design and CO-OSP. "Specifications" refers to Johns Hopkins documents for installations. This is stated for clarification and not as all-inclusive definitions.

F. Like standards and codes, this document uses the word "shall" to indicate mandatory requirements and "may" or "should" to indicate optional components. Conflicts within this document are to be resolved by JH Networking, Telecommunications, and/or Johns Hopkins Personnel prior to application of the specification by a Contractor.

G. While the ANSI/TIA/EIA standards and BICSI methodologies may refer to "telecommunications network", this specification will refer to the Distributed Antenna System as defined below.

1.2 REFERENCES

A. ANSI/TIA/EIA standards referenced below may include multiple components which apply to JH projects. In all cases, the current versions or succeeding documents for the codes, standards, and methodologies listed above shall be used. Should conflicts exist within the standards, then JH Networking, Telecommunications, and/or Johns Hopkins Personnel staff shall resolve the conflict.

1.3 ABBREVIATIONS AND ACRONYMS

A. 3GPP: 3rd Generation Partnership Project
B. 3GPP2: 3rd Generation Partnership Project 2
C. AC/DC: Alternating Current/Direct Current
D. ACG: Automatic Gain Control
E. AHJ: Authority Having Jurisdiction
F. ANSI: American National Standards Institute
G. ATP: Acceptance Test Plan
H. AWS: Advanced Wireless Service
I. BDA: Bi-Direction Amplifier
J. BER: Bit Error Rate
K. BICSI: Building Industry Consulting Service International
L. BOM: Bill-of-Material
M. BRS: Broadband Radio Service
N. BTS: Base Transceiver Station
O. CDMA: Code Division Multiple Access
P. CFR: Code of Federal Regulations
Q. C/N: Carrier-to-Noise Ratio
R. CPRI: Common Public Radio Interface
S. CWDM: Coarse Wave Division Multiplexing
T. DAS: Distributed Antenna System
U. DWDM: Dense Wave Division Multiplexing
V. EBS: Educational Broadband Service
W. EDGE: Enhanced Data Rates for GSM Evolution
X. EIA: Electrical Industrial Association
Y. ER: Entry Room
Z. ESMR: Enhanced Specialized Mobile Radio
AA. FCC: Federal Communications Commission
BB. FDD: Frequency Division Duplex
CC. FirstNetTM: Maryland State First Responder Public Safety UHF Network
DD. GHz: Giga Hertz
EE. GSM: Global System for Mobile Communications
FF. GUI: Graphical User Interface
GG. iDEN: Integrated Enhanced Digital Network
HH. IDF: Intermediate Distribution Frame
II. IEEE: Institute of Electrical and Electronic Engineers
JJ. JH: Johns Hopkins

KK. JHHS: Johns Hopkins Health System
LL. JHU: Johns Hopkins University
MM. LC: Lucent Connector
NN. LMR: Land Mobile Radio
OO. LTE: Long Term Evolution
PP. MDF: Main Distribution Frame
QQ. MTBF: Mean Time Between Failure
RR. NECA: National Electrical Contractors Association
SS. NEC: National Electric Code
TT. NEMA: National Electrical Manufacturers Association
UU. NFPA: National Fire Protection Association
VV. NMS: Network Management System
WW. NRTL: National Recognized Testing Laboratory
XX. OTDR: Optical Time Domain Reflectometer
YY. OFNP: Optical Fiber, Nonconductive, Plenum
ZZ. OFNR: Optical Fiber, Nonconductive, Riser
AAA. PCS: Personal Communications System
BBB. PS: Public Safety
CCC. RoF: Radio-over-Fiber
DDD. PIM Passive Intermodulation
EEE. PS: Public Safety
FFF. MIMO Multiple-Input, Multiple-Output
GGG. MHz: Mega Hertz
HHH. MTFB: Mean Time Between Failure
III. LTE Long Term Evolution
JJJ. RL: Return Loss
KKK. RF: Radio Frequency
LLL. RFP: Request for Proposal
MMM. RoHS: Restriction of Hazardous Substances
NNN. RSL: Received Signal Level
OOO. RSSI: Received Signal Strength Indicator
PPP. RSRP: Reference Signal Received Power
QQQ. RSRQ Reference Signal Received Quality
RRR. SC-APC: Standard Connector / Angle Polished Connector
SSS. SISO: Single-Input, Single-Output
TTT. SMR: Specialized Mobile Radio HH.

UUU. SMS: Short Message Service

VVV. SNIR: Signal-to-Noise Interference Ratio

WWW. SNMP: Simple Network Management Protocol

XXX. SOW: Statement of Work

YYY. SP: Service Provider (Baltimore City/ Maryland FirstNetTM, Paging, UHF Radios)

ZZZ. SRL: Structural Return Loss

AAAA. TDD: Time Division Duplexing

BBBB. TIA: Telecommunications Industry Association

CCCC. TDMA:

DDDD. UHF: Ultra High Frequency

EEEE. UL: Underwriters Laboratories

FFFF.VOP: Velocity Of Propagation

GGGG. VSWR: Voltage Standing Wave Ratio

HHHH. WCDMA: Wideband Code Division Multiple Access

IIII. WMTS: Wireless Medical Telemetry Service

JJJJ. WSP: Wireless Service Provider

1.4 DEFINITIONS

A. Acceptance: Expressed approval by the customer

B. Active: DAS components that require AC/DC power for operation

C. Carrier Approval: Expressed written approval to interconnect to the WSP macro network

D. Channel: A path for an RF transmission between two points

E. Component: A main system element of the DAS

F. Contractor: The prime contractor bidding the project

G. Passive: DAS components that do not require AC/DC power for operation

1.5 UNITS OF MEASURE

A. C: Celsius

B. dB: Decibel

C. dBi: Decibels relative to Isotropic

D. F: Fahrenheit

E. ft: Foot or feet

F. in: Inch(es)

G. km: Kilometer

H. kw: Kilowatt

I. nm: Nanometer

J. µm: Micrometer

K. Ω: Ohm

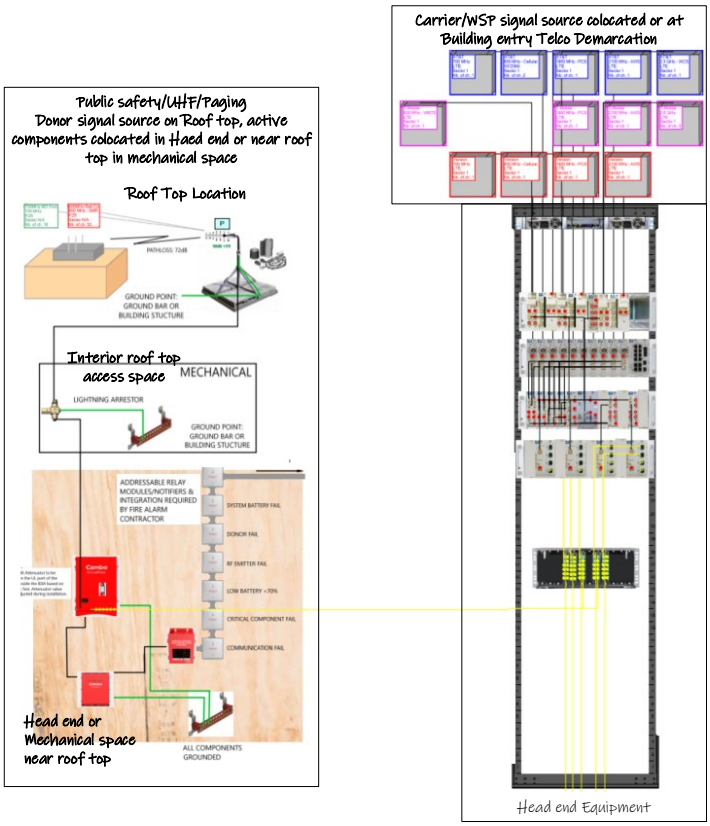
1.6 DAS SYSTEM SPECIFICATION

A. This specification describes technical and performance criteria for deploying a Neutral- Host Distributed Antenna System (DAS) capable of supporting Wireless Service Providers (WSP), Public Safety Networks (PS), Paging and UHF Radio.

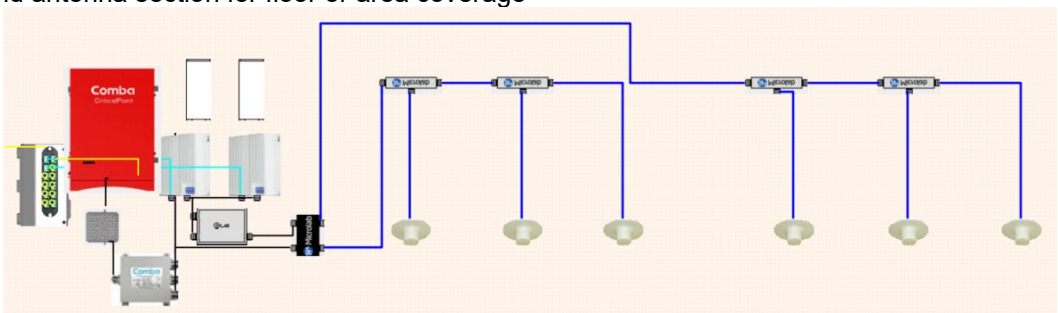
1.7 SYSTEM DESCRIPTION

A. The WSP and PS DAS is a composite system providing wireless communications through-out the facility. The system is generally comprised of a headend with signal sources and the remotes for re-transmission in a building or facility area. A typical DAS topology and system is shown below.

1. Headend and signal sources



2. Remote and antenna section for floor or area coverage



3. HEAD END COMPONENTS
   a. UHF Services
   b. Baltimore City and Maryland FirstNetTM Public safety, Paging and Facilities Police/Safety (UHF) BDAs and radios
   c. Donor antennas
   d. Outdoor rated Air Dielectric coaxial cable
   e. Lightening surge protection components
   f. Grounding components
   g. Indoor Plenum rated Air Dielectric coaxial cable
   h. Fiber Optic patch Backbone termination and patch panel
   i. WSP signal source equipment (Not in Contract, or to be bid by vendor)
   j. DAS Master unit
   k. WSP and all other UHF services Point of Interface, RF connection
   l. WSP Point of interface CPRI, Fiber link from WSP
   m. Combiners/ Splitters/ Diplexers
   n. TDD Synchronization
   o. Fiber Optic Master Unit; Optical transmitter/Receiver
   p. Fiber Optic patch Backbone termination and patch panel
   q. Indoor Plenum rated Air Dielectric Coaxial Cable
   r. RF Coaxial patch cords
   s. Indoor coverage antennas

4. REMOTE COMPONENTS
   a. PS and UHF remote transmitter/receiver
   b. WSP Remote transmitter/receiver
   c. Fiber Optic Remote unit, (may be integral to a WSP or PS and UHF remote)
   d. Fiber Optic patch Backbone termination and patch panel
   e. Combiners/ Splitter and Couplers
   f. Indoor Plenum rated Air Dielectric Coaxial Cable
   g. RF Coaxial patch cords
   h. Indoor coverage antennas

B. Services: Upon commissioning, the DAS shall provide coverage for the WSPs and other radio Service Providers (SP) listed below on all frequencies currently being used by the designated Service Providers and WSPs.

C.

Service provider	Frequency	
MD FirstNet$_{TM}$	700	MHz
Baltimore Co	800	MHz
Paging	900	MHz
Facilities UHF Radio	450	MHz
T-MOB WMTS LTE	600	MHz
T-MOB PCS LTE	1900	MHz
T-MOB AWS LTE	2100	MHz
T-MOB LTE	2.6	GHz
ATT LTE	700	MHz
ATT Cell WCDMA	850	MHz
ATT PCS LTE	1900	MHz
ATT AWS LTE	2100	MHz
ATT WCS LTE	2.3	GHz
VZN LTE	700	MHz
VZN Cell LTE	850	MHz
VZN PCS LTE	1900	MHz
VZN AWS LTE	2100	MHz

D. The system shall be able to transport and integrate in the DAS solution the PS frequencies according the local requirements and ordinances.

E. SP and WSP Approval: The Contractor shall propose and deploy a DAS system with equipment that is WSP approved and a RF design and installation that guarantees WSP approval for interconnection to the WSPs' macro networks or BTS equipment. The system will not be turned on without previous WSP acceptance and retransmission agreement. Contractor is responsible to obtain WSP approval. Contractor is responsible to ensure the RF design adapts to the carrier requirements in all stages of the project.

F. Costs associated with each respective RF Source Type and potential costs needs to be included in the response document

G. Situations where the WSP must own the BDA/Repeater needs to be clearly identified and included in the response document

H. The Contractor working with the end user customer is responsible for confirming that the site has the necessary space and power to support the DAS as well as the RF Sources including either BDA/Repeaters and identify the potential power required for Cellular Base Stations.

I. PS Approval: The Contractor shall propose and deploy a DAS system capable of receiving approval of the PS Authority Having Jurisdiction (AHJ).

J. Broadband Active Distribution: Single-mode fiber-optic cable will be used for Active distribution. In-line amplifiers are not allowed.

K. Network Management:
   1. NMS: The DAS shall have a Network Management System (NMS) capable of alarm, monitor, configuration and control of all Active Components.
   2. SNMP Integration: The DAS NMS shall be capable of integration with 3rd party SNMP based NMS products for alarm purposes and provide alarming information.

PART 2 - COMPONENTS

A. The following information shall be required for each component with submittal of the bid response:
   1. Passive Components:
      a. Detailed product specifications, specific to the project and designed devices
      b. Independent test results verifying the product specifications
      c. Written documentation from the manufacturer guaranteeing that any alternative component(s) shall remain available for new purchase for a period of 7-years from the date of system acceptance.
   2. Active Components General:
      a. Hardware and software manuals
      b. Detailed product specifications, specific to the project and designed devices
         - Call out for individual components and devices
         - Rack mounted components and devices
      c. Mean Time Between Failure (MTBF) data for each Active Component
      d. Independent test results verifying the product specifications
      e. Written documentation from the manufacturer guaranteeing that any alternative component(s) shall be supported for a period of 7-years from the date of system acceptance.
      f. For Active Components serving the WSPs, written documentation from the WSPs that the component(s) are approved for use within the WSP's network and that interconnection of the DAS to the WSP's network will not be withheld due to the component being used in the DAS.
      g. For Active Components serving the PS, written documentation from the AHJ that the component(s) are approved for use within the PS and that system acceptance of the DAS to the PS will not be withheld due to the component being used in the DAS.

PART 3 - CODES, STANDARDS AND CERTIFICATIONS

A. All work, including but not limited to items listed in this specification shall comply with the latest editions of the National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractors Association (NECA) Standard of Installation.

B. This specification is based on NFPA 70 (NEC), IEEE C2 (NESC), ANSI/TIA/EIA Telecommunication Standards, and BICSI methodologies (TDMM and CO-OSP). The requirements within those documents are not superseded by this document unless specifically stated. As required, NEC and NESC code requirements cannot be superseded by this document at any time. ANSI/TIA/EIA standards and BICSI methodologies may be superseded, as specified, or may be made stricter by this document. Not all codes, standards, and methodologies are specifically addressed by this document. The absence of a specific reference to an element of those codes, standards, and methodologies does not relinquish compliance with those elements.

C. In case of discrepancy or disagreement between the documents noted above, the contractor shall satisfy the most stringent requirements.

D. Requirements set forth by first-responder code, ordinance, or the PS AHJ shall supersede the requirements described herein and shall be met in their entirety. It is the Contractor's responsibility to ensure that the DAS complies with local code, ordinances or requirements.

3.1 PERFORMANCE REQUIREMENTS WSP DAS:

1. Contractor in their response shall identify the specific market criteria requested by each respective WSP. Ultimately it is the Contractor's responsibility to confirm that all design requirements for each respective WSP are met with their proposed solution.
2. Contractor shall state the assumed channel loading and frequency bands for the proposed WSP in-building coverage. Prior to installation, contractors shall confirm the channel loading and frequency use in the serving area, and shall guarantee coverage for these channels per the WSP.
3. The DAS shall deliver WSP coverage -75dBm RSRP for 95% of the building/facility, (based on WSP specification). Unless stated separately in the floor plans it is expected coverage including basement and garage.
4. The contractor shall explain the method used to avoid downlink and uplink interference.

3.2 Baltimore City and Maryland FirstNetTM Public Safety (PS):

1. The PS DAS shall comply with NFPA-1 2012 Edition
2. Where the in-building coverage requirements include 700 - 800 MHz public safety system and commercial wireless in-building coverage, the two systems shall be able to operate over a unified Passive Cable and Coverage Antenna Infrastructure.
3. The DAS shall deliver coverage throughout no less than 95% of the building with a Delivered Audio Quality of no less than 3.0 and an RSSI of -90dBm
4. Unless stated separately in the floor plans it is expected coverage including stairwells, elevators, basement and garage.
5. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
6. The contractor shall explain the method used to avoid downlink and uplink interference.
7. PS Approval: When approval of the DAS deployment is required by code or ordinance, the Contractor shall be responsible for facilitating the AHJ approval(s) per the requirements of the code or ordinance.

3.3 Clinical Paging Services:

1. The Paging services shall comply with NFPA-1 2012 Edition
2. Where the in-building coverage requirements include 900MHz system and commercial wireless in-building coverage, the two systems shall be able to operate over a unified Passive Cable and Coverage Antenna Infrastructure.
3. The DAS shall deliver coverage throughout no less than 95% of the building with an RSSI of -90dBm
4. Unless stated separately in the floor plans it is expected coverage including stairwells, elevators, basement and garage.
5. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
6. The contractor shall explain the method used to avoid downlink and uplink interference.

3.4 Johns Hopkins JHMI Security and Facilities Radios (UHF):

1. The Facilities DAS shall comply with NFPA-1 2012 Edition
2. Where the in-building coverage requirements include 450 MHz Facilities Radio system and commercial wireless in-building coverage, the two systems shall be able to operate over a unified Passive Cable and Coverage Antenna Infrastructure.
3. The DAS shall deliver coverage throughout no less than 95% of the building with a Delivered Audio Quality of no less than 3.0 and an RSSI of -90dBm
4. Unless stated separately in the floor plans it is expected coverage including stairwells, elevators, basement and garage.
5. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
6. The contractor shall explain the method used to avoid downlink and uplink interference.
7. PS Approval: When approval of the DAS deployment is required by code or ordinance, the Contractor shall be responsible for facilitating the Facilities Operations and safety/police force manager approval(s) per the requirements of the code or ordinance.

