

SECTION 27 05 00

COMMON WORK AREA RESULTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies the basic requirements for communications installations as indicated or required and includes requirements common to more than one specification section of this division (such as related documents, related sections, definitions, governing requirements, contractor requirements, warranty requirements, submittal requirements/procedures, and project closeout requirements/procedures, as well as other requirements). This section may expand upon and/or supplement the requirements specified in Division 01.
- B. Structured Cabling System (SCS) to support all low-voltage systems including: data networking, including wireless and Voice over IP (VoIP), CATV, video surveillance and access control, intercom and paging, and Integrated Audiovisual systems (as applicable).
- C. Horizontal Cabling
 - 1. Furnish and install plenum-rated Category, 4-pair UTP cables for all horizontal voice and data links from the cross-connect in the Telecommunications Data Room (TDR) or Telecommunications Equipment Room (TEC) or Intermediate Distribution Frame (IDF) or Meet Me Room (MMR) to each telecommunications outlet and provide quantities as shown on drawings.
 - 2. The maximum horizontal cable distance from the telecommunications outlet to the horizontal cross-connect within the telecommunications rooms shall be 295 feet.
 - 3. All horizontal cables shall be routed through an approved pathway such as basket tray, J-hooks, conduits, sleeves, EZ Path, speed sleeve, or furniture pathway.
- D. Telecommunication outlets
 - 1. All telecommunications outlets shall consist of 8-position, 8-wire modular RJ-45 jack(s) as noted locations on drawings. Drawings note the quantity to provide at the outlet.
 - 2. Faceplates shall be a minimum 1-port configuration unless otherwise noted. Coordinate color with architect. Provide blank inserts for unused ports where required.
 - 3. Analog Wall phone faceplates shall be a metal single port configuration with two mounting studs were shown on plans as wall hung.
 - 4. Telecommunications outlets shall be wall mounted, floor mounted or furniture mounted as shown on drawings.
 - 5. Terminate all horizontal voice/data cables per the TIA/EIA 568B wiring scheme unless otherwise noted.
- E. Telecommunications Rooms

1. The primary function of the Telecommunications Rooms is the location of technology systems, equipment and the distribution of copper horizontal cables and termination of copper and fiber backbone cables.
2. Furnish and install equipment racks as shown on drawings. Field verify locations and requirements with the Technology Designer, Architect/Engineer and Owner prior to installation.
3. Telecommunications Rooms shall be built and provisioned according to the requirements in TIA/EIA Standard 569B and the general provisions of the Contract, including General, Supplementary and other conditions, and the requirements of other Divisions apply to the work of this Division.

F. Other Systems Cabling.

1. Furnish and install cabling to support access control, video surveillance, Integrated Audio-Visual and any other system as called out in the specifications and drawings.

1.2 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General, Supplementary, and other conditions, and the requirements of other Divisions apply to the work of this Division.
- B. Examine the Contract Documents in their entirety (including Drawings and Specification Sections in the other Divisions) for requirements or work, which may affect work under this Section, regardless of whether such requirements or work are specifically indicated in this Section.
- C. Follow the additional codes, references, standards and guidelines:
 1. NEMA VE 1-2017 – “Metallic Cable Tray Systems”
 2. NEMA VE 2-2013 with 2016 Corrections – “Cable Tray Installation Guidelines”
 3. ASTM E 814 and ANSI/UL 1479 – “Fire Tests Through Penetration Firestops”
 4. ASTM E 84 and ANSI/UL 723 “Surface Burning Characteristics of Building Materials”
 5. ASTM E 119 and ANSI/UL 263 “Fire Tests of Building Construction Materials”

1.3 SCOPE OF WORK

- A. The work covered under this section of the specifications consists of furnishing all labor, equipment, supplies and materials, tools, services and facilities in performing all operations, including installation of wire and cable, telecommunication outlets, and all other functions necessary for the complete installation of a structured cabling system supporting data networking, telecommunications, integrated audiovisual, video surveillance and access control systems in accordance with the specifications and drawings, except as specifically noted otherwise.
- B. The Cable Contractor shall coordinate with other trades and vendors prior to the start of work.
- C. The work of this section shall include, but not be limited to furnishing and installation of the following:

1. Category 6/6A unshielded twisted-pair horizontal cables.
2. Singlemode fiber optic backbone cables.
3. Innerduct
4. Max Cell
5. Telecommunications outlets/connectors and faceplates.
6. Category 6/6A UTP Modular-to-IDC type patch panels.
7. Build out of equipment rooms and cabinets.
8. Basket tray, ladder rack, and J-hooks including all necessary support hardware and fittings.
9. Firestopping systems.
10. Grounding and bonding.
11. Access control cable.
12. Video surveillance cable.
13. Network cable for integrated audiovisual devices.
14. Cross-connect of voice circuits at termination blocks.
15. Fire stopping of telecommunications pathways that penetrate fire-rated walls, floors, and ceiling.
16. Category 6/6A UTP patch cables for voice/data cross-connects in telecommunications rooms and at work stations.
17. Category 6/6A patch cables for security cross-connects in telecommunications rooms.
18. Multimode and single mode fiber optic jumper cables.
19. All materials necessary for complete and proper cable management.

D. PATHWAY COORDINATION REQUIREMENTS

1. Adjust location of conduits, terminal blocks, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication:
 - a. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
 - b. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.
 - c. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.
2. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
3. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed.

1.4 WORK SPECIFICALLY EXCLUDED AND PROVIDED BY OTHERS ARE AS FOLLOWS:

- A. Fire alarm cabling.
- B. Network hardware such as access switches, routers, servers, workstation computers, printers, and all other customer premise equipment.

- C. Telephone system hardware such as telephone stations, servers/managers, and other associated telephone equipment hardware.
- D. Floor boxes for access to workstations and equipment shall be furnished and installed by the EC under applicable sections of Division 26 and the drawings.
- E. Floor penetrations, conduits, and back-boxes shall be furnished and installed by the EC under other Division 26 sections and the drawings.
- F. Grounding bus bar in each telecommunications room and the data center/server room shall be furnished and installed by the EC under Division 26 and the drawings.

1.5 REVIEW OF CONTRACT DOCUMENTS

- A. The Contractor shall carefully study the Contract Documents and report to the consultant and project manager any error, inconsistency, or omission they may discover. If contractor performs any construction activity knowing it involves a recognized error, inconsistency, or omission in the Contract Documents without such notice to the consultant or project manager, the contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable cost for correction.
- B. The Contractor must verify all dimensions locating the work and its relation to any existing work, all existing conditions and their relation to the work, and all man-made obstructions and conditions, etc., affecting the completion and proper execution of the work as indicated by the Contract Documents.

1.6 EXAMINATION OF THE PREMISES

- A. The Contractor shall visit the site to familiarize themselves with the local conditions under which the