PART4 - SUBMITTALS

A. Submittal Requirements with Bid or RFP Response:

1. Statement of Work (SOW): Submit sample SOW with the following items covered at a minimum
   a. Project Contacts
   b. System description/solution
   c. High level design – Summary of the work, number of floors, parts lists, and expected coverage
   d. Work days and Hours
   e. Carrier Acceptance (If Required)

2. Bill-of-Material (BOM)

3. Recommended Spares

4. Pricing
   a. Key Components
      - Hardware
      - Licensing
      - Labor
      - Maintenance
   b. Total

5. Acceptance Test Plan:
   a. Submit sample ATP
   b. Test List
   c. Expected passing criteria

PART5 - Construction Submittal Requirements (Prior to Start of Construction)

A. Project Plan

1. Project responsibilities matrix
    a. Work schedule
    b. Work inspection schedule
    c. Safety plan
    d. Planned equipment deliveries,
    e. Equipment delivery acceptance plan
    f. Final Test and Acceptance Plan, (WSP/Paging/UHF coverage walks, Baltimore City and Maryland FirstNetTM PS Grid walks)

2. Project schedule showing major milestones and activities.
    a. Detailed time frames for any system or service outages
    b. Planned equipment deliveries
    c. Equipment delivery acceptance plan
    d. Work inspection schedule
    e. Test dates, (WSP/Paging/UHF coverage walks, Balimore City and Maryland FirstNet$_{TM}$ PS Grid walks

3. RF design documentation
    a. System Riser diagram
    b. Antenna placement floorplans
    c. Coaxial cable branch and Riser Link Loss
    d. Fiber Riser Link Loss
    e. Final RF design propagation modeling “Heat Maps”, (RSSI, RSRP and RSRQ and BER)

4. Manufacturer product documentation: Submit manufacturer datasheets for the following components:
    a. Donor and Coverage Antennas
    b. Coaxial Cable and Connectors
    c. Splitters, Combiners and Couplers (Passive device PIM compliance)
    d. Bi-Directional Amplifiers (BDA)
    e. Fiber Optic Riser Cables
    f. Fiber Optic Master Unit
    g. Fiber Optic Remote Units

5. Shop Drawings: Submit the following items:
    a. Overlay of system Components on floor plans
    b. Device, equipment and cable labeling plan
        • Labels will be IAW with the JH Information Technology Wireless System naming convention, as edited for brevity with JH project management
    c. Head equipment
        • Floor plans
        • Rack elevations
        • Wall mounted component details
        • Equipment Grounding design plan
        • Equipment interconnection plans
    d. Remote equipment
        • Floor plans
        • Rack elevations
        • Wall mounted component details

- Equipment Grounding design plan
- Equipment interconnection plans

e. Drawings for Donor Antenna and grounding
- Lighting protection plan

6. Final Bill-of-Material (BOM)

7. Maintenance Service Contract

8. Acceptance Test Plan (ATP): The contractor shall submit an ATP that has been accepted by the customer or customer's designated representative.
   a. Fiber Riser Cable tests
   b. Coaxial Cable tests
      - Constant wave signal coverage tests (WSP, Baltimore City and Maryland FirstNetTM Paging and UHF)

B. Submittal Requirements at Close Out
   1. Product Data: Submit manufacturer datasheets for the following components:
      a. Donor and Coverage Antennas
      b. Coaxial Cable and Connectors
      c. Splitters, Combiners and Couplers
         - Passive device PIM compliance
      d. Bi-Directional Amplifiers (BDA)
      e. Fiber Optic riser cables
      f. Fiber-Optic Master Unit
      g. Fiber-Optic Remote Units

   2. Drawings: Submit as-built drawings updated from Installation plans and drawings

   3. As-built Pictures
      a. Headend room, rack rows and individual racks
      b. Remote location equipment installations
      c. Typical antenna installation

   4. Field Reports: Submit sweep-testing results for all cable runs.

   5. Field Reports: Submit OTDR test results for all fiber runs.

   6. Test Reports
      a. WSP DAS: Submit accepted ATP reports confirming the requirements of Section 2.04A have been met.
      b. Baltimore City and Maryland FirstNet$_{TM}$: Submit Accepted ATP reports confirming the requirements have been met.
      c. Paging: Submit Accepted ATP reports confirming the requirements have been met.
      d. Facilities and Police/Safety UHF: Submit Accepted ATP reports confirming the requirements have been met.

   7. Installed and tested coverage "Heat Maps" for all DAS supported service providers' frequency and service
      a. (RSSI, RSRP and RSRQ and BER)

8. Operation and Maintenance Data: Submit hardware and software manuals for all Active Components.

9. Warranty Documents:
    a. Submit for all manufactured components specified in this Section.
    b. Submit Contractor's System Warranty.
    c. Submit Manufacturer's Extended Warranty

PART6 - QUALITY ASSURANCE

A. Qualifications
    1. Contractor, and/or Sub-Contractors, shall have a minimum of 5-years full-time experience executing work of similar scope and complexity.

B. Certifications
    1. Passive Components: Contractor or Sub-Contractor shall provide manufacturer certification that their personnel have been trained on the components being installed.
    2. Active Components: Contractor or Sub-Contractor shall provide manufacturer certification that their personnel have been trained on the components being installed.

C. Inspections
    1. JH personnel reserve the right to do spot inspections of installation techniques
        a. Cable pathway supports for riser and horizontal cables
        b. Coaxial cable terminations
        c. Fiber optic splices and connectors
        d. Passive device and antenna support/installation
        e. Grounding
        f. Lightening protection
        g. Rack installation
        h. Wall board installation
        i. Power cabling
        j. Equipment interconnection

D. Warranty
    1. Manufacturer Warranty:
        a. Splitters, Couplers and Coverage Antennas: 5-year limited warranty from date of system acceptance.
        b. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
        c. Fiber-Optic Cable: 20-year limited warranty from date of system acceptance.
        d. Active Components: The earliest of 1-year limited warranty from date of system installation or 15 months from date of shipment.
    2. Contractor Warranty: Contractor shall warrant the system performance as specified for 1-year.

E. Maintenance
    1. The Contractor shall provide an optional maintenance service contract, covering for a period of one-year: preventative maintenance, system monitoring, spares, fault mitigation, equipment repair, and response time.

F. Contractor Credentials
   1. The Contractor shall document their relations with the equipment manufacturer, certifications with the manufacturer and significant success stories.

PART 7– PRODUCTS

A. Antenna Frequencies supported

Frequencies	
450	MHz
600	MHz
700	MHz
800	MHz
850	MHz
1900	MHz
2100	MHz
2.3	GHz
2.6	GHz

B. Broadband Donor Antennas: Broadband Donor Antennas shall feature a multi-band design accommodating the frequencies defined above for this system.

C. PS, UHF and paging Donor Antennas shall feature a multi-band design accommodating the frequencies defined above for this system.

D. Omni-Directional Coverage Antennas shall feature a multi-band design accommodating the frequencies defined above for this system.
   a. Omni-Directional Coverage antennas shall feature a multi-band design, accommodating multiple frequency bands in a single small antenna.

Specifications (for commonly used frequencies)								
Frequency (MHz)	450-512	617-806	806-960	1350-1435	1670-2200	2200-3500	3500-4200	4200-6000
Max Gain (dBi)	1.3	1.6	4.3	4.5	5.1	6.2	6.4	7.2
Avg Gain (dBi)	1	1	3.5	3.5	4.5	5.5	5.5	6
Avg VSWR	<3:1	<3:1	<2.5:1	<2:1	<2:1	<2:1	<2:1	<2:1
Impedance	50 Ω							
Polarization	Vertical							
Beamwidth	Omni (360°)							
Max Power	20 Watts							
Input Connect.	Single input, single output - Type N-Connector							

E. Directional Coverage Antennas: Directional coverage antennas shall feature a multi-band design, accommodating multiple the system frequency bands in a single small antenna.

F. Fiber-Optic Cable and Connectors General Specifications:

1. The DAS fiber backbone cabling system shall be designed to conform to the requirements of ANSI/EIA/TIA-568-B. In conformance with this standard, the cabling system shall be designed in a hierarchical star topology.
2. This cable shall be armored or shall be routing in conduit, innerduct or steel raceway.
3. Optical fiber cables shall meet or exceed all applicable national and local building fire code requirements. Fiber cables used in a return air plenum environment shall have an Underwriters Laboratories rating that meets or exceeds the requirements of NFPA 262- 1985 and UL®-910. (OFNP) and (UL®) shall be printed every two (2) feet on the cable jacket. The optical fiber riser cable shall have an Underwriters Laboratories rating that meets or exceeds the requirements of UL®-1666 (OFNR) and (UL®) shall be printed every two (2) feet on the cable jacket.
4. All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical and environmental requirements of this specification. The attenuation specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable. No nominal values will be acceptable.
5. Johns Hopkins does not follow the industry standard practice of reversing pairs in optical fiber termination. In all cases, the first strand of a termination module is blue. The complexity of the Johns Hopkins infrastructure and the past practices makes this requirement necessary.
6. Connections between any fiber optic patch panels shall be made with a pre-manufactured, fiber optic patch cord. All fiber optic jumper assemblies shall comply with the standards for both fiber optic cables and fiber optic connectors.
7. Fiber shall be installed with strain relief as outlined by BISCI methodologies.
8. A service loop of 20 feet is required at each MDF and ER location. A service loop of 10 feet is required at all IDF locations. Service loops shall be neatly secured a minimum of eight feet above floor level on an adjacent wall within the communications room.
9. Secure the cable to the cable tray using Velcro cable ties.
10. Secure the cable to the wall to prevent horizontal movement of the cable (D-rings are acceptable). Secure the cables to the wall in a non-deforming manner to prevent vertical movement of the cable.
11. Optical fiber intra-building backbone cables run entirely within stacked network rooms, within metallic conduit, or within innerduct can be unarmored. Otherwise, the cables shall be armored, including cables run in open raceways.

G. Fiber-Optic Riser cables:

1. Cables shall be six-strand or greater, designed for point-to-point applications as well as mid-span access, and shall provide a high- level of protection for optical fiber installed in interior building environments.
2. Higher optical fiber count cables shall utilize a sub-unitized design with color-coded subunits for easy identification.
3. Single-mode optical fibers shall be 8.3 µm and use standard colored tight-buffered construction.
4. The single-mode optical fiber shall be dispersion-unshifted optical fiber that meets ITU-T G.652c standards.
5. Cable shall provide optimum performance over entire wavelength range from 1260 to 1625 nanometers.
6. Cable shall support new and emerging applications that utilize extended E band, 1360 to 1460 nanometers.

7. Cable shall also support existing and legacy single-mode applications that traditionally operate in 1310 and 1550 nanometer regions.
8. Cable shall deliver a cost-effective upgrade path by expanding available wavelengths by 50 percent supporting 16 Channels of coarse wave division multiplexing (CWDM) on a single optical fiber and up to 400 Channels of dense wave division multiplexing (DWDM) on a single cable.
9. Multi-count fiber cables shall utilize a sub-unitized design with color-coded subunits for easy identification.
10. Single mode Fiber Characteristics
    a. All specified single-mode fiber optic cable shall meet the following grade, attenuation and bandwidth characteristics.
        - 8.3 to 9/125 micron
        - 1.0 dB/km @ 1310 nm and 1550nm Maximum attenuation
    b. The termination panels/connectors for single mode fiber shall be blue in color.
    c. Terminations and Connectors for Fiber Optic Cable
    d. Each strand of optical fiber cable shall be terminated with factory installed, LC connectors with field fuseable or Uni-cam pigtails. Terminate the fiber on a rack mounted patch panel.
    e. Typical loss shall not exceed 0.2 dB with a maximum loss of 0.4 dB per connector using LC type connectors. Durability shall not be less than 0.2 dB change over 100 rematings.

H. Fiber-Optic Pigtails General Specifications:
1. To maintain channel integrity, optical fiber patch cords and pigtails shall be fabricated to meet the performance parameters corresponding to the optical fiber cable approved product type specified below. Patch cord and pigtail plug connectors shall be equipped with boots, and shall have same colors as related optical fiber backbone cables, unless specified or indicated otherwise. Optical fiber patch cords and pigtails shall be available with the following options as specified or indicated:
    a. Termination types: SC-APC
    b. Connector/cable configuration: Simplex and duplex
    c. Fire ratings: Riser, plenum and/or LSZH
    d. Patch cord outside diameters: 1.6 millimeters (0.063 inches) and 3.0 millimeters (0.118 inches)
    e. Pigtails: Ruggedized and tight-buffered optical fiber—0.9 millimeters (0.035 inches) outside diameter
    f. Lengths: As specified or indicated

I. Optical Fiber Patch Cord
1. Fiber Patch cords shall meet the Single Mode fiber specifications in the Johns Hopkins Information Transport Systems Design and Construction Specification, Section 27 16 19 - COMMUNICATIONS STATION CORDS, PATCH CORDS, & CROSS CONNECT WIRE
2. Single-mode patch cords:
    a. Corning
        - Duplex LC connectors, yellow, 1 meter
        - Duplex LC connectors, yellow, 3 meters
3. Single mode Fiber Characteristics
    a. All specified single-mode fiber optic cable shall meet the following grade, attenuation and bandwidth characteristics.
        - 8.3 to 9/125 micron

- 1.0 dB/km @ 1310 nm and 1550nm Maximum attenuation

b. The termination panels/connectors for single mode fiber shall be blue in color.

4. Verify the appropriate length and ratio based on the rack/remote design and with the Owner.

J. Coaxial Cable -- Air Dielectric, Plenum Rated Cable:
1. Material Characteristics
   a. Inner conductor: Copper-Clad Aluminum Wire
   b. Dielectric: Extruded Polyethylene
   c. Outer conductor: Corrugated Copper
   d. Jacket: Plenum Rated / color blue
2. Electrical Characteristics:
   a. Characteristic impedance [Ω] 50 +/- 1
   b. Relative propagation velocity [%] 91
   c. Capacitance [pF/m (pF/ft)] 76 (23.2)
   d. Inductance [µH/m (µH/ft)] 0.19 (0.058)
   e. Max. operating frequency [GHz] 6
   f. Jacket spark test RMS [V] 8000
   g. Peak power rating [kW] 40
   h. RF Peak voltage rating [V] 2000
   i. DC-resistance inner conductor [Ω/km (Ω/1000ft)] 1.48 (0.45)
   j. DC-resistance outer conductor [Ω/km (Ω/1000ft)] 1.9 (0.58)
   k. Impedance: 50 ± 2.0 Ω
3. Mechanical Characteristics:
   a. Weight, approximately [kg/m (lb/ft)] 0.37 (0.25)
   b. Minimum bending radius, single bending [mm (in)] 125 (5)
   c. Minimum bending radius, repeated bending [mm (in)] 254 (10)
   d. Bending moment [Nm (lb-ft)] 4.1 (3)
   e. Max. tensile force [N (lb)] 1112 (250)
   f. Recommended / maximum clamp spacing [m (ft)] 0.5 / 0.9 (1.8 / 3)
4. Attenuation Characteristics are shown in the table below.

Frequency	Attenuation	Power
[MHz]	[dB/100ft]	[kW]
450	1.48	1.49
500	1.56	1.41
512	1.58	1.39
600	1.73	1.28
700	1.88	1.17
750	1.95	1.13
800	2.02	1.09
824	2.06	1.07
894	2.15	1.02
900	2.16	1.02
925	2.19	1.01
960	2.24	0.986
1000	2.29	0.964

Frequency	Attenuation	Power
[MHz]	[dB/100ft]	[kW]
1250	2.60	0.851
1400	2.77	0.799
1500	2.88	0.768
1700	3.09	0.713
1800	3.20	0.693
2000	3.40	0.650
2100	3.50	0.633
2200	3.59	0.618
2300	3.69	0.603
2400	3.78	0.588
2500	3.87	0.575
2600	3.96	0.562

Attenuation at 20°C (68°F) cable temperature, Mean power rating at 40°C (104°F) ambient temperature

a. Approved Manufacturer: RFS ICA12-50JPL.

K. Coaxial Cable -- Air Dielectric, Outdoor Rated Cable:
   1. Material Characteristics:
      a. Jacket: Halogenated, Fire-Retardant
      b. Outer Conductor Material: Aluminum Tape
      c. Inner Conductor Material: Solid BCCAl
   2. Electrical Characteristics:
      a. Impedance: 50 ± 2.0 Ω
      b. Peak Power Rating: ≥ 40.0 kW
   3. Mechanical Characteristics:
      a. Diameter Over Jacket: ≤ .590 in
      b. Minimum Bending Radius: ≤ 6 in
      c. One Time Minimum Bending Radius: ≤1.5 in
      d. Approved Manufacturer: Times Microwave LMR-600

   4. Attenuation Characteristics

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.848
450	≤ 1.53
800	≤ 2.105
2000	≤ 3.564

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

L. Coaxial Cable Connectors
   a. Low PIM
   b. Compression fit
   c. Type N or 4.3-10 as required by antenna, passive device and headend/remote equipment

M. Coaxial Patch cables
   a. Low PIM
   b. Low VSWR
   c. 100% VSWR, PIM certified and tested
   d. Quantity and sizes per application
   e. Type N or 4.3-10 as required by antenna, passive device and headend/remote equipment. The Contractor shall test all coaxial cables per ANSI/SCTE ANSI/SCTE 15 2001 (Formerly IPS SP 100). Tests shall include characteristic impedance, conductor resistance, velocity of propagation (VOP), structural return loss (SRL), and attenuation from 5 - 1000 MHZ.

      1. Approved Manufacturer: ADRF

N. Splitters, Combiners, Couplers,
   a. Low PIM construction
   b. Low insertion loss design

O. Lightening Protection, Grounding and Bonding
   1. The DAS components will be grounded and bonded in accordance with the following standards:
      a. ANSI/TIA 607B
      b. ANSI/TIA-607-C-1
      c. ANSI J-STD 607B
      d. ANSI/NECA/BICSI 607
      e. IEEE 1100

f. IEEE 81
g. ISO/IEC 30129:10.2015
h. NFPA 70 (NEC)
i. ATT-TP-76416 Grounding and Bonding Standard

2. There are two areas for grounding and bonding exterior and interior.

2.1 Interior

- Where the interior active equipment at the headend, signal source and remote locations is powered by AC the electrical grounding is accommodated by the electrical circuits provided by others. The chassis of each device/equipment component will be grounded to the cabinet/rack or building ground.
- Where these devices use a dedicated DC power source then the equipment chassis and power source must be grounded and bonded to the building ground. The methods used will be dictated by the DC power system and the WSP/UHF and Paging system installation guidance.
- At a minimum there will be a #6awg connecting ground wire, (green) from each cabinet/rack bonded to #2awg main ground wire which is connected to a ground bus bar that is bonded to the building ground.

2.2 Equipment Grounding Conductors

- Grounding conductors, whether stranded or solid, shall be tinned copper. Aluminum conductors shall not be used.
- A grounding conductor located within a rack/cabinet or equipment bay shall be a copper bus bar, ribbon, or a solid or stranded copper conductor. It may be insulated or uninsulated and tinned.
- Insulation on grounding conductors used in ac power systems shall be green. The most common of these are:
  a) Equipment grounding conductors run with feeder and branch circuit conductors
  b) Grounding electrode conductors from house service panels and the sources of separately derived systems
  c) Main and equipment bonding conductors. When these conductors are larger than #6 AWG, they may be identified with a suitable means of green marking (tape, paint, etc.)

2.3 Grounding Connectors

- Crimp (compression) type bolted tongue connectors shall be used to terminate stranded grounding conductors. The connectors shall be tin plated copper, either short barrel or long barrel., and shall be listed for their intended use by an NRTL.
- Crimp type connectors used on solid conductors must be listed by an NRTL for use on solid conductors, and must be crimped with the dies specified by the manufacturer of the connector.
- Two-hole bolted tongue connectors shall be used except where single hole connectors are specified in the standard equipment drawing.
- Two-hole bolted tongue connectors shall have an “inspection window” between the tang and the barrel to allow verification that the wire is fully inserted into the connector.
- Back to-Back cable connections are not permitted on ground busbars. Any time an installer uses the last connection point on a ground bus, he shall provide a supplemental CO bus bonded to the original bus with a 750-kcmil conductor.

2.4 Telecommunications Grounding Bus Bars

- Construction
  Bus bars shall be copper and may be tinned or un-tinned. Un-tinned bus bars shall be burnished to a bright finish before anti-oxidant is applied and terminations completed. Ground bars furnished as part of a listed assembly or an assembly that has been approved for use may be used without regard to material.
- Dimensions
  Bus bars shall be sized to accommodate the initial conductors plus a 50 percent growth factor, and in no case shall it be smaller than the minimum size for a CO GRD bus bar: 3/8" x 6" x 16" and 3/8" x 6" x 24" is recommended. When bus bars specified in standard drawings are different in size from those in this Practice, the dimensions specified in the standard drawing shall be used.

2.5 Exterior grounding and bonding are a lightening protection consideration.

- Antenna mounted above the roof top parapet and on free standing masts/roof mounts that are subject to lightening strikes the mast and mounting devices will be bonded to the rooftop lightening protection.
- RF cables extending from the antennas into the building will be protected using a gas activated lightening surge protector rated from DC to 6000MHz. This surge protector will be installed at the closets point of cable entry and connected to the building steel or ground. The surge protector is connected to the exterior grade coaxial cable from the antenna to the interior riser cable for the DAS system.

P. Headend and Remote location devices and components

1. All equipment selected will be approved and acceptable to the WSP(s)
2. All equipment complies with the applicable rules described in Title 47 CFR (Code of Federal Regulations), Part 15.
   - GSM/EDGE/TDMA and CDMA compliant with CDMA2000-3GPP2 specifications (C. S0051-0) and FCC regulations, 8.5dB PAR;
   - EV-DO: compliant with CDMA2000/1xEV-DO 3GPP2 specifications (C. S0032-B);
   - WCDMA carriers TM1-64DPCH 60% clipping, 8.5dB PAR, compliant with 3GPP TS 25.143 and FCC regulations;
   - LTE FDD: compliant with 3GPP specifications (TS 36.143) and FCC regulations, 60% clipping, 8.5dB PAR;
   - 5G NR: compliant with 3GPP specifications, 8.5dB PAR.

Q. The remote equipment will support all frequencies

1. Enclosure rating:
   - IP32 (box)
   - IP66 NEMA Type 4 enclosure

R. BDA: When the AHJ, SP (UHF) and/or WSP dictates a BDA drive the DAS, the BDA shall be of modular design and use digital filtering to mitigate interference and accommodate multiple services at the headend and the remote locations

1. Supports Baltimore City and Maryland FirstNet$_T$ 700/800MHz in single band or dual band version
2. Supports P25 P1/P2 digital and conventional analog communications simultaneously
3. Built-in mandatory isolation test to prevent BDA oscillation

4. Auto shutdown with alarm upon oscillation detection
5. NFPA compliant dry contact alarms,
6. Alarming: Shall support both SNMP and SMS using wireless modem
7. NEMA 4X enclosure
8. LTE band 14 Compliance with NFPA-1 2012 edition Annex O In- Building Public Safety Radio Enhancement Systems.
9. FCC: Shall be FCC type certified.
10. Mounting Options: shall support rack, and wall mounting
11. Approved Manufacturer: Comba PS BDA (AC power) or equivalent

S. Cable and equipment labels

1. TAGs
   - Preformed stamped fire-retardant material that measures ¾" to 1" wide, by 1 ¼" to 1 ¾" in length with rounded corners and a ¼" inch hole at one end. Tag shall be secured with multi-strand waxed cord, with a sufficient pigtail to allow the tag to be rotated for viewing,
2. P-Touch DESIGNATION MARKERS
   - Designation markers shall be ½" to 1 inch in width tape, not to exceed 3 inches in length
   - All markers shall be white with black lettering

PART8-EXECUTION

A. INSTALLATION

1. The contractor shall design, install, commission and test the DAS in accordance with the manufacturer's instructions and recommendations.
2. The contractor shall install the DAS in accordance with the accepted SOW.
3. Johns Hopkins reserves the right to be present during any phase of construction and testing.
4. Progress reports shall be provided at significant construction/installation milestones.

B. ACCEPTANCE TESTING

1. Acceptance testing will be performed confirming the requirements have been met.
2. Johns Hopkins IT personnel will be present for acceptance testing
3. The contractor shall complete the acceptance testing as prescribed in the approved Acceptance Test Plan (ATP) submittal.

END OF SECTION

28 13 00 - ACCESS CONTROL

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 08 71 11 - Electrical Locking Control

B. Section 27 05 28.29 – Hangers and Supports for Communications

C. Sections 27 15 00 - Communications Horizontal Cabling.

D. Section 27 15 43 – Communications Work Areas, Faceplates and Connectors

1. 2 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 SYSTEM DESCRIPTION

A. Security Access System: Control access to building using encoded cards:

1. Selected Exterior Doors: Control access into building.
2. Selected Building Areas: Control access into specific areas.

1. 5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years documented experience.

D. Products: Furnish products listed and classified by Underwriters Laboratories Inc. As suitable for purpose specified and indicated.

1. 6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer’s descriptive literature for each system component specified in this section.

C. Shop Drawings: Indicate type, quantity, layout, dimensions, support points, and finishes.

D. Closeout Submittals: If variations from approved shop drawings occur during installation of of system components, submit final as-built drawings indicating such variations.

PART 2 PRODUCTS

2. 1 MANUFACTURERS

A. Security Access System:

1. Blackboard, Inc. / J-Card - Homewood Campus
2. Software House C CURE 9000 – East Baltimore Campus

2. 2 COMPONENTS

A. Homewood cabling products provided by Johns Hopkins Institutions. Security cable shall be gray in color.

B. East Baltimore Campus Cabling

1. Card Readers - 18 AWG 6 Conductor Plenum Cable
2. Door Power - 18 AWG 2 Conductor Plenum Cable
3. Panic Alarms - 22 AWG 2 Conductor Plenum Cable

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturers and JH specifications.

END OF SECTION

28 23 00 - VIDEO SURVEILLANCE

PART 1 GENERAL

1. 1 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 SYSTEM DESCRIPTION

A. Description: Provide video communications between points of surveillance indicated on Drawings and central monitoring station.

B. Distribution: Baseband, DC to 6 MHZ.

1. 4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate electrical characteristics and connection requirements, including system wiring diagram.

C. Product Data: Provide showing electrical characteristics and connection requirements for each component.

D. Manufacturer’s Installation Instructions: Indicate application conditions and limitations for use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of cameras and routing of television cable.

F. Operation Data: Instructions for starting and operating system.

G. Maintenance Data: Routine trouble shooting procedures.

H. Closeout Submittals: If variations from approved shop drawings and samples occur during installation of video surveilance, submit final as-built documentation indicating such variations.

1. 5 QUALITY ASSURANCE

A. Conform to requirements for NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 100 miles of Project.

E. Products: Furnish products listed and classified by Underwriters Laboratories, Inc. As suitable for purpose specified and indicated.

PART 2 PRODUCTS

2. 1 ACCESSORIES

A. UTP Category 6A Cable

1. Reference section 27 15 13 for cable information

B. Optical Fiber

1. Inside cable

a. 2-strand, 50/125 micron multimode, or single mode plenum:

1) Corning

2. Outside cable

a. Corning Cable Systems,

1) Interlocking armored

2) Listed NEC OFNR, riser-rated

3) Loose tube, gel-free

4) Single Mode

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Contractor shall coordinate connector types for copper and optical fiber installation.

3. 2 INTERFACE WITH OTHER PRODUCTS

A. Interface installation of video surveillance with security access and intrusion detection systems.

3. 3 MANUFACTURER'S FIELD SERVICES

A. Provide the services of manufacturer's technical representative to prepare and start systems and supervise final wiring connections and system adjustments.

3. 4 ADJUSTING

A. Adjust manual lens irises to meet lighting conditions.

3. 5 DEMONSTRATION

A. Demonstrate system operation and provide four hours of instruction with manufacturer's training personnel.

B. Conduct walking tour of project and briefly describe function, operation, and maintenance of each component.

END OF SECTION

APPENDIX A - SPECIAL PROJECT PROCEDURES FOR HEALTHCARE FACILITIES

PART 1 - GENERAL

1. 1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1. 2 SUMMARY

A. This Section includes administrative, supervisory, and operational requirements necessary for performing construction operations within or about the Owner's property.

1. 3 PUBLISHED REGULATIONS

A. The Contractor shall at all times abide by the published regulations of the Owner, and all amendments including those that may be issued during the duration of the Contract. Particular attention is called to those regulations pertaining to life safety, infection control, noise, and security.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3. 1 OWNER'S REPRESENTATIVE

A. The Contractor shall abide by the directions of the Owner's Representative in matters affecting the operation, safety, and security of the facility, its patients, and its visitors.

B. The Contractor shall abide by all directions of the Owner's Construction Safety Coordinator in matters affecting fire safety and preventative measures.

C. The Contractor shall implement all oral instructions given to the Contractor by the Owner's Construction Safety Coordinator immediately. The Owner will make confirmation or explanation of oral instruction by written notice or at the next scheduled progress meeting.

D. All personnel employed by the Contractor, including subcontractors and their employees, shall be instructed by the Contractor to abide by all published regulations, and all directives of the Owner's Representative and the Owner's Construction Safety Coordinator.

3. 2 NOISE CONTROL

A. The Contractor shall execute the Work in this Contract as quietly as practicable to avoid unnecessary disturbances to patients within the facility premises use of special precautions and methods of operation by the Contractor to reduce noises to acceptable levels.

B. The Owner shall be the sole judge of the tolerability of noise levels.

C. No entertainment radios, receivers, CD/tape players, including personal headsets will be allowed on construction site.

3. 3 PERSONNEL IDENTIFICATION

A. All employees of the Contractor and all subcontractors shall be required to wear photo identification badges furnished by the Owner's Security I.D. Office while on the owner's premises.

B. The identification badges shall be conspicuously fixed to outer garment above elbow level and must be worn at all times.

C. Loaning or borrowing badges for the purpose of gaining access to the facility is strictly forbidden and could result in criminal charges against the parties involved.

D. Any of the Contractor's or subcontractor's personnel who do not comply with this requirement at all times will be denied access to the facility or will be escorted off the premises by the Owner's Security Guards.

E. All outside personnel of the Contractor and his subcontractors must be trained by the Construction Safety Coordinator prior to obtaining an I.D. badge. The training must be done yearly to maintain the use of the I.D. badge.

3. 4 PERSONNEL PARKING

A. At no time shall the employees of the Contractor or subcontractors employed by the Contractor be allowed to park their vehicles on the Owner's premises, except as paying patrons of the Johns Hopkins Parking Facilities.

3. 5 LIMIT OF OPERATIONS

A. Normal Limit of Operation: The Contractor's normal limit of operations shall be confined within the Limits of Work Area as designated on the Drawings.

B. The Owner will make all efforts to prohibit his personnel, patients, and visitors from using these areas.

C. The Owner, Owner's Representative, and other contractors performing work within these limits of operation shall be allowed access at all times.

D. Periodic Operation Outside Limits of Operation: Use of certain loading docks, passageways, elevators, and other areas, outside of the limits of operation as defined, will be granted to the Contractor by the Owner on an intermittent basis as required and requested in advance by the Contractor. The Owner will judge the proper time and extent of such use.

3. 6 OWNER'S PROPERTY

A. Existing Unattached Equipment: All existing equipment to be salvaged or reused will be removed from the Limits of Operation by the Owner prior to start of construction by the Contractor, unless otherwise directed.

B. Existing Attached Equipment: Existing attached equipment designed for reuse by the Owner shall be disconnected and removed by the Contractor. Such equipment shall be removed in the largest possible sections, convenient for handling.

C. The Contractor shall disconnect and cap all services and utilities serving such equipment, and make any necessary patching required.

D. All such equipment shall remain the property of the Owner and shall be delivered by the Contractor to such storage area within the Owner's property as designated by the Owner.

E. The Contractor shall remove all other equipment not designated for salvage. It shall remain the Owner's property until such time that the Contractor removes such equipment from the Project site. Upon removal from the site, such equipment shall become the property of the Contractor and must be removed from the facility premises immediately.

3. 7 SCHEDULING AND COORDINATION

A. Supervision: The Contractor shall employ a competent superintendent and necessary assistants, acceptable to the Owner, who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. The Owner has determined that this Project will require the use of ,<**insert either "full time" or "adequate", if applicable, clarify that one or the other would apply during a specific phase, work shift, activity, and/or complexity of work>** supervision for the performance of the Work.

1. Full Time Supervision: The Contractor is required to have a superintendent present at the site of the Project at all times when performance of the Work is actively underway regardless of the day or shift. During these times the superintendent will not be assigned to any other project and will not perform any trade work on the Project. Consistent with the foregoing as well as for superintendent's personal reasons, at those times when the superintendent is taken away from the site of the Project, a replacement superintendent suitable to the Owner shall be assigned to the Project.

2. Adequate Supervision: The Contractor is required to have as superintendent at the site of the Project periodically during times when performance of the Work is actively underway regardless of day or shift. During these times the superintendent can be assigned to other projects, whether or not for the Owner, and can perform trade work on the Project. Such activity not related to the Project will not interfere with the superintendent's knowledge of or ability to control the Project's schedule, coordination, quality, etc. Further during these times, the superintendent will be readily accessible by pager and telephone, and able to be at the site of the Project with two (2) hours of notification. When the superintendent cannot comply with the foregoing and for personal reasons, a replacement superintendent suitable to the Owner shall be assigned to the Project. It is the responsibility of the Contractor to determine the degree to which less than full time supervision can be utilized in the performance of the Work without compromising any other provision of the Contract Documents. At the Owner's sole discretion, if it is observed that the Contractor is not providing adequate supervision, the Owner will direct the Contractor to increase the intensity of supervision to a level that is acceptable to the Owner. The Contractor shall do so at no additional cost to the Owner and with no adjustment of Contract Time.

B. Specifications and Work Drawings: Titles to divisions and paragraphs in the specifications are introduced merely for convenience and are not to be taken as part of the specifications or as a segregation of the several units of materials and labor. The Owner's Representative or Owner assumes no responsibility, either direct or implied, for omission or duplications by the Contractor or Subcontractor, due to real or alleged error in arrangements of matter in these Contract Documents.'

C. The Drawings and Specifications are complimentary. Anything shown either by Drawings or described in Specifications shall be done as if called for by both.

D. No extra charge or compression will be allowed on account of differences between actual measurements and the dimensions indicated on the drawings.

E. When the word "approved", "satisfactory", "equal", "acceptance", "proper", or "as directed" are used, prior approval by the Owner shall be required.

F. Should the Drawings disagree in themselves or with the Specifications, or should be Specifications disagree in themselves, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise ordered in writing, shall be provided.

G. Measured dimensions shall take precedence over scale measurements and large scale drawings over small scale drawings.

H. Scheduling: All arrangements for work which will involve interference with the normal functioning of the facility, particularly in occupied patient areas, or adjacent thereto, shall be scheduled in advance with the Owner to provide for a minimum of disruption and inconvenience.

I. The Owner will schedule such interferences so as to cause a minimum of disruption to normal facility functioning.

J. The Contractor's request for use of docks, corridors, elevators, and other spaces shall be limited to an hour-by-hour basis and shall be approved by the Owner.

K. Outages: Utility, service, and life safety outages shall be kept to a minimum, and will be permitted only with written approval from the Owner. Contractor shall request all outages through the Owner's online outage system. Contact the Construction Safety Coordinator for access and guidance with the outage system. Refer to the latest edition of the Johns Hopkins Health System's "Safety and Commissioning Manual," including the "Coordinated Life Safety Assurance Program (CLASP)" document, for related policies and procedures.

L. Requests for outages will not be considered unless they include an identification of all areas which will be affected by the proposed outage.

M. All requests for outages shall be made a minimum of seven (7) working days in advance of their need. When there is an extensive or complicated impact to the facility as determined by the Owner a twelve (123) day period will be required.

N. The Contractor, with the cooperation of the Owner, shall also be responsible for searching out utility and service lines to determine the effect of any outage upon the facility's operations outside of the Limit of Contract. Approval shall be obtained from the Owner to execute such searches ahead of their need.

O. Working Hours and Overtime Notification: The Contractor shall notify the Owner and receive permission from the Owner for the Contractor's personnel to work outside of normal daytime working hours either within or outside the Limits of contract. "Normal working hours" for purposes of this Project shall be **<insert the range of clock times available to the Contractor for unrestricted work; standard is 7:30 AM to 4:30 PM>**

3. 8 SECURITY

A. Keys: When necessary to perform the Work, the Contractor will be issued keys to existing mechanical and electrical spaces by the Owner. These keys shall be returned at the end of each work day on which they are issued, and redrawn on succeeding days, if necessary.

B. The Contractor shall lock the Work area during off hours using Owner issued keys and locks.

3. 9 CEILING PERMITS

A. The Contractor must request from the Construction Safety Coordinator a ceiling permit anytime he enters a ceiling space, even for observation. This permit must be displayed when entering the ceiling space. The ceiling permit locates compartmentation breaches and establishes infection control measures.

3. 10 BURNING AND WELDING PERMITS

A. Neither open-flame burning, welding, nor arc welding will be permitted without the Contractor having secured an appropriate permit from Owner's Construction Safety Coordinator. Contractor shall submit the burning permit request through the Owner's CLASP outage system online. The Construction Safety Coordinator or the Owner has the right to stop any work at any time if he determines that unsafe conditions exist. The Contractor shall correct all such unsafe conditions as directed by the Construction Safety Coordinator and obtain his approval of such corrections prior to commencing further work.

B. The Contractor shall keep a portable hand fire extinguisher of the appropriate class within reach at all times during welding. The mechanic performing the hot work must have a current OSHA certification for handling fire extinguishers. The Contractor shall also keep all required exit corridors, and the like, clear and unobstructed at all times when working in such areas. All flammable materials shall be removed to a location no closer than 35 feet from all welding operations. All workmen shall be instructed as to the location of the nearest fire alarm. All fixed flammable items shall be completely covered with non-asbestos flameproof blankets. Arc welding shall be screened from vision of all passers-by.

C. The Contractor shall be required to maintain a "Fire Watch" security effort for a minimum of

thirty (30) minutes at the completion of each welding operation.

D. Hot work will not be allowed in areas when the sprinkler system has been disabled.

3. 11 FACILITY ROOM NUMBERING

A. Rooms: Use facility room numbers in all drawings and correspondence relating to the Project.

B. Where rooms are removed or new rooms are added, obtain instructions from Owner as to system to be followed.

C. Place and maintain temporary room labels to aid in identifying work throughout the construction project, for the duration of construction until permanent signage is installed.

3. 12 LABELS

A. Labels on pipes, conduit, and equipment shall follow the facility's standard.

3. 13 OVERNIGHT STORAGE

A. Do not store materials and equipment in public areas such as docks, corridors, and unfenced yards.

3. 14 CLASP (COORDINATED LIFE SAFETY ASSURANCE PROGRAM)

A. All contractors who are working within the Johns Hopkins Health System must comply with the most recent revision of the CLASP manual, which is available from the Owner, and shall coordinate compliance with the requirements with the Owner.

END OF SECTION

APPENDIX B - TELECOMMUNICATION ROOM LAYOUTS

GENERAL NOTES (THIS SHEET ONLY):

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KEYED NOTES (THIS SHEET ONLY):

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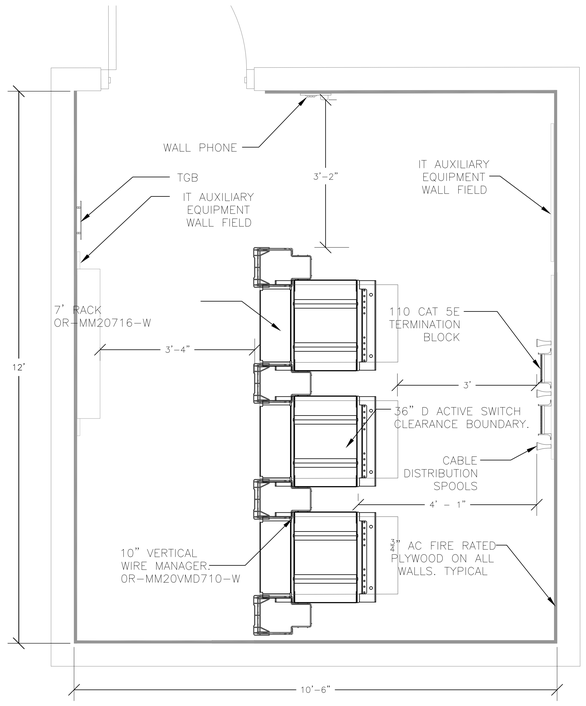

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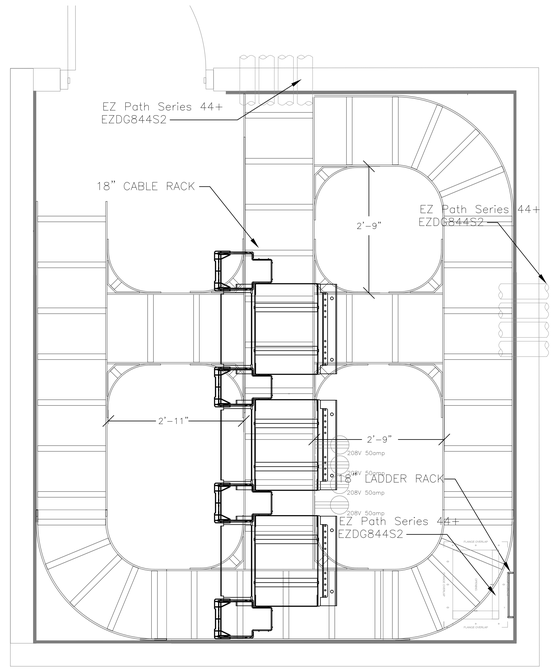

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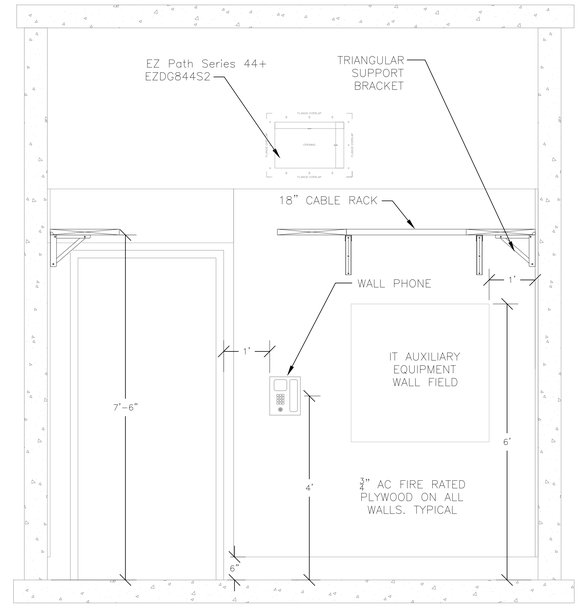

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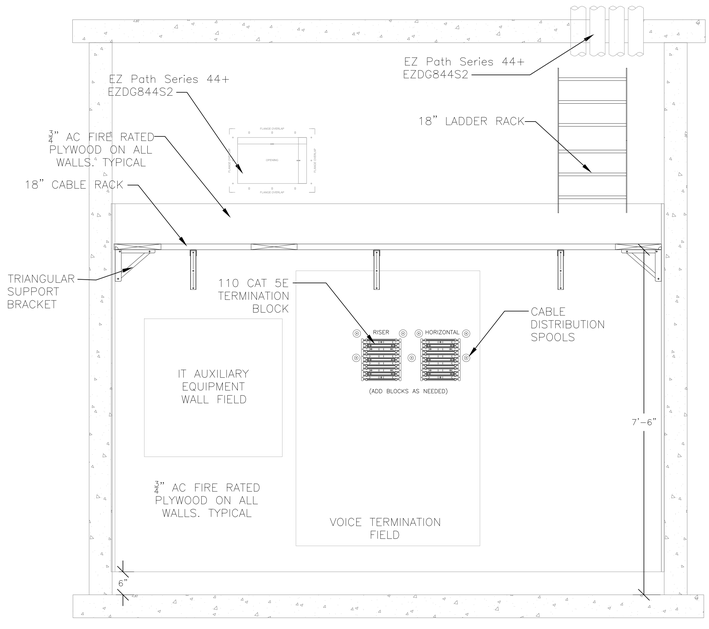

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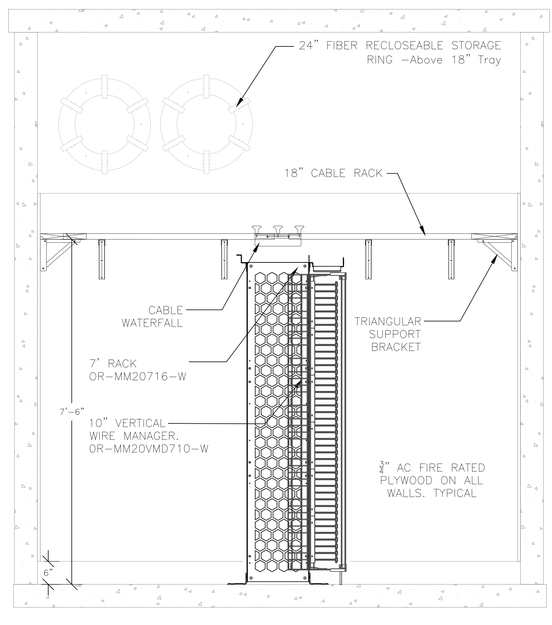

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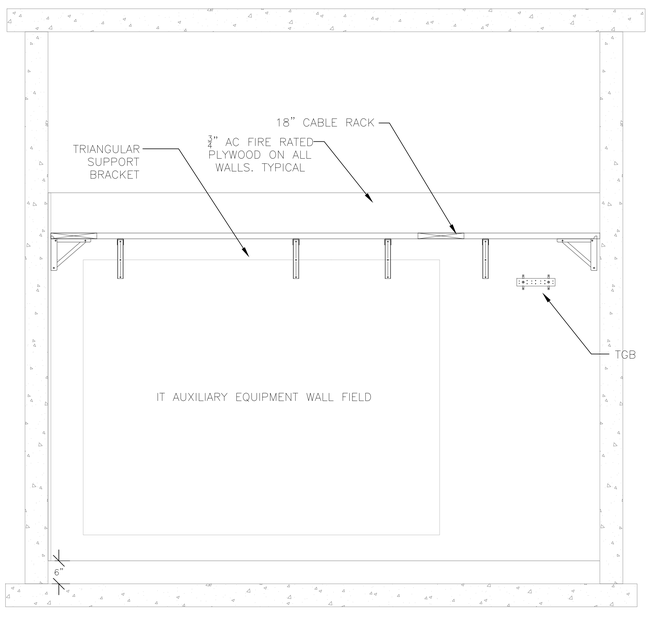

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Revisions:

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Oct12-??-2014

Sheet Number:
TC1.04

Drawing Title:
TELECOM ROOM LAYOUTS

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KEYED NOTES (THIS SHEET ONLY):

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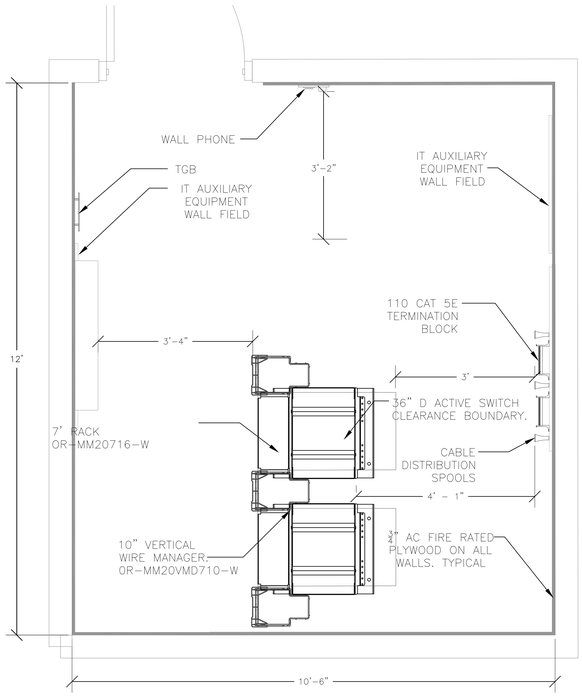

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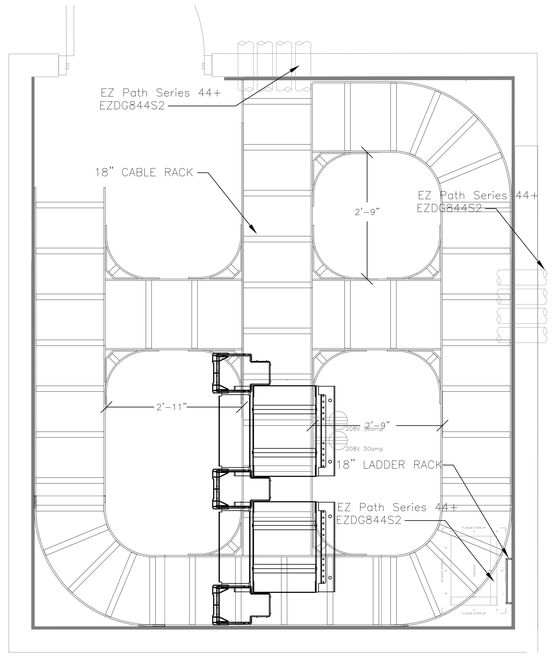

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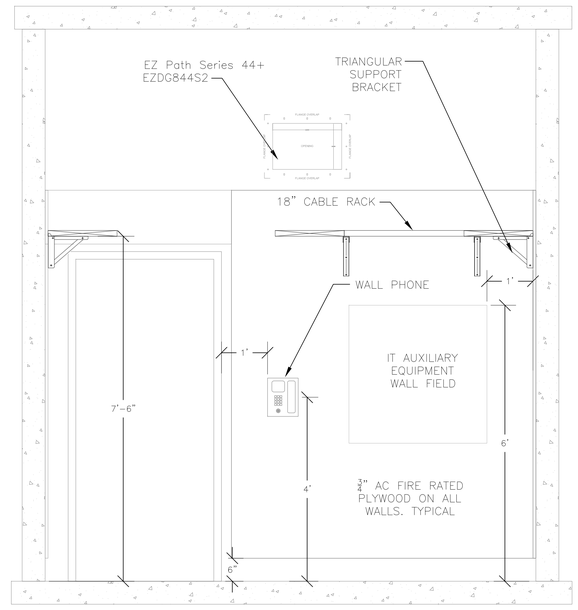

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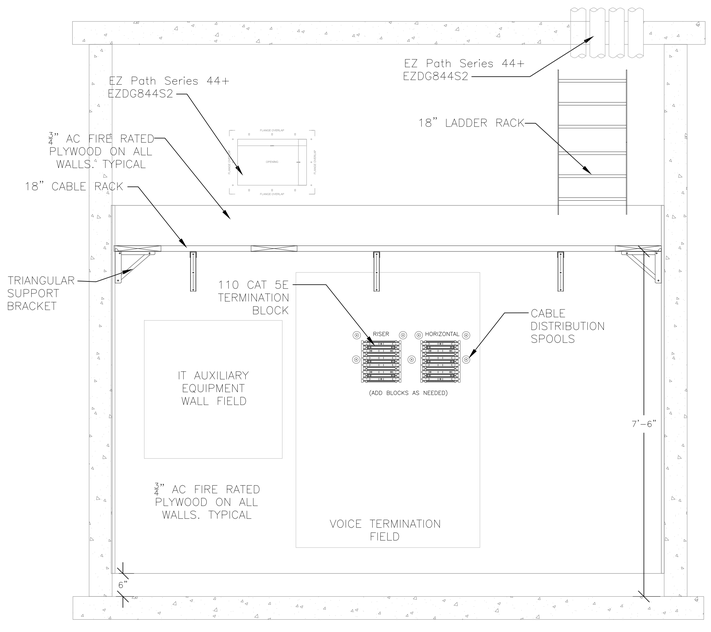

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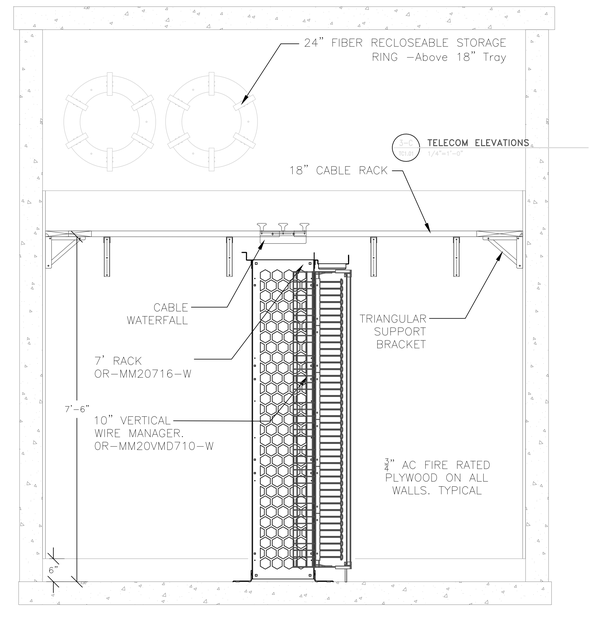

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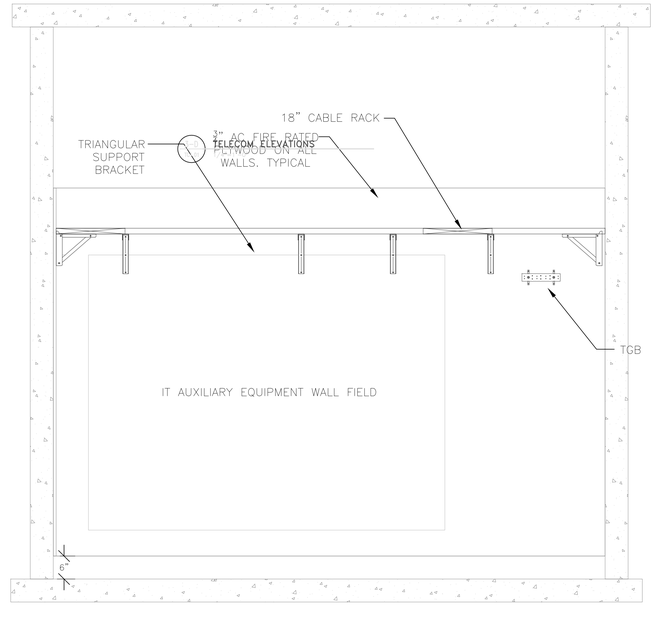

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Enfinity Project Number:
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Drawing Title:
TELECOM ROOM LAYOUTS

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KEYED NOTES (THIS SHEET ONLY):

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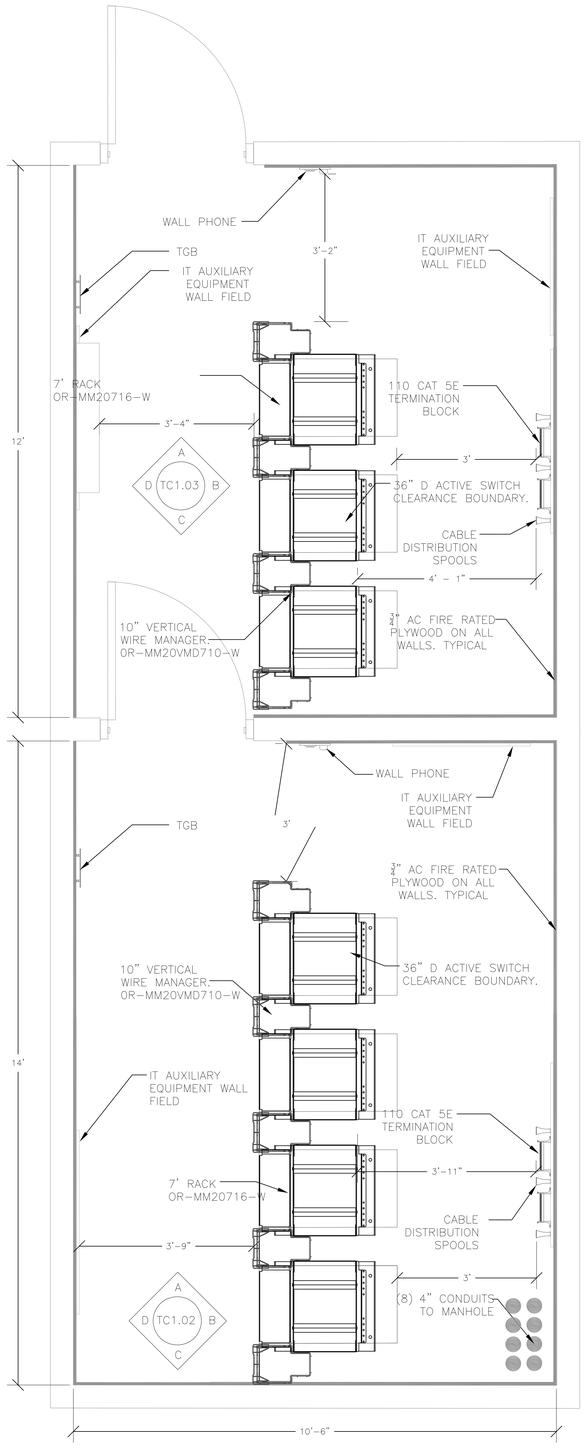

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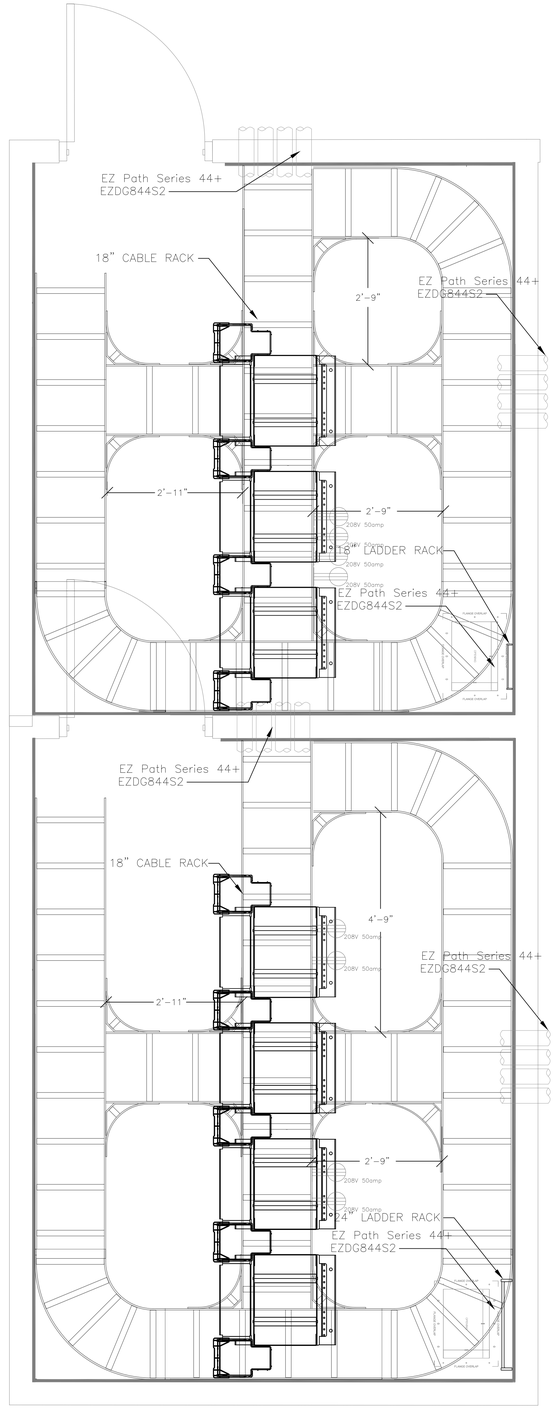

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Revisions:

Enfinity Project Number:
12-??-2014

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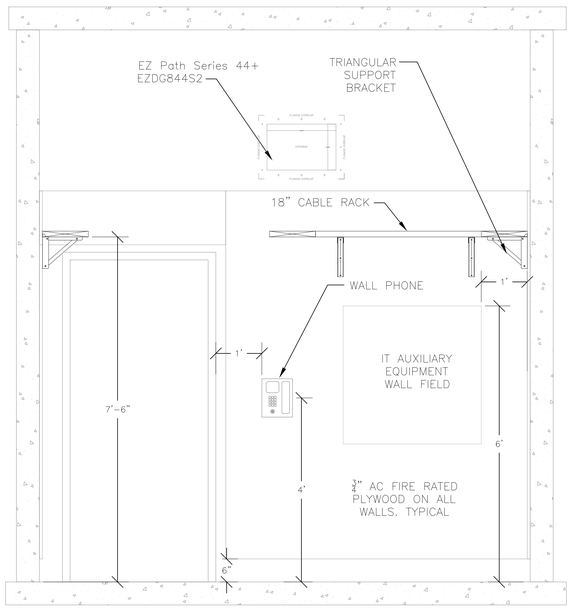
TELECOM ROOM LAYOUTS



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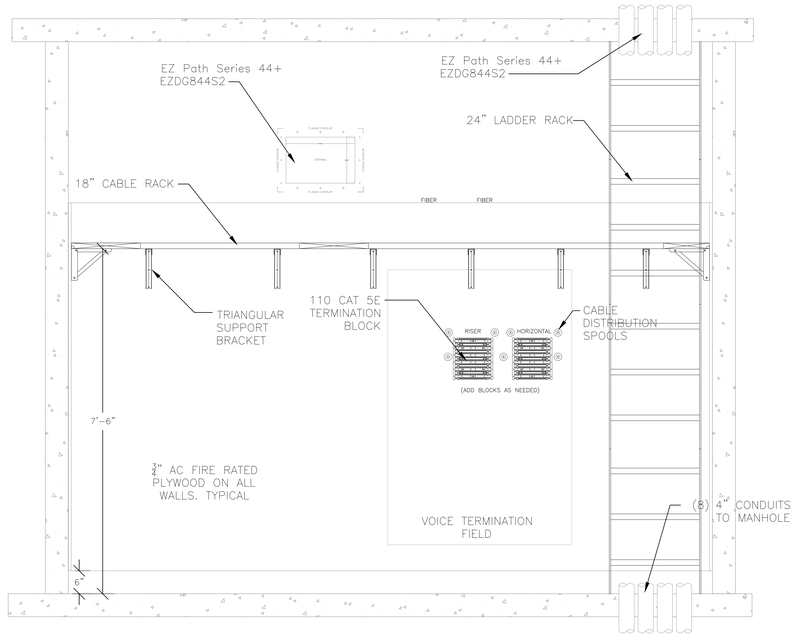

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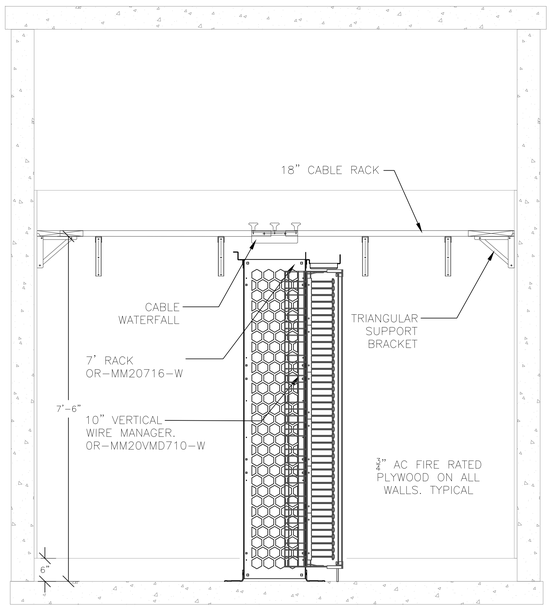

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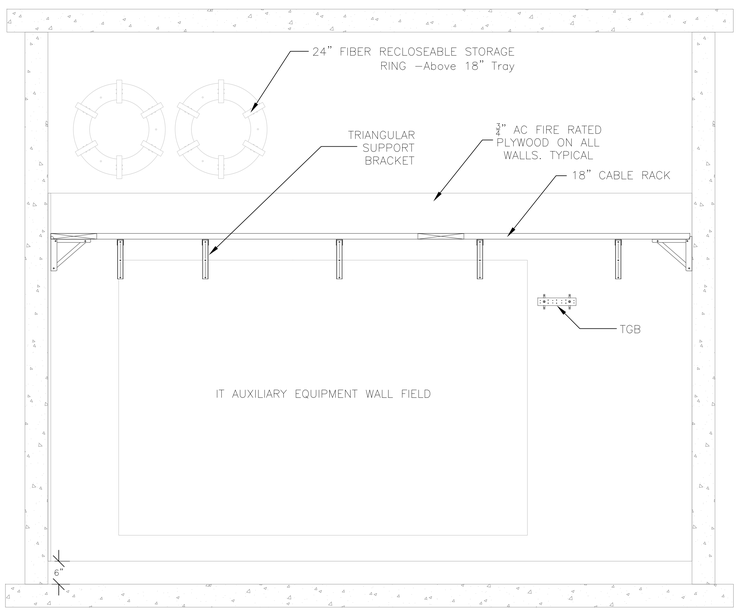

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GENERAL NOTES (THIS SHEET ONLY):

A. NOT USED.

KEYED NOTES (THIS SHEET ONLY):

1. NOT USED.

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0212-??-2014

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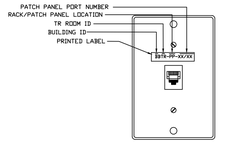
TC1.02

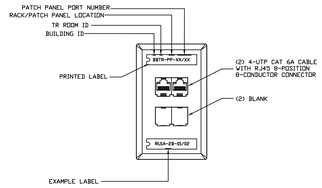
Drawing Title:
TELECOM ROOM LAYOUTS

APPENDIX C - TELECOMMUNICATION DETAILS



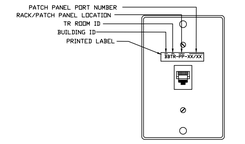
NOTE:
1. OUTLET SHALL BE MOUNTED ON A SINGLE-GANG FACEPLATE, FINAL COLOR OF FACEPLATE SPECIFIED BY ARCHITECT/OWNER.

1 TC5.0 TYPICAL UNIVERSITY VOIP WALL PHONE OUTLET – 1
SCALE: N.T.S.



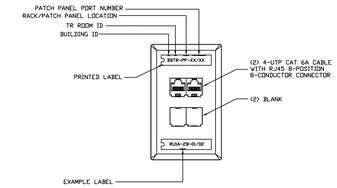
NOTE:
1. OUTLET SHALL BE MOUNTED ON A SINGLE-GANG FACEPLATE, FINAL COLOR OF FACEPLATE SPECIFIED BY ARCHITECT/OWNER.

2 TC5.0 TYPICAL UNIVERSITY DATA OUTLET – 3
SCALE: N.T.S.



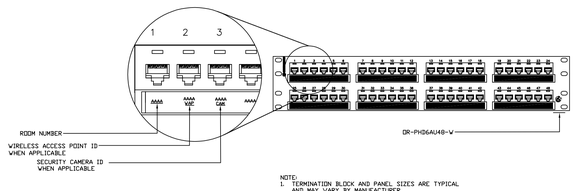
NOTE:
1. OUTLET SHALL BE MOUNTED ON A SINGLE-GANG FACEPLATE, FINAL COLOR OF FACEPLATE SPECIFIED BY ARCHITECT/OWNER.

3 TC5.0 TYPICAL HEALTHCARE WALL PHONE OUTLET – 1
SCALE: N.T.S.



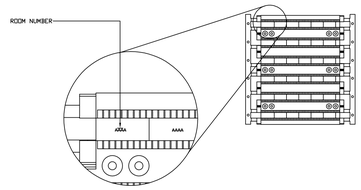
NOTE:
1. OUTLET SHALL BE MOUNTED ON A SINGLE-GANG FACEPLATE, FINAL COLOR OF FACEPLATE SPECIFIED BY ARCHITECT/OWNER.

4 TC5.0 TYPICAL HEALTHCARE DATA OUTLET – 3
SCALE: N.T.S.



NOTE:
1. TERMINATION BLOCK AND PANEL SIZES ARE TYPICAL AND MAY VARY BY MANUFACTURER.
2. LABELING SCHEME SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY. REFER TO SPECIFICATIONS AND APPLICABLE STANDARDS FOR ACTUAL LABELING SCHEME.

5 TC5.0 TYPICAL UNIVERSITY PATCH PANEL LABELING
SCALE: N.T.S.



NOTE:
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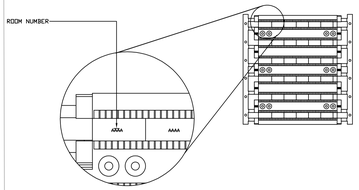
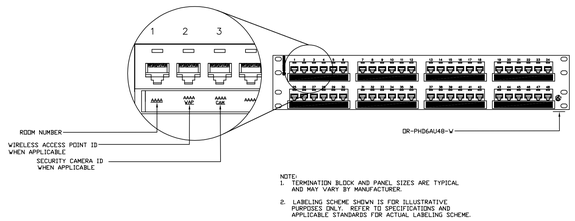
2. LABELING SCHEME SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY. REFER TO SPECIFICATIONS AND APPLICABLE STANDARDS FOR ACTUAL LABELING SCHEME.

6 TC5.0 TYPICAL UNIVERSITY 110 BLOCK VOICE LABELING
SCALE: N.T.S.



NOTE:
1. TERMINATION BLOCK AND PANEL SIZES ARE TYPICAL AND MAY VARY BY MANUFACTURER.
2. LABELING SCHEME SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY. REFER TO SPECIFICATIONS AND APPLICABLE STANDARDS FOR ACTUAL LABELING SCHEME.

7 TC5.0 TYPICAL HEALTHCARE 110 BLOCK VOICE LABELING
SCALE: N.T.S.



NOTE:
1. TERMINATION BLOCK AND PANEL SIZES ARE TYPICAL AND MAY VARY BY MANUFACTURER.
2. LABELING SCHEME SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY. REFER TO SPECIFICATIONS AND APPLICABLE STANDARDS FOR ACTUAL LABELING SCHEME.

8 TC5.0 TYPICAL HEALTHCARE PATCH PANEL LABELING
SCALE: N.T.S.

9 TC5.0 SCALE: –

10 TC5.0 SCALE: –

11 TC5.0 SCALE: –

12 TC5.0 SCALE: –

JOHNS HOPKINS INSTITUTION

Stamp:

Revisions:

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Date:

Sheet Number:

TC5.01

Drawing Title:

TELECOM DETAILS

APPENDIX D - TELECOMMUNICATION OSP SPECIFICATIONS
33 81 19 - COMMUNICATIONS UTILITY POLES

PART 1 GENERAL

1. 1 REFERENCES

A. IEEE C2 - National Electric Safety Code.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 SAFETY AND RESTRICTIONS

A. Contractors shall provide all necessary equipment to safely work on utility poles. Contractor shall comply with all federal, state, and Johns Hopkins regulations regarding working in this environment. Johns Hopkins Office of Health, Safety & Environment may regular work with utility poles owned by Johns Hopkins. Personal protective equipment is required and shall be the responsibility of the Contractors.

B. Contractors shall coordinate with Johns Hopkins Personnel to gain access to Johns Hopkins utility poles. Contractors shall provide advanced notice for this access. Contractors shall coordinate with utility companies to gain access to non-Johns Hopkins utility poles.

C. Johns Hopkins Security shall determine if closures of Johns Hopkins-controlled roads or spaces are possible at proposed dates and times. When on non-Johns Hopkins property, Contractors shall coordinate all activities with interested parties and/or city officials.

D. Contractors must receive approval from Johns Hopkins Personnel for building attachments from aerial pathways prior to installation.

E. Contractors shall follow all pole owner-specific safety requirements.

F. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. Utility poles shall have very limited use. New utility poles shall not be installed. Certain fringe areas with existing poles may utilize them, if pre-approved by Johns Hopkins Personnel. Areas of the campus beyond the contiguous core may use existing poles, if pre-approved.

B. Aerial pathways follow the same general guidelines as utility poles previously mentioned. In addition, inter-building, aerial cabling shall not be permitted. This type of installation in certain fringe areas may be allowed, if pre-approved. Areas of the campus beyond the contiguous core may use aerial pathways, if pre-approved. Underground pathways will always be preferred, unless limited by existing conditions.

C. Refer to the current BICSI CO-OSP manual for transverse loads on poles (kg/m per lb/ft of span length).

D. Pole height should provide sufficient space for the maximum number of attachments that will be made during the service life of the pole line. The attachment space shall include the space between the top of the pole, as well as the highest and lowest attachments. For pole lines supporting cable, 457 mm (18 in) should be provided at the top of the pole and 3205 mm (12 in) for each cable attachment.

E. As long as the last section is less than 30.5 m (100 ft), a slack span design may be used when it is not possible to terminate an aerial run with a dead-end guy. By using less than

normal stringing tension in the final span, guying on that end can be omitted. Situations that may require the use of a slack span design include space deficiencies and right-of-way problems.

F. Pole to building slack span construction shall be used for cables under 300 pair. For cables 300 pair or greater, select an alternate route into the building.

G. Refer to the latest edition of the NESC for typical attachment clearances.

H. Midspan clearances should be at least 75 percent of the clearance required at the pole. Consult the latest edition of the NESC for specific details.

I. Refer to the current NESC for the required radial clearances from antennas, signs, pole structures, storage tanks, and chimneys.

J. When installing multiple strands on a pole line, design separate guys and anchors for each strand. One guy may be used when the distance between two strands is 610 mm (24 in) or less.

K. Generally, all corner poles should be guyed except when a pole line supporting 6M or 6.6 M has less than 910 mm (36 in) of pull, or when a pole line supporting 10M strand has less than 610 mm (24 in) of pull.

PART 2 PRODUCTS

2. 1 MATERIALS

A. All materials used shall be manufactured for the specific purpose in which they are to be used.

B. When available, materials shall meet or exceed any available ANSI or ASTM standard for manufacture and installation.

C. All materials used shall meet or exceed any requirements for use as established by Baltimore Gas and Electric, Verizon, the City of Baltimore, or any other third-party owner for leased pole installations.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Aerial pathways shall only be used when existing poles are in place and available. Poles may be Johns Hopkins-owned or available for lease from local utilities.

B. Contractors shall obtain permits, lease agreements, and any other required documentation for Johns Hopkins use of non-Johns Hopkins poles. All documentation shall be in the name of Johns Hopkins and shall be submitted to Johns Hopkins prior to installation.

C. Contractors shall adhere to requirements of the utility pole owner when using non-Johns Hopkins poles. Owner requirements that violate the standards, and methodologies listed in Appendix 2 shall be approved by Johns Hopkins Personnel prior to pole use. Johns Hopkins Personnel may eliminate a specific pole as a pathway element based on unacceptable owner requirements.

END OF SECTION

33 81 26 COMMUNICATIONS UNDERGROUND DUCTS, TUNNELS, MAINTENANCE HOLES, AND HAND BOXES

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. 27 05 43: Underground Ducts and Raceways for Communications Systems

1. 2 REFERENCES

A. IEEE C2 - National Safety Code.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 SAFETY AND RESTRICTIONS

A. Communications Underground Ducts

1. See Section 27 05 43: Underground Ducts and Raceways for Communications Systems.

B. Tunnels

1. Johns Hopkins tunnels are not classified as permit-required confined spaces by Johns Hopkins Safety Office. Personal protective equipment is strongly recommended and shall be the responsibility of the Contractors. Conditions may be excessively hot, cramped, and/or damp.

2. Contractors shall coordinate with Johns Hopkins Personnel to gain access to the tunnels. Contractors shall provide advanced notice for this access. Space restrictions may prohibit access, if other utility contractors are in the same area. Ongoing utility work and emergency repairs may prevent access. Delays in installation schedules because of inaccessibility to the tunnels may be accepted by Johns Hopkins project managers and should be brought to their immediate attention. Johns Hopkins Personnel shall determine priorities in the event of overlapping work areas.

3. Generally, work in tunnels is not restricted by day or time.

C. Maintenance Holes

1. Johns Hopkins maintenance holes are classified as permit-required confined spaces by Johns Hopkins Safety Office. During construction of a maintenance hole, but prior to the final pathway connection(s) to other existing underground spaces or building entrance facilities, maintenance holes are not permit-required confined spaces. Contractors shall contact the Safety Office at least 24 hours in advance of a permit-required confined space entry. Contractors shall provide all necessary equipment for such an entry. Contractors shall comply with all federal, state, and Johns Hopkins regulations regarding permit-required confined space entry. Johns Hopkins Safety Office can provide confined space entry permits to Contractors.

2. Contractors shall use appropriate personal protective equipment to work safely within maintenance holes. Contractors shall provide all appropriate safety equipment as needed to extract disabled workers or as otherwise needed to provide a safe work environment and to provide immediate support in emergency situations. Conditions may be excessively hot, cold, cramped, and/or damp.

3. Contractors shall coordinate with Johns Hopkins Personnel to gain access to maintenance holes. Contractors shall provide advanced notice for this access. Space restrictions may prohibit access, if other utility contractors are in the same area. Ongoing utility work and emergency repairs may prevent access. Delays in installation schedules because of inaccessibility to maintenance holes may be accepted by Johns Hopkins project managers and should be brought to their immediate attention. Johns Hopkins Personnel shall determine priorities in the event of overlapping work areas.
4. Generally, work in maintenance holes is not restricted by day or time.

D. Handholes and Hand boxes

1. Johns Hopkins hand boxes and handholes are not classified as permit-required confined spaces by the Johns Hopkins Safety Office. Personal protective equipment is strongly recommended and shall be the responsibility of the Contractors.
2. Contractors shall coordinate with Johns Hopkins Personnel to gain access to hand boxes and handholes. Contractors shall provide advanced notice for this access.

1. 5 DESIGN REQUIREMENTS

A. Communications Underground Ducts

1. See Section 27 05 43: Underground Ducts and Raceways for Communications Systems.

B. Tunnels

1. Johns Hopkins University has an existing tunnel structure below parts of the main contiguous campus. These tunnels have been used extensively for Information Transport System cabling and are available for additional installations. Site conditions within the tunnels vary by location. Contact Johns Hopkins Personnel for information on tunnel conditions. Installation of additional tunnels is unlikely at this time. Designs should not anticipate expansion of this system.
2. The tunnels supply high voltage power, steam/condensate, chilled water, and domestic water to a variety of buildings. Space may be very limited for installation beyond existing cable locations within the tunnel.
3. Oversight of the Homewood tunnels is the responsibility of Johns Hopkins Personnel. All installations shall be approved and coordinated, and all designs requiring new tunnel penetrations shall be approved in advance.
4. Penetrate tunnel walls in such a position to allow broad sweeps of cables into the tunnel space while minimizing interference to the passage and access to adjacent utilities. Vertical (roof) penetrations may be allowed in certain instances for small ductbanks.
5. All ductbanks abutting a tunnel shall be concrete encased for a minimum of ten horizontal feet from the tunnel.
6. When abutting a ductbank to a tunnel wall, provide dowel holes in the exterior surface of the tunnel for reinforcing bars. These bars shall extend into the tunnel wall without penetrating the wall and be embedded in the concrete ductbank. Dowel holes are not required for reinforcing bars when penetrating the roof of the tunnel.
7. Shape the concrete in such a way as to slope water away from the ductbank-tunnel seam. Alternately, purge the area around the seam as to slope water away.
8. Specify waterproofing material to provide a permanent, waterproof coating. Designs may include a protective membrane, sprayed/brushed product, or any combination.

The specified product shall be manufactured for the explicit, but not necessarily exclusive, purpose of waterproofing concrete.

9. Design for waterproofing material to the sides and top of a horizontal ductbank extending no less than 4 feet from the tunnel wall. Specify a waterproofing material to the tunnel wall extending a minimum of 18 inches (wrapping over and onto tunnel roof if required) from the ductbank. The waterproofing shall be applied to all surfaces except the bottom of the ductbank where poured on aggregate bed.
10. Design for waterproofing material to all sides of a vertical ductbank extending no less than 6 vertical feet from the tunnel roof. Specify a waterproofing material to the tunnel roof extending 18 inches (or to the edge of the tunnel roof) from the ductbank, and to any curved part of the ductbank within 6 feet of the roof. The waterproofing shall be applied to all surfaces.
11. Existing Support Structures
    a. Use existing pathways and support mechanisms within tunnels, when possible. These include existing raceways, chases, and support strands. All cable installations shall be supported off the tunnel floor.
12. New Open Support Structures
    a. Support structures shall be designed to minimally impact open space and access to other utilities within the tunnels. Support structures shall be placed against, or as close as possible, to walls and ceilings. All cable installations shall be supported off the tunnel floor.
    b. These support structures shall be Snake Tray products. Fully enclosed box raceways have been used in the past and shall not be used on new installations. Specify Snake Tray cable turn out and cable turning fence parts as needed.
13. New Support Wires
    a. The design may specify support wires onto existing or installed structures for the attachment of cables. Support wires shall be designed to minimally impact open space and access to other utilities within the tunnels. Support wires and any other support structure needed to install support wires shall be placed against, or as close as possible, to walls and ceilings.
    b. Support wires shall be 10M (minimum size) galvanized steel. They shall be supported every 8 feet (maximum interval). Messenger supported siring shall be grounded per NEC1999 Section 321-7, which considers them to be conductor enclosures per NEC1999 Section 250-86. Grounding within the tunnels shall be coordinated with Johns Hopkins Personnel.
14. Cable Lashing
    a. When using existing support strands, attach cables directly to the support strand. Installations may wrap around a single existing cable and support strand provided the support strand bears the weight of the cable. New cables shall not add any strain to existing cables.
15. Vertical Exits
    a. Cables leaving the tunnel beneath a building, vertically into the building, shall be supported by vertical backbone cable supports.
16. Splices
    a. Cables may be spliced in the tunnels as needed to obtain necessary cable lengths

and to branch cables as needed. Locations of splice cases are to be pre-approved by Johns Hopkins Infrastructure Project Team. Splice locations shall enable relatively easy access for future maintenance and installations. Splice cases shall be fully supported off the tunnel floor.

b. Splice specifications are detailed later in this specification.

C. Maintenance Holes

1. In general, the use of MHs should be minimized as a design element. Where possible, contractors shall use HBs. Large ductbanks (greater than three conduits) shall necessitate the use of a MH. Primary building backbone cables shall use MHs within the pathway.
2. The design may use an existing MH to provide needed pathways. An existing MH shall be upgraded with respect to integral parts and grounding as specified in the installation of a new MH. If a single new conduit is installed into a MH, the entire MH shall be addressed with respect to integral parts and grounding.
3. The design shall provide butterfly drawings indicating planned cable pathways, racking, location and type of splice case(s), and entry configuration for new MH and use of existing MH. MHs shall be designed with the following installed as integral parts: A sump, corrosion-resistant pulling irons, cable racks (grounded per applicable electrical code or practice), and ladders (grounded per applicable electrical code or practice).
4. Except when needed to support telecommunications equipment, MHs should not be used as pathways for power and light conductors. For specific details, consult the NESC (or applicable safety code).
5. New MHs shall be designed to accept a splay conduit entry, where possible. A splay entry does not require the cables to be routed since they align with the cable racks. Conduits may enter a single off-center window in the end walls. Submit documentation from the manufacturer should a center penetration be required to maintain structural integrity of the MH.
6. The design must anticipate any future additions of new ductbanks to same MH wall so as to avoid crossing the designed ductbank. This can be done at other vertical elevations if necessary.
7. All ducts entering MH and building entrance point locations shall be sealed to prevent the intrusion of liquids and gases into the MH or building. Universal duct plugs are available in a variety of sizes for use in unoccupied ducts. In those ducts where the cable has been installed, ducts can be sealed through the use of putty sealants, compression plugs, or sealing bags.
8. Specify MHs engineered with sufficient ratings to withstand the necessary load for the location. The minimum rating shall be H-10. A MH installed in a roadway or asphalt-based walkway shall be rated as AASHTO H-20 (20 ton GVW vehicles under ASTM C-857), unless a lower rating is pre-approved by Johns Hopkins Personnel.
9. MHs shall be pre-cast. A pre-cast MH shall be Type a. Right angle turns are to be made with sweeping conduits outside of the MH (subsidiary ducts). Type J, L, or T MHs may be used with prior permission where physical restrictions required lateral ducts.
10. Additional “knock-out” windows may be present within the MH. Permission should be sought prior to final design.
11. Pre-cast sections of a MH with horizontal seams shall have a bonding ribbon clamped or welded to the embedded reinforcing steel of the MH to enable connection of the

reinforcing steel between sections.

12. Specify watertight joint sealer between MH sections, provided or approved by the MH manufacturer when possible. Contractors shall provide Johns Hopkins with the MSDS for the sealer products used.
13. MHs may be site-poured to accommodate existing cabling or unusual conditions only with pre-approval of Johns Hopkins Personnel.
14. MHs shall have an interior height of 6'-6" or greater. MHs shall have a minimal width of 6 feet and a minimal length of 8 feet. Smaller MHs (in length and width only) shall be pre-approved in advanced by Johns Hopkins Personnel. Larger MHs may be required in areas of known future expansion.
15. MH collars shall be pre-cast, when the appropriate size is available. MH collars shall be sized to allow a 30" opening.
16. Covers do not need to be locking and shall be labeled “COMMUNICATIONS” in raised letters. Covers shall be a standard size for a 30" opening. Covers shall adhere to ASTM A48/A48M-00 Standard Specification for Gray Iron Castings. Covers and cast-iron rings all be manufactured by East Jordan Iron Works, Inc.
17. If a MH has two or more openings, all of the openings should be the same size. At least one opening should be provided by MHs up to 3.7 m (12.0 ft.) in length, two openings beyond 3.7 m (12.0 ft) in length, and three openings beyond 6 m (20 ft.) in length.
18. Pulling irons shall be installed at all eight corners of the MH. At least two embedded loops are to be installed in the ceiling to support temporary lighting. Pulling irons and loops are to be galvanized or otherwise treated to prevent rust or corrosion. Pulling irons are to be embedded in the MH structure by the manufacturer.
19. Compacted aggregate to be used to form a bed under MHs may be crushed stone or gravel fill as specified under the materials section.
20. Do not install conduits into the neck of a MH for any purpose including lighting, sump pump drains, and/or sump pump power. Avoid ceiling penetrations of any kind. Design may specify conduits into the ceiling of a MH for sump pump drain or power lines, with prior approval from Johns Hopkins Personnel.
21. Specify a level bed of compacted aggregate onto which a MH is to be installed. The bed shall extend 1 foot beyond the exterior of the MH when in final position. The aggregate bed shall be a minimum of 6" thick (post-compaction) and shall be compacted to not less than 95% density compared to maximum laboratory tests by weight per ASTM D1557-64T, method A.
22. Specify water-tight joints in pre-cast MH sections.
23. Design the MH cover flush with the final grade of the surrounding area. If the distance from the final grade to the MH ceiling is 24" or greater, specify permanent steps into the neck.
24. Use pre-formed openings for penetrations into the MH.
25. Specify a sump pump. Design a separate pathway to the MH for power and effluent discharge. Power cables shall not be installed into a communication ductbank. Sump pump discharge shall be routed to the nearest available storm drain. The discharge hose shall not be installed into a communications ductbank, but shall have an independent pathway out of the MH.
26. Design for MH racking on all four sides. Stanchions shall be installed at a minimum of

two vertical locations on each wall. Stanchions shall be stacked at each location to provide a minimum of 6 feet of height. Two spare cable rack arms of equal size to those planned for use shall be installed at each vertical location use. Splayed MHs that function as straight pass-through spaces may not need racking on the short sides with the penetrations as determined by Johns Hopkins Personnel.

27. Specify a permanent ladder in a MH. Installed ladders shall meet all federal and state requirements for permanently mounted ladders in MHs.
28. Specify an 8 ft. ground rod (per NESC) into the floor of each MH. Seal the space around the ground rod to prevent water penetration around the rod. Bonding ribbon between pre-cast sections shall be bonded to the ground rod or grounding conductor.
29. Specify an insulated (green), stranded #6 (minimum) copper grounding conductor from the ground rod to each wall. Design may specify a single conductor encircling the space. The conductor(s) shall run the entire length of each long wall and shall be securely anchored to the wall.
30. Specify exothermic welds for all grounding conductor bonds within a MH.
31. Bond to ground all existing conductive racking, stanchions, and ladders.
32. Do not design any permanent attachments to pulling irons or loops. Cables are not to be permanently supported by pulling irons or loops.
33. Use of Existing Maintenance Holes
    a. Follow all guidelines above when using existing MHs, unless waived by Johns Hopkins Personnel.
    b. Specify a sump pump, power, and drain as specified above, if standing water or evidence of past flooding is evident in the MH.
    c. Design for racking on any side without racking. Johns Hopkins may waive this specification for certain MH walls based on current MH configuration. Specify racking of manufacturer and type specified above.
    d. The design are not required to specify a ladder into an existing MH lacking a ladder.
    e. Specify grounding into an existing MH without proper grounding as required by codes, standard, methodologies, and specifications referenced in this document.
    f. Bond to ground all existing conductive racking, stanchions, and ladders. Notify Johns Hopkins of any pre-existing splice cases not bonded to ground.
    g. The designs are not required to specify pulling irons and loops into existing MHs, unless needed by the Contractor.

D. Handholes and Hand boxes

1. In general, HBs shall be incorporated over MHs, whenever possible. New HHs shall not be installed. Where possible, contractors shall use existing HBs over existing HHs. HBs and HHs shall not be used with ductbanks exceeding three conduits (not more than a total of six conduits, three in and three out). A HB/HH shall not be used as an intersection of two independent pathways, but can be used to form a radial branch of a single pathway (e.g. three in one side, one out of three sides). Johns Hopkins Personnel may waive the conduit count specifications, acknowledging these deviations from BICSI methodology, in special circumstances where a MH cannot be installed, but a large HB can be installed.

2. Pathways using HBs shall not be designed to expose an HB to deliberate vehicular traffic. HBs may be placed within sidewalks and other walkways or areas otherwise restricted to occasion traffic by University light vehicles. HBs may be installed in grass and wooded areas. All locations shall be approved by Johns Hopkins Personnel.
3. An existing HB may be used to provide needed pathways. An existing HH shall not be used to provide needed pathways. A HH location may be used, if the HH is replaced by a new HB. An existing HB shall be upgraded with respect to integral parts and grounding as specified in the installation of a new HB. If a single new conduit is installed into a HB/HH, the entire HB/HH shall be addressed with respect to integral parts of grounding.
4. Johns Hopkins Personnel may require a HB or HH to be replaced entirely if incorporated into a new cable installation. Do not assume existing HBs and HHs may be used. Installation of cable into existing conduits terminating in a HB or HH shall require a review of the HB/HH and its possible replacement.
5. HHs shall not be used to house splice cases. HBs may be used to house splice cases. This use for a HB is an acknowledge deviation from BICSI methodology. The designs may classify these HBs as splice enclosures, and a pedestal may be specified for this purpose.
6. Butterfly drawings shall be provided indicating planned cable pathways, racking, location and type of splice case(s), entry configuration for a new HB and use of existing HB/HH, when and where appropriate. HBs shall be designed with cable racks (for large HB) and grounding as required. HBs should also have drainage provisions (e.g., drain holes, open bottom, sump-hole).
7. HBs shall not be:
    a. Larger than 1.2 m (4.0 ft) in length by 1.2 m (4.0 ft) in width by 1.2 m (4.0 ft) height.
    b. Shared with electrical installations other than those used for network cabling/telecommunications.
8. Divided boxes may be considered for specific applications (remotely located devices requiring power and communications cabling) and shall be pre-approved by Johns Hopkins Personnel.
9. Divided boxes shall not contain cable splices or any possible exposure of conductors within the communications side of the box. A separate “communications-only” HB shall be required to house necessary fiber splices.
10. Horizontal penetrations of the box shall be made using knockout locations, when available. The sidewalls of the HB shall not be penetrated in other locations without pre-approval. Conduits may “stub up” into the box. Conduits entering this way shall be within 2" of a sidewall.
11. Conduit entering a HB should be aligned on opposite walls at the same elevation. Some HBs are available without bottoms for drainage. When installed without bottoms, these HBs should be equipped with a 102 mm (4.0 in) layer of small rock in the bottom to prevent mud from intruding into the HB.
12. Specify a HB with sufficient rating to withstand the necessary load for the location. All new HBs shall be Strongwell UL-listed QUAZITE boxes. HBs shall be “PG” style, Tier 15 or greater. The use of other QUAZITE boxes shall be pre-approved.
13. QUAZITE HB covers shall be HA-rated covers labeled “Communications” (covers shall be HH-rated for areas with anticipated vehicular traffic). Covers located off the main

body the campus shall have locking covers. Contact Johns Hopkins Personnel for determination of this need.

14. QUAZITE boxes and lids shall be standard gray. QUAZITE boxes and lids in grass or planting beds may be green. The use of other QUAZITE colors shall be pre-approved.
15. Large boxes shall have two QUAZITE pulling eyes installed on the shorter sides of the box (or opposite sides of a square box).
16. HB sides 24" or greater shall have QUAZITE galvanized steel racking.
17. Any HB designed to house a splice case shall be grounded. The HB shall have an 8 ft ground rod.
18. Compacted aggregate to be used to form a bed under HBs may be crushed stone, or gravel fill of the type specified below by the materials section.
19. Compacted aggregate shall not be sand or gravel dust.
20. HBs shall rest on a bed of gravel or crushed rock measuring six or more inches deep and extending six or more inches beyond the sides of the HB.
21. Specify 4"-6" of gravel or crushed rock outside HBs prior to backfilling to grade.
22. HBs shall be installed with covers flush with the final grade. HBs shall match any slope in the final grade. HBs may be installed with a partially exposed side on steep grades. Johns Hopkins Personnel shall pre-approve non-flush designs.
23. Using Existing Hand Boxes
    a. Johns Hopkins Personnel shall approve the use of an existing HB. An existing HB may have to be replaced if the conditions of the HB are beyond remediation. Johns Hopkins Personnel shall determine the status of the HB. Replacement HBs shall be installed to the specifications of the previous section.
    b. Existing conditions of conduits may not be able to be fully reconfigured to meet location specifications of the previous section. Johns Hopkins Personnel may allow deviations from conduit design specifications during design approval.
    c. If available for use, enter an existing HB horizontally through knockouts. If pre-manufactured knockouts are not available, enter the HB by sweeping under the sidewall and “stubbing up” into the box within 2" of a sidewall.
    d. HB sides 24" or greater without racking shall be retrofitted with appropriate racking. Johns Hopkins Personnel may waive this specification depending on the existing conditions.
    e. Grounding rods shall be installed, as needed. Correct any improper or missing grounding within the HB.
    f. Excavate within the HB such that 6" of gravel or crushed rock can be placed into the box. The box shall be raised or lowered to existing grade as needed. This specification may be waived if existing conduit conditions block such modifications.
24. Using Existing Hand Holes
    a. Johns Hopkins Personnel shall approve the use of an existing HH. The design may have to specify replacement of an existing HH with a HB, if the conditions of the HH are unacceptable. Johns Hopkins Personnel shall determine the status of the HH. Replacement HBs shall be installed to the specifications of the previous section.

b. Enter the HB by sweeping under the sidewall and “stubbing up” into the HH within 2" of a sidewall. Johns Hopkins Personnel may waive this specification depending on the existing conditions.

c. Excavate within the HH such that 6" of gravel or crushed rock can be placed in to the hole. The HH shall be raised or lowered to existing grade as needed. This specification may be waived if existing conduit conditions block such modifications.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Maintenance Holes

1. Minimum load rating- H-10
2. Higher rating- H-20; for roadways or asphalt-based walkways
    a. 20-ton GVW vehicles under ASTM C-857
3. Pre-cast, Type A, off-center wall penetrations/windows
    a. Type J, L, or T with prior approval
4. Additional “knock-out” windows may be pre-manufactured
5. MH with horizontal seams- bonding ribbons clamped or welded to embedded reinforcing steel for connection of MH sections
6. Watertight joint sealer, by MH manufacturer when available
7. Dimensions
    a. Minimum size: Height- 6'6"; Width- 6'; Length- 8'
    b. Smaller sizes, when needed, must be pre-approved by Johns Hopkins
8. Pre-formed sump and sump cover

B. Maintenance Hole Collars

1. Standard 30" opening
2. Manufacturers
    a. East Jordan Iron Works
    b. Other acceptable manufacturers offering equivalent products

C. Maintenance Hole Covers

1. Labeled “COMMUNICATIONS” in raised letters
2. Standard size for a 30" opening
3. Adheres to ASTM A48/A48M-00 Standard Specification for Gray Iron Castings
4. Manufacturers
    a. East Jordan Iron Works
    b. Other acceptable manufacturers offering equivalent products

D. Maintenance Hole Accessories

1. Stanchions and Brackets
    a. Heavy duty, non-metallic

b. Stanchions- 36" with mounting holes at 4" intervals

c. Bracket load rating: 8" arms- 450 lbs, 14" arms- 350 lbs, 20" arms- 250 lbs

d. Manufacturers

1) Underground Devices

(a) Adjustable arm cable rack arms- RA08, RA14, RA 20 (b) Stanchions- CR36

(b) Other acceptable manufacturers offering equivalent products

2. Ladder

a. UL-listed, non-conductive, designed for electrical maintenance hole installations

b. Manufacturers

1) M.A. Industries, Peachtree, GA, Tel. 800-241-8250

2) Other acceptable manufacturers offering equivalent products

3. Pulling irons and loops

a. Galvanized or treated to prevent rust or corrosion

b. Embedded by maintenance hole manufacturer

4. Ground rod

a. Copper clad steel or solid copper

b. 8' minimum length

c. 5/8" minimum thickness

d. Manufacturers

1) Harger

2) Other acceptable manufacturers offering equivalent products

5. Ground wire

a. #6 AWG copper stranded wire, bare or green insulated

E. Sump pump

1. Low water pump (pump down to ½" or less)

2. Designed to pump water with debris

3. Designed for permanent installation

4. Float switch

F. Hand boxes

1. QUAZITE brand hand box, PG-style, Tier 15 or greater

2. QUAZITE cover, HA-rated, labeled “Communications”, locking cover for locations beyond contiguous campus (e.g. locations on City streets/sidewalks)

3. Gray hand box and lid, green acceptable in grass

4. Large hand boxes

a. QUAZITE pulling eyes (hand box sides 3' or larger)

b. QUAZITE racking (hand box sides 2' or larger)

5. Manufacturers
   a. Owner approved products

G. Aggregate
1. Crushed stone or gravel fill
2. Percent composition by dry weight as determined by laboratory sieves (U.S. series)
   a. ASTM C136-01 (Test Method C136-01 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates):

H. Concrete
1. 3/8" maximum size
2. Nominal compressive strength: 3000 PSI at 28 days

I. Steel reinforcing bars
1. Size-standard size #5

J. Water-proofing material
1. Elastomeric water-proof material for exterior, below-grade concrete surfaces.
2. Manufactured explicit, but not necessarily exclusive, purpose of waterproofing concrete.

K. Cable Support Structures
1. Cable raceway
   a. Cable Management Solutions Snake Tray (501 series wall snake, 201 series overhead snake, and 101 series underfloor raceway)
2. Steel support wires
   a. Size: 10M (3/8" dia.), galvanized steel with mounting hardware
   b. Conform to ASTM A475-98 Standard Specification for Zinc-Coated Steel Wire Strand
3. Vertical cable supports
   a. Erico CADDY CableCat CAST600 series
4. Steel cable ties
   a. Panduit Stainless Steel System
   b. Band-It steel strapping
   c. Other acceptable manufacturers offering equivalent stainless or galvanized steel products

L. Conduits
1. See Section 27 05 43: Underground Ducts and Raceways for Communications Systems

PART 3 EXECUTION

3. 1 INSTALLATION

A. Communications Underground Ducts

1. See Section 27 05 43: Underground Ducts and Raceways for Communications Systems.

B. Tunnels

1. All space elements shall be labeled in accordance with the OSP specifications.
2. Tunnel Penetrations
    a. Contractors shall penetrate tunnels walls in such a position to allow broad sweeps of cables into the tunnel space while minimizing interference to the passage and access to adjacent utilities. Vertical (roof) penetrations may be allowed in certain instances for small ductbanks.
    b. All ductbanks abutting a tunnel shall be concrete encased for a minimum of ten horizontal feet from the tunnel. The ductbank shall be constructed as specified by this document.
    c. When abutting a ductbank to a tunnel wall. Contractors shall provide dowel holes in the exterior surface of the tunnel for reinforcing bars. These bars shall extend into the tunnel wall without penetrating the wall and be embedded in the concrete Ductbank Contractors are not required to provide dowel holes for reinforcing bars when penetrating the roof of the tunnel.
    d. Contractors shall core drill all penetrations. Contractors shall be responsible to consult structural engineers and to maintain the structural integrity of the tunnel at the point of penetration and the surrounding area. Any damage to the tunnel or its contents shall be repaired by the Contractors or by Johns Hopkins at Contractor's expense. Contractors may be liable for any costs or damages associated with lose of service resulting from tunnel damage.
    e. Contractors shall provide and install framing as necessary for pouring ductbank abutting the tunnel. Contractors shall remove this framing when the concrete has properly set.
    f. Contractors shall shape the concrete in such a way as to slope water away from the ductbank-tunnel seam. Alternately, Contractors shall purge the area around the seam as to slope water away.
    g. Contractors shall provide and install framing as necessary to prevent the penetration of concrete into the interior space of the tunnel. Contractors shall remove this framing after the concrete has properly set and backfilling is complete.
    h. Contractors shall provide waterproofing material to provide a permanent, waterproof coating. Contractors may use a protective membrane, sprayed/brushed product, or any combination. The proposed product shall be manufactured for the explicit, but not necessarily exclusive, purpose of waterproofing concrete. Contractors shall submit manufacturer-produced product information sheets for proposed products to be used.
    i. Contractors shall install, per manufacturer's specification, a waterproofing material to the sides and top of a horizontal ductbank extending no less than 4 feet from the tunnel wall. Contractors shall install, per manufacturer's specifications, a waterproofing material to the tunnel wall extending a minimum of 18 inches (wrapping over and onto tunnel roof if required) from the ductbank. The waterproofing shall be applied to all surfaces except the bottom of the ductbank where poured on aggregate bed.

j. Contractors shall install, per manufacturer's specification, a waterproofing material to all sides of a vertical ductbank extending no less than 6 vertical feet from the tunnel roof. Contractors shall install, per manufacturer's specifications, a waterproofing material to the tunnel roof extending 18 inches (or to the edge of the tunnel roof) from the ductbank, and to any curved part of the ductbank within 6 feet of the roof. The waterproofing shall be applied to all surfaces.

3. Existing support structures

   a. Contractors shall use existing pathways and support mechanisms within tunnels, when possible. These include existing raceways, chases, and support strands. All cable installations must be supported off the tunnel floor.

   b. Contractors may be asked to re-engineer an existing support structure to accommodate the current cabling as well as the new cabling. If the existing support structure is inadequate for new installations, Contractors shall consult with Johns Hopkins Personnel as to the need for re-engineering the structure.

4. New open support structures

   a. Contractors may install new open support structures as needed. Support structures shall be installed to minimally impact open space and access to other utilities within the tunnels. Support structures shall be placed against, or as close as possible, to walls and ceilings. Any supports or protrusions shall be rounded or padded to minimize injury to people, if impacted. Final placement of support structures shall be pre-approved. All cable installations shall be supported off the tunnel floor.

   b. The Contractor shall provide and install Snake Tray products for cable support. Contractors shall use Snake Tray cable turn out and cable turning fence parts as needed. Contractors shall not substitute connectors or other Snake Tray-specific parts designed for the Snake Tray series installed.

   c. Other products must be pre-approved by Johns Hopkins Personnel.

   d. Cables shall be placed into open support structures in a loose and random fashion, when possible. Cables shall not be secured into an open support structure, unless required to remain in the structure, to support vertical rises, or to maintain bend radii.

   e. Contractors shall use Panduit Stainless Steel System cable ties, Band-It steel strapping, or equivalent to connect to support wires. The cable ties are to be installed per manufacturer's instructions. The locking mechanism shall be placed towards the wall or ceiling as to minimize its exposure to contact. All sharp corners or edges created by cutting excess length shall be rounded and smoothed.

5. New support wires

   a. Contractors may install support wires onto existing or installed structures for the attachment of cables. Support wires shall be installed to minimally impact open support structure needed to install support wires shall be placed against, or as close as possible, to walls and ceilings. Any support structure needed to install support wires shall be rounded or padded to minimize injury to people, if impacted. Final placement of support structures shall be pre-approved by Johns Hopkins Personnel.

   b. Support wires shall be 10M (minimum size) galvanized steel. They shall be supported every 8 feet (maximum interval). Messenger supported wiring shall be grounded per NEC1999 Section 321-7, which considers them to be conductor enclosures per MEC1999 Section 250-86. Grounding within the tunnels shall be

coordinated with Johns Hopkins Personnel.

6. Cable Lashing
    a. When using existing support strands, Contractors shall attach cables directly to the support strand. Contractors shall not attach new cables directly to existing cables. Contractors may wrap around a single existing cable and support strand provided the support strand bears the weight of the cable. New cables shall not add any strain to existing cables.
    b. Contractors shall use Panduit Stainless Steel System cable ties, Band-It steel strapping, or equivalent to connect to support wires. The cable ties are to be installed per manufacturer's instructions. The locking mechanism shall be placed towards the wall or ceiling as to minimize its exposure to contact. All sharp corners or edges created by cutting excess length shall be rounded and smoothed. Lashing may be tight, but shall not deform the cable.
    c. Cables installed into open support structures shall not be lashed to the support structure. The following are exceptions to this specification: lashing required to keep the cables within the confines of the structure and lashing required to provide support for vertical cables.
7. Vertical exits
    a. Cables leaving the tunnel beneath a building, vertically into the building, shall be supported by vertical backbone cable supports. Equivalent products may be galvanized, have a similar locking mechanism, and be pre-approved by Johns Hopkins Personnel.
8. Nonmetallic flexible raceway (Innerduct)
    a. Innerduct shall not be placed into existing or new enclosed raceways, including open raceways like Snake Tray. Innerduct may be used to transition into and out of these raceways. Innerduct may be used for mechanical protection when support wires are used for optical fiber cables. Innerduct is not required within the tunnels in any location, unless specified by Johns Hopkins Personnel for a given installation.
    b. Fire alarm cable shall be installed in accordance with NFPA 70 National Electrical Code.
9. Splices
    a. Locations of splice cases are to be pre-approved by Johns Hopkins Personnel. Splice cases shall be fully supported off the tunnel floor.
    b. Splice specifications are detailed later in this specification.

C. Maintenance Holes
1. Contractors shall label and document all space elements.
2. Contractors shall install maintenance holes at the location and in the orientation specified by Johns Hopkins and project documentation.
3. Contractors shall locate conduit penetrations into a maintenance hole as specified by Johns Hopkins and construction document. Contractors shall not install conduits into the neck of a MH for any purpose including lighting, sump pump drains, and/or sump pump power. Contractors shall avoid ceiling penetrations of any kind. Contractors may install conduits into the ceiling of a MH for sump pump drain or power lines, with prior approval from Johns Hopkins Personnel.

4. Contractors shall provide and install a level bed of compacted aggregate onto which a MH is to be installed. The bed shall extend 1 foot beyond the exterior of the MH when in final position. The aggregate bed shall be a minimum of 6" thick (post-compaction) and shall be compacted to not less than 95% density compared to maximum laboratory tests by weight per ASTM D1557-64T, method A.
5. Contractors shall provide water-tight joints in pre-cast MH sections.
6. Contractors shall have all brick joints in all of the brick courses (neck) between the MH box and the collar (cover cone) fully mortared inside and outside. Brick necks constructed on site shall have the inner and outer surfaces completely purged to prevent water penetration of the neck.
7. Contractors shall install the MH cover flush with the final grade of the surrounding area. If the distance from the final grade to the maintenance hole ceiling is 24" or greater, Contractors shall provide and install permanent steps into the neck.
8. Contractors shall keep the MH opening covered to prevent rain and runoff from penetrating into the MH during construction and until watertight measures are complete.
9. Contractors shall use pre-formed openings for penetrations into the MH. Contractors may core drill MH walls or may cut a window to provide space for new conduits.
10. Contractors shall install new conduits in a neat arrangement, with horizontal and vertical rows. Contractors shall not install conduits in a random, clustered fashion. The integrity and appearance of the walls shall be restored after conduit installation to original conditions. Plywood frames used to pour concrete around conduits shall be removed at the end of the job. New penetrations shall be sealed against moisture and gas penetration around conduits.
11. Contractors shall install a sump pump. The power cable for this pump shall be provided using a separate pathway to the MH. Power cables shall not be installed into a communication ductbank. Sump pump discharge shall be routed to the nearest available storm drain. The discharge hose shall not be installed into a communications ductbank, but shall have an independent pathway out of the MH.
12. If Johns Hopkins Personnel pre-approves not installing a sump pump, Contractors shall cover and watertight seal the sump for future use, if needed. The cover shall be sealed in a removable manner enabling future access to the sump.
13. Contractors shall provide and install MH racking on all four sides. Stanchions shall be installed at a minimum of two vertical locations on each wall. Stanchions shall be stacked at each location to provide a minimum of 6 feet of height. Two spare cable rack arms of equal size to those planned for use shall be installed at each vertical location used.
14. Contractors shall provide and install a permanent ladder in a maintenance hole.
15. Contractors shall provide and install an 8 ft ground rod (per 1997 NECS 94.B.2) into the floor of each MH. Contractors shall seal the space around the ground rod to prevent water penetration around the rod. Bonding ribbon between pre-cast sections shall be bonded to the ground rod or grounding conductor.
16. Contractors shall provide and install an insulated (green), stranded #6 (minimum) copper grounding conductor from the ground rod to each wall. Contractors may install a single conductor encircling the space. The conductor(s) shall run the entire length of each long wall and shall be securely anchored to the wall.

17. Contractors shall provide exothermic welds for all grounding conductor bonds within a maintenance hole.
18. Contractors shall bond to ground all existing conductive racking, stanchions, and ladders.
19. Contractors shall not make any permanent attachments to pulling irons or loops. Cables are not to be permanently supported by pulling irons or loops.
20. Use of Existing Maintenance Holes
    a. Contractors shall follow all specifications above when using existing maintenance holes, unless waived by Johns Hopkins Personnel.
    b. Contractors shall strictly follow above specifications regarding conduit placement, arrangement, and penetration.
    c. Contractors shall install a sump pump, power, and drain as specified above, if standing water or evidence of past flooding is evident in the MH.
    d. Contractors shall install racking on any side without racking. Johns Hopkins may waive this specification for certain MH walls based on current maintenance hole configuration. Contractors shall provide and install racking of manufacturer and type specified above.
    e. Contractors are not required to install a ladder into an existing maintenance hole lacking a ladder.
    f. Contractors shall provide and install grounding into an existing maintenance hole without proper grounding as required by codes, standards, methodologies, and specifications referenced in Appendix 2, included in this document.
    g. Contractors shall bond to ground all existing conductive racking, stanchions, and ladders. Contractors shall notify Johns Hopkins of any pre-existing splice cases not bonded to ground.
    h. Contractors are not required to install pulling irons and loops into existing MH, unless needed by the Contractor.

D. Handholes and Hand boxes
1. Contractors shall label and document all space elements.
2. Hand boxes shall be installed per manufacturer’s instructions.
3. Hand boxes shall rest on a bed of gravel or crushed rock measuring six or more inches deep and extending six or more inches beyond the sides of the HB. Sand and gravel dust are not acceptable.
4. The Contractor shall install 4"-6" of gravel or crushed rock outside hand boxes prior to backfilling to grade. Sand and gravel dust are not acceptable.
5. Hand box color and lid type shall be coordinated with Johns Hopkins.
6. Hand boxes shall be installed with covers flush with the final grade. Hand boxes shall match any slope in the final grade. Hand boxes may be installed with a partially exposed side on steep grades. Johns Hopkins Personnel shall pre-approve non-flush installations.
7. Horizontal penetrations of the box shall be made using knockout locations, when Available. The sidewalls of the hand box shall not be penetrated in other locations with pre-approval from Johns Hopkins Personnel. Conduits may “stub up” into the box.

Conduits entering this way shall be within 2" of a sidewall.

8. Using Existing Hand boxes
    a. Johns Hopkins Personnel must approve the use of an existing hand box. Contractors may have to replace an existing hand box, if the conditions of the hand box are beyond remediation. Johns Hopkins Personnel shall determine the status of the hand box. Replacement handboxes shall be installed to the specifications of the previous section.
    b. Existing conditions of conduits may not be able to be fully reconfigured to meet location specifications of the previous section. Johns Hopkins Personnel may allow deviations from conduit placement specifications prior to installation.
    c. If available for use, Contractors shall enter an existing hand box horizontally through knockouts. If pre-manufactured knockouts are not available, the Contractors shall enter the hand box by sweeping under the sidewall and “stubbing up” into the box within 2" of a sidewall.
    d. Hand box sides 24" or greater without racking shall be retrofitted with appropriate racking. Johns Hopkins Personnel may waive this specification depending on the existing conditions.
    e. Ground rods shall be installed, as needed. Contractors shall correct any improper or missing grounding within the hand box.
    f. Contractors shall excavate within the hand box such that 6" of gravel or crushed rock can be placed into the box. The box shall be raised or lowered to existing grade as needed. This specification may be waived if existing conduit conditions block such modifications.
9. New Handholes
    a. New handholes shall not be installed.
10. Using Existing Handholes
    a. Johns Hopkins Personnel must approve the use of an existing handholes. Contractors may have to replace an existing handhole within a hand box, if the conditions of the handhole are unacceptable. Johns Hopkins Personnel shall determine the status of the handhole. Replacement hand boxes shall be installed to the specifications of the previous “New Hand boxes” section.
    b. Contractors shall enter the hand box by sweeping under the sidewall and “stubbing up” into the handhole within 2" of a sidewall. Johns Hopkins Personnel may waive this specification depending on the existing conditions.
    c. Contractors shall excavate within the handhole such that 6" of gravel or crushed rock can be placed into the hole. The handhole shall be raised or lowered to existing grade as needed. This specification may be waived if existing conduit conditions block such modifications.

END OF SECTION

33 81 29 - COMMUNICATIONS VAULTS, PEDESTALS, AND ENCLOSURES

PART 1 GENERAL

1. 1 REFERENCES

A. IEEE C2 - National Safety Code.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 DESIGN REQUIREMENTS

A. Pedestals

1. There are no specific safety information or restrictions for pedestals.
2. Pedestals & cabinets shall have very limited use at Johns Hopkins campuses. Contractors shall not use pedestals or cabinets without design approval from Johns Hopkins IT Infrastructure Project Team. Certain fringe areas or areas with sufficient concealment may utilize them, if pre-approved. Areas of the campus beyond the contiguous core may use pedestals, if pre-approved.
3. Pedestals and cabinets may be mounted directly in the ground or on concrete pads, mounting feet, floor stands, walls, or on poles. These housings may include:
    a. Locking device or hasp.
    b. Adjustable mounting bracket/panel to secure taps.
    c. Splitters.
    d. Couplers.
    e. Line extenders.
    f. Amplifiers.
    g. Interdiction devices.
    h. Mounting hardware.
    i. Reels for cable storage.
    j. Warning labels.
    k. Grounding/bonding provisions.
    l. Identification.
    m. Manufacturers markings.
    n. Cable knockouts.
    o. Grommets.
4. When selecting pedestals and cabinets, the following should be considered:
    a. Cable bend radii >15x cable diameter.
    b. Capacity to accommodate four cables for current and future requirements.
    c. Capacity to accommodate both inline and butt splice closures.
    d. Security—special bolts, keys and security alarm monitoring.

e. Flood control provisions.

f. Weather-tight seals/gaskets/grommets.

g. Optical cable storage to permit moving the splice closure to a working location.

h. Ventilation for environmental control and/or heat extraction (forced air fan optional).

i. Resistance to rodent and insect intrusion.

j. Environmentally controlled cabinets (fans, heaters, and thermostats included).

k. Color options.

l. Impact resistance (vandalism).

m. Resistance to dust intrusion.

n. Resistance to water spray.

o. Chemical resistance.

5. Pedestals and cabinets shall be designed so that there is a minimum of 3 ft of clearance in front and on both sides.

B. Enclosures

1. The use of direct-buried spaces shall be limited. These spaces are primary locations for direct-buried splices. The use of direct-buried pathways is discussed above.

2. Direct-buried locations shall not necessitate the installation of a ground rod. Electrical ground continuity through any device in the space shall be maintained and insulated from the surrounding space.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Pedestals

1. Manufacturers

a. Emerson Network Products (formerly Marconi), Energy Systems- North America, 1122 F Street, Lorain, OH 44052, Tel: 1-800-800-1280

1) ACCESS 360 Metallic Pedestal

b. Other acceptable manufacturers offering equivalent products

B. Enclosures

1. Manufacturers

a. 3M Better Buried Closure

b. Preformed Line Products REDDI Seal closures

c. Other acceptable manufacturers offering equivalent products

2. Buried closure shall use re-enterable encapsulate specified by the closure manufacturer.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Pedestals

1. New pedestals shall not be installed, except in exception circumstances.

C. Enclosures, direct-buried

1. Direct-buried spaces shall be at a minimal depth of 30 inches to the device in the space, where possible. Deviations from this specification must be pre-approved by Johns Hopkins Personnel.
2. Contractors shall excavate in and around the final space location such that 6" of gravel or crushed rock can be placed below and around any direct buried device in the space. Contractors shall cover any direct buried devices in the space with 6" of gravel or crushed rock.
3. Direct-buried locations shall not necessitate the installation of a ground rod. Electrical ground continuity through any device in the space shall be maintained and insulated from the surrounding space.

END OF SECTION

33 82 13 - COPPER COMMUNICATIONS DISTRIBUTION CABLING

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 13 13: Communications Copper Intrabuilding Backbone Cabling.

1. 2 REFERENCES

A. IEEE C2 - National Electrical Safety Code.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. There are several physical networks on Johns Hopkins campuses. The primary networks are the data, voice, fire alarm, parking, and mechanical control networks. Backbone cables to buildings have been used to provide voice and data service to other locations. While not ideal, it may be more practical to evaluate available backbone capacity in neighboring buildings. Field devices (e.g. emergency phones, security cameras, kiosks, etc.) will likely be cabled to the nearest building for voice and/or data service, when needed.

B. Underground - Underground cable is subject to some of the same environmental problems as those in direct-buried cable. Moisture and lightning are a problem, but rodent damage is less likely. Both are subject to excavation damage, although underground cable has some mechanical protection by the conduit that encases it.

C. Direct-Buried - Direct-buried OSP cables are subject to different environmental conditions than those of aerial cables. Moisture, rodent damage, and lightning are some of the more critical areas that are addressed in the manufacture of direct-buried OSP cables.

D. Aerial - There are three methods for placing cable on pole lines:

1. Lash new cable to a support strand.
2. Lash new cable to an existing support strand/cable.
3. Use self-supporting-type cable that contains a support strand.

E. Copper Voice Backbone Cabling

1. The voice network is based on a variety of OSP backbone cables. The network is also a hierarchical star with several major and several minor concentration points. Johns Hopkins Personnel, in conjunction with Telecommunications, shall assist in determining end points for backbone designs. As a deviation from BICSI methodologies, a “primary” backbone to a building may be composed of two cables with a splice at a star location. Buildings may also be cabled from high-count copper splice cases functioning as a secondary star at a strategic location.
2. Johns Hopkins IT Infrastructure Project Team, in conjunction with Telecommunications, shall assist in determining the number of pairs and type of copper cable to be installed.
3. Underground voice cables shall be 24 AWG, Superior-Essex SEALPIC-FSF cable.
4. Other voice cables may be 24 AWG, Superior-Essex SEALPIC-84 self=supporting cable, as specified below.
5. Other AWG sizes may be used for specific applications and shall be pre-approved by Johns Hopkins Personnel.

6. Material of similar design and specifications may be approved by Johns Hopkins Personnel. Substitutions shall be pre-approved.
7. The voice network may have dead pairs in one or more splices that may be used to extend service. Verify with Johns Hopkins Personnel regarding the location and use of dead pairs as an alternative and potentially better source for voice service.
8. Refer to the BICSI CO-OSP manual for guidelines on copper cable requires under different conditions.
9. The physical design of the system should minimize splices whenever possible. Splices cannot always be avoided due to the cable plant layout, length, raceway congestion, and unplanned requirements (e.g., cable damaged during the installation or accidental damage to existing cable).

F. Fire Alarm Backbone Cabling

1. Johns Hopkins Personnel shall be contacted for specific guidance on fire alarm cabling. Fire alarm signals may use copper or optical fiber cables, dependent upon the equipment being installed and the location of the equipment.

G. Parking Backbone Cabling

1. Johns Hopkins Personnel shall be contacted for specific guidance on parking lot lift gate cabling. Johns Hopkins Personnel, in conjunction with the Security Department Parking office, shall assist in determining the best design for this type of cabling.

H. Mechanical Control Backbone Cabling

1. A separate mechanical network element shall not be designed without prior approval of Johns Hopkins Personnel. The existing mechanical network is being phased out as building systems become IP-based and use the data network.

I. Other Backbone Cabling

1. Johns Hopkins Personnel shall be contacted prior to planning the introduction of any additional cable plant elements (e.g. coax backbone cable). Expansion of the OSP into other media shall be very limited and shall have justification beyond the existing infrastructure's ability to support the new service.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Underground voice cable

1. 24 AWG copper
2. Pair count: Refer to IT Infrastructure Project Team
3. Manufacturers
    a. Superior-Essex
        1) SEALPIC-FSF cable
        2) SEALPIC-84 self-supporting cable
    b. General Cable
        1) Filled Foam Skin Cable - Spec 2007
    c. Other acceptable manufacturers offering equivalent products

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Copper (Voice) Backbone Cabling

1. Underground voice cables shall be SEALPIC-FSF.
2. Aerial voice cables may be 24 AWG, Superior-Essex SEALPIC-84 self-supporting cable. SEALPIC-FSF may be used with a separate support strand.
3. Voice cables shall not be spliced in the OSP, except as required by the limitations of manufactured cable lengths. Oversized cables may be installed over part of the pathway and downsized at a splice to the final size for the project. (This would leave dead pairs within the splice or as a stub for future development from this branch splice point.)
4. All cables installed in maintenance holes and large handboxes with racking must be supported by racking arms. Cables shall not be secured directly to stanchions by cable ties or other means unless the full weight of the cable is also supported by an arm.
5. Additional information on splicing can be found under OSP devices- copper enclosures.
6. Where possible, splice conductors by using the foldback splice method. Conductors are folded into the splice to provide slack in the conductors for maintenance, rearrangement, or transfer of conductors.

C. Other Backbone Cabling

1. Other cable types shall be project-specific and detailed in project documentation.

END OF SECTION

33 82 13.13 - COPPER SPLICING AND TERMINATIONS

PART 1 GENERAL

1. 1 REFERENCES

A. IEEE C2 - National Electric Safety Code.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 DESIGN REQUIREMENTS

A. Splices may be made in MHs, tunnel locations, or with HBs (in certain circumstances, noting this as a deviation from BICSI methodologies). All splice locations and configurations shall be pre-approved by Johns Hopkins Personnel. No dead copper pairs shall remain within a sealed splice case. Specify stubs for unused pairs. Exceptions may be made for large backbone cables spliced to provide multiple branches for future installation.

B. Copper closures shall be re-enterable, watertight or vented depending on the specific situation. They may be used on poles, strands, buildings, underground, direct-buried, and above-ground pedestals.

C. OSP cables shall not be spliced within a building. All OSP cables shall terminate in buildings on building entrance terminals. Splices may be used to connect OSP cables to manufacturer-installed BET stubs.

D. All splices shall use high pair count splice modules.

E. Copper closures shall be capable of:

1. Storing and organizing splices (whether individually spliced or mass spliced).
2. Providing bonding and grounding facilities.
3. Restoring the mechanical integrity and electrical properties of the sheath.
4. Protecting splices from moisture. Closures shall be filled with re-enterable encapsulate, unless otherwise specifically instructed otherwise by the closure manufacturer.

F. Closures shall be sized to accommodate the maximum number of splice modules for the feeder backbone cable.

G. When designing for a branch splice, the last available opening in the endplates cannot be used if any unspliced pairs would remain unused within the enclosure. If only one opening in the endplates is available and if unspliced pairs would remain with the enclosure, design for a single short cable spliced to the available pairs. This cable shall terminate in a new closure from which the needed pairs for the final installation may be spliced. If all pairs cannot be spliced onto a single cable, contact Johns Hopkins Personnel. A new closure, or custom endplates may be required.

H. All splices shall maintain grounding continuity between all non-transmitting, conductive elements within the cables with enclosure. All splices shall be bonded to ground per codes, standards, and methodologies.

1. 4 PROJECT CONDITIONS

A. There is no specific safety information for devices.

B. The location and orientation of OSP devices shall be strictly controlled by Johns Hopkins. Contractors shall confirm all proposed locations and orientations of OSP devices. Visible

devices or visible elements of devices, including any supporting structure for OSP devices, shall be pre-approved by Johns Hopkins Personnel.

C. Restrictions on OSP devices are on a case-by-case basis without general campus specifications.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Manufacturers

1. 3M
    a. 2-Type Fire Retardant Closures
    b. 2-Type Series Pressurized Closures (larger splices)
2. Preformed Line Products
    a. ARMADILLO Series
3. Other acceptable manufacturers offering equivalent products

B. 3M MS2 or 710 modules or appropriate hardware, as determined by the enclosure manufacturer.

PART 3 EXECUTION

3. 1 INSTALLATION

A. Proper installation of a splice/termination shall require remediation of any past improper installation procedure that would impact the proper installation of the device (e.g. proper grounding).

B. Install in accordance with manufacturer’s instructions.

C. Copper cable splicing shall be performed with high pair count modular connectors.

D. The splice and stripped cable shall be protected by a rated splice closure.

E. Closures shall be sized to accommodate the maximum number of splice modules for the feeder backbone cable.

F. When installing a branch splice, Contractors shall not use the last available opening in the endplates for a spliced backbone cable if any unspliced pairs would remain unused within the enclosure.

G. If only one opening in the endplates is available and if unspliced pairs would remain with the enclosure, Contractors shall provide a single short cable spliced to the available pairs. This cable shall terminate in a new enclosure from which the needed pairs for the final installation may be spliced. If all pairs cannot be spliced onto a single cable, Contractors shall contact Johns Hopkins Personnel before proceeding. A new enclosure, or custom endplates may be required.

H. All splices shall maintain grounding continuity between all non-transmitting, conductive elements within the cables within the enclosure. All splices shall be bonded to ground per codes, standards, and Owner methodologies.

I. OSP cables shall not be spliced within a building. All OSP cables shall terminate in buildings on building entrance terminals.

END OF SECTION

33 82 23 - OPTICAL FIBER COMMUNICATIONS DISTRIBUTION CABLING

PART 1 GENERAL

1. 1 RELATED SECTIONS

A. Section 27 13 23 - Communications Optical Fiber Intrabuilding Backbone Cabling.

1. 2 REFERENCES

A. IEEE C2 - National Electric Safety Code.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

1. 3 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 4 DESIGN REQUIREMENTS

A. There are several physical networks on Johns Hopkins campuses. The primary networks are the data, voice, fire alarm, parking, and mechanical control networks. Backbone cables to buildings have been used to provide voice and data service to other locations. While not ideal, it may be more practical. To evaluate available backbone capacity in neighboring buildings. Field devices (e.g. emergency phones, security cameras, kiosks, etc.) will likely be cabled to the nearest building for voice and/or data service, when needed.

B. Underground - Underground cable is subject to some of the same environmental problems as those in direct-buried cable. Moisture and lightning are a problem, but rodent damage is less likely. Both are subject to excavation damage, although underground cable has some mechanical protection by the conduit that encases it.

C. Direct-Buried - Direct-buried OSP cables are subject to different environmental conditions than those of aerial cables. Moisture, rodent damage, and lightning are some of the more critical areas that are addressed in the manufacture of direct-buried OSP cables.

D. Aerial - There are three methods for placing cable on pole lines:

1. Lash new cable to a support strand.
2. Lash new cable to an existing support strand/cable.
3. Use self-supporting-type cable that contains a support strand.

E. Optical Fiber Backbone Cabling

1. The existing data network is an optical fiber-based network in a hierarchical star with one major and several minor concentration points. The majority of the physical cable has been manufactured by Corning, but several other manufacturers have been used in the past.
2. Johns Hopkins IT Infrastructure Project Team, in conjunction with Networking, shall assist in determining end points for backbone designs. As a deviation from BICSI methodologies, a “primary” backbone to a building will likely be composed of two cables with a cross-connect at a star location. Buildings may also be cabled from high-count fiber splice cases functioning as a secondary star at strategic locations.
3. A minimum 144 strand single mode fiber backbone cable is required for new construction.
4. New construction projects require at least two (2) redundant/diverse pathways for installation of the fiber-optic backbone cable (minimum 144 strand fiber). Consult Johns Hopkins IT Infrastructure Project Team for additional requirements.

5. Johns Hopkins IT Infrastructure Project Team, in conjunction with Networking, shall assist in determining the number of strands and type of optical fiber cable to be installed.
6. Buildings may be connected using traditional cables or may be connected using air-blown fiber cables for the University, as determined by Johns Hopkins Personnel. All intra-campus backbone cables passing through non-JHU spaces (DPW conduits, etc.) adjacent to the Homewood campus shall be air-blown fiber cables, including aerial installations.
7. Optical fiber cables shall be Corning interlocking armored FREEDM cables or Sumitomo air-blown fiber, unless specifically noted. Optical fiber cable may be Corning (unarmored) FREEDM cables, Corning ALTOS armored cables, Corning ALTOS All-Dielectric cables, or Sumitomo air-blown fiber cables, as specified by Johns Hopkins Personnel, Sumitomo air-blown fiber is the preferred product for the Homewood Campus.
8. Optical fiber cables installed within the utility tunnels for any length shall be Corning interlocking armored FREEDM cables or Sumitomo air-blown fiber cables.
9. Optical fiber cables installed without entering the utility tunnels may be Corning FREEDM cables or Sumitomo air-blown fiber cables with pre-approval from Johns Hopkins Personnel.
10. Optical fiber cables installed over long distances (inter-campus) without entering the utility tunnels may be Corning ALTOS cables. These cables are subject to the 50-foot rule.
11. Aerial cables shall be Sumitomo air-blown fiber cables.
12. Optical fiber cables shall not be spliced in the OSP, except as required by the limitations of manufactured cable lengths. Fiber distribution panels and/or branch splices may be allowed in special circumstances. ALTOS cables may need to be spliced to FREEDM cables within structures under the 50-foot rule. Tunnels at the Homewood campus are not subject to the 50-foot rule.
13. All cables installed in Mhs and large Hbs with racking shall be supported by racking arms. Cables shall not be secured directly to stanchions by cable ties or other means unless the full weight of the cable is also supported by an arm unless pre-approved.
14. Johns Hopkins IT Infrastructure Project Team, in conjunction with Networking, shall assist in determining the type of fiber cable to be installed. In most Homewood applications, air-blown fiber cables shall be installed.
15. The physical design of the system should minimize splices, whenever possible. Splices cannot always be avoided due to the cable plant layout, length, raceway congestion, requirements for a transition splice between non-listed OSP cables and listed cable at the building entrance point, and unplanned requirements (e.g., cable damaged during the installation or accidental damage to existing cable).

F. Fire Alarm Backbone Cabling

1. Johns Hopkins Personnel shall be contacted for specific guidance on fire alarm cabling. Fire alarm signals may use copper or optical fiber cables, dependent upon the equipment being installed and the location of the equipment.

G. Other Backbone Cabling

1. Johns Hopkins Personnel shall be contacted prior to planning the introduction of any additional cable plant elements (e.g. coax backbone cable). Expansion of the OSP into

other media shall be very limited and shall have justification beyond the existing infrastructure's ability to support the new service.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Indoor/outdoor optical fiber cable

1. Corning Cable Systems, FREEDM cable
    a. Interlocking armored
    b. Listed NEC OFNR, riser-rated
    c. Loose tube, gel-free
    d. Multimode- 50/125 micron
    e. Single Mode

B. Outdoor optical fiber cable

1. Corning Cable Systems, ALTOS cable
    a. All-dielectric cables
2. Corning Cabling Systems, ALTOS cable
    a. Double-Jacket/Single-Armor cable

C. Air-blown optical fiber cable

1. Sumitomo Electric Lightwave
    a. Tubing cables
        1) All-dielectric, TCxxMSO series, (xx="02", "04", "07", "19" tubes)
        2) Armored, TCxxTLA, (xx="07", "19" tubes)
    b. Optical Fiber Bundles
        1) Single Mode, 24 fibers per bundle
        2) Multimode- 50/125 micron, 24 fibers per bundle

PART 3 EXECUTION

3. 1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. A minimum 144 strand single mode fiber backbone cable is required for new construction.

C. Implementing redundant fiber backbone cable is required for new construction projects (minimum 144 strand Fiber). Consult Johns Hopkins IT Infrastructure Project Team for additional requirements.

D. Optical Fiber (Data) Backbone Cabling

1. Unlisted cables are subject to the 50-foot rule when entering a building and must have a transition splice within the entrance facility.
2. OSP air-blown fiber cables are subject to the 50-foot rule and can transition to ISP tubes using a Sumitomo housing or a standard splice enclosure. All incoming tubes shall be connected to the same numbered outgoing tubes.
3. Optical fiber cables shall not be spliced in the OSP, except as required by the

limitations of manufactured cable lengths. Fiber distribution panels and/or branch splices may be allowed in special circumstances. ALTOS cables may need to be spliced to FREEDM cables within structures under the 50-foot rule.

4. All cables installed in maintenance holes and large handboxes with racking must be supported by racking arms. Cables shall not be secured directly to stanchions by cable ties or other means unless the full weight of the cable is also supported by an arm.
5. Additional information on splicing can be found under OSP devices-fiber enclosures.
6. Optical fiber cables shall not be spliced in maintenance holes under any circumstances.

E. Other Backbone Cabling

1. Other cable types shall be project specific and detailed in project documentation.

END OF SECTION

33 82 23.13 - OPTICAL FIBER SPLICING AND TERMINATIONS

PART 1 GENERAL

1. 1 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2002.

B. IEEE C2 - National Electric Safety Code.

1. 2 DEFINITIONS

A. See Section 27 00 00: Communications General.

1. 3 DESIGN REQUIREMENTS

A. Splices may be made in Mhs, tunnel locations, or with Hbs (in certain circumstances, noting this as a deviation from BICSI methodologies). All splice locations and configurations shall be pre-approved by Johns Hopkins Personnel. No dead copper pairs shall remain within a sealed splice case. Specify stubs for unused pairs. Exceptions may be made for large backbone cables spliced to provide multiple branches for future installation.

B. Fiber splices do not need to provide stub, provided the case can physically hold the eventual splicing of all strands. A second fiber splice case may be needed based on available end cap space for additional cables.

C. Splice point locations should be chosen only after considering the requirements for performing optical fiber splicing:

1. To effectively perform a splice, the cable ends shall reach a satisfactory work surface (preferably a vehicle or table that is clean and stable). The distance can be as much as 9 m (30 ft.). The chosen location should have provisions for storing the slack cable after splicing is completed.
2. Physical protection of all slack is recommended, although not required.
3. Splicing and racking slack should be considered when making cable length calculations. Optical fiber splice closure typically requires 2.4 to 3 m (8 to 10 ft). Of stripped cable inside the closure.

D. Optical fiber cables shall not be spliced in maintenance holes under any circumstances.

E. Allow for cable slack, normally 9 m (30 ft.), allowing for easy mid-span access, cable repair or relocation, and future cable drop points.

F. Fusion or mechanical splicing is approved.

G. The splice and stripped cable shall be protected by a rated splice closure.

H. Optical fiber closures shall be re-enterable, watertight, or vented depending on the specific situation. They may be used on poles, strands, buildings, underground, direct-buried, and above-ground pedestals.

I. Fiber closures shall be capable of:

1. Storing and organizing the fibers.
2. Storing and organizing splices (whether individually spliced or mass spliced) generally through the use of splicing trays.
3. Providing bonding and grounding facilities.
4. Maintaining minimum bend radius for the individual fibers.
5. Protecting splices from moisture. When air pressure systems are not used, closure shall be filled with re-enterable encapsulate. The use of an inner closure shall be used

to simplify the reentry process.

6. Supporting up to a maximum of four cable entries, where possible.

J. Closures shall be sized to accommodate the maximum number of splice modules for the feeder backbone cable.

K. When designing for a branch splice, the last available opening in the endplates cannot be used for a spliced backbone cable if an unspliced strands would remain unused within the enclosure. If only one opening in the endplates is available and if unspliced strands would remain with the enclosure, design for a single short cable spliced to the available strands. This cable shall terminate in a new enclosure from which the needed strands for the final installation may be spliced. If all strands cannot be spliced onto a single cable, contact Johns Hopkins Personnel. A new closure, or custom endplates may be required.

L. All splices shall maintain grounding continuity between all non-transmitting, conductive elements within the cables within the enclosure. All splices shall be bonded to ground per codes standards, and methodologies.

M. Splice Trays

1. Splice trays are required to protect and organize fibers and splices at splice points.
2. Splice trays are sized for either multimode or single model applications due to their different bend radii requirements. Single mode or multimode fibers may be spliced in the single mode trays. The single mode trays are preferred due to their larger, craft-friendly larger size. Accordingly, most splice hardware is designed around the single model splice tray.
3. The completed splices shall be placed in the organizer and coated with a room temperature vulcanization (RTV) compound to protect the bare fibers, unless otherwise instructed by the enclosure manufacturer instructions.
4. Splice trays shall include clear, plastic covers for easy visual inspection.

N. Fiber Distribution Panel

1. Fiber distribution panels may be used within the utility tunnels, but not within Mhs. Panels shall provide a water-tight seal and a NEMA rating appropriate for the installation location.

O. Air-blown fiber tube cable splices

1. Air-blown fiber tube cables shall only be spliced when limited by cable length from the manufacturer.
2. The preferred method of splicing air-blown fiber tube cables is by using copper splice enclosures to for a water-tight splice environment.
3. Where possible, the Contractor shall splice air-blown fiber tube cables in non-flooding area (e.g. tunnels, basements, areaways). Splices in non-flooding areas may use distribution housings or copper splice enclosures.
4. Splicing in a flooding area (e.g. maintenance holes) must be pre-approved by JH. Splices in flooding areas shall use copper splice enclosures.
5. Air-blown fiber tube cables shall be straight splices with all tubes entering and leaving the splice without branching. Branch splices may be installed if pre-approved by JHU. Dead tubes shall be plugged and marked as dead in a splice case.
6. Air-blown fiber tube splices shall not be re-entered unless absolutely required. The Contractor shall provide a water-tight seal upon re-sealing the enclosure to the degree of a “new enclosure” seal where “new enclosure” is defined as the initial sealing of a new enclosure as instructed by the manufacturer to ensure maximum performance of

the enclosure. All old sealing material shall be totally removed. Only new sealing materials, including gaskets, shall be used. The Contractor shall replace any hardware, up to and including the entire enclosure assembly, if required to achieve a “new enclosure” seal.

1. 4 PROJECT CONDITIONS

A. There is no specific safety information for devices.

B. The locations and orientation of OSP devices shall be strictly controlled by Johns Hopkins. Contractors shall confirm all proposed locations and orientations of OSP devices. Visible devices or visible elements of devices, including any supporting structure for OSP devices, shall be pre-approved by Johns Hopkins Personnel.

C. Restrictions on OSP devices are on a case-by-case basis without general campus specifications.

PART 2 PRODUCTS

2. 1 MATERIALS

A. Fiber Distribution Panel

1. NEMA 4X
2. Accepts Corning Cable Systems Edge fiber modules
3. Manufacturers
    a. Corning Cable Systems, Environmental Distribution Center
    b. Other acceptable manufacturers offering equivalent products

B. Fiber Splice Closures

1. Manufacturers
    a. 3M
        1) 2178-series Optical Splice Case
        2) Quante BPEO Splice-Protection Closures
    b. Tyco Electronics
        1) Tyco FOSC series closures
2. Additional hardware from the same manufacturer, as needed to complete splicing

PART 3 EXECUTION

3. 1 INSTALLATION

A. Proper installation of a splice/termination shall require remediation of any past improper installation procedures that would impact the proper installation of the device (e.g. proper grounding).

B. Fiber Distribution Panel

1. Install in accordance with manufacturer’s instructions.
2. Installation of fiber distribution panels with the utility tunnels shall follow pathway requirements for tunnel installations as described by this specification on tunnel usage.

C. Fiber Splice Closures

1. Install in accordance with manufacturer’s instructions.
2. Fusion or mechanical splicing is approved. Fiber splice loss shall be a maximum of 0.1 dB.

3. Closures shall be sized to accommodate the maximum number of splice trays for the feeder backbone cable.
4. When installing a branch splice, Contractor shall not use the last available opening in the endplates for a spliced backbone cable if any unspliced strands would remain unused within the enclosure.
5. If only one opening in the endplates is available and if unspliced strands would remain in the enclosure, Contractors shall provide a single short cable spliced to the available strands. The Cable shall terminate in a new enclosure from which the needed strands for final installation may be spliced. If this option is not feasible, Contractors shall contact Johns Hopkins Personnel before proceeding.
6. All splices shall maintain grounding continuity between all conductive elements within the cables within the enclosure. All splices shall be bonded to ground per codes, standards, and methodologies in Section 27 00 00 Communications General.

D. Air-blown fiber tube cable splices

1. Air-blown fiber tube cables shall only be spliced when limited by cable length from the manufacturer.
2. The preferred method of splicing air-blown fiber tube cables is by using copper splice enclosures for a water-tight splice environment.
3. Where possible, the Contractor shall splice air-blown fiber tube cables in non-flooding area (e.g. tunnels, basements, areaways). Splices in non-flooding areas may use distribution housings or copper splice enclosures.
4. Splicing in a flooding area (e.g. maintenance holes) must be pre-approved by JH. Splices in flooding areas shall use copper splice enclosures.
5. Air-blown fiber tube cables shall be straight splices with all tubes entering and leaving the splice without branching. Branch splices may be installed if pre-approved by JHU. Dead tubes shall be plugged and marked as dead in a splice case.
6. Air-blown fiber tube splices shall not be re-entered unless absolutely required. The Contractor shall provide a water-tight seal upon re-sealing the enclosure to the degree of a “new closure” seal where “new enclosure” is defined as the initial sealing of a new enclosure as instructed by the manufacturer to ensure maximum performance of the enclosure. All old sealing material shall be totally removed. Only new sealing materials, including gaskets, shall be used. The Contractor shall replace any hardware, up to and including the entire enclosure assembly, if required to achieve a “new enclosure” seal.

END OF SECTION

APPENDIX E – ADMINISTRATION TABLE BUILDING DESIGNATORS

APPENDIX F – APPROVED LOW VOLTAGE CABLING CONTRACTORS

Appendix F:

Approved Low Voltage Cabling Contractors

- **ConCor Networks**
  513 Progress Drive, Suite M
  Linthicum Heights, MD 21090

Cameron S DiGregorio	csdegregorio@emcor.net	443-803-4159
Dan Ng	dng@emcor.net	443-610-7943
Andrew Rellihan	arellihan@emcor.net	443-458-8370

- **Bluestone Communications**
  11695 Crossroads, Circle Suite L
  Middle River, MD 21220

Eric Bray	e.bray@bluestonecomm.com	443-790-3036
Tony Donoghue	a.donoghue@bluestonecomm.com	443-790-2347

- **Systcom**
  707 E Ordnance Rd #401
  Curtis Bay Industrial Area, MD 21226

Derek Shiver	dshiver@systcom.com	443-324-9241
Don Godman	dgodman@systcom.com	443-271-4454

Approved OSP Fiber Optic Cabling Contractors

- **BlueStar Technologies**
  4204 Shannon Drive
  Baltimore, MD 21213

Winfield Berrell	win@bluestartechnologiesinc.com	443-690-3872

- **ConCor Networks**
  513 Progress Drive, Suite M
  Linthicum Heights, MD 21090

Cameron S DiGregorio	csdegregorio@emcor.net	443-803-4159
Dan Ng	dng@emcor.net	443-610-7943
Andrew Rellihan	arellihan@emcor.net	443-458-8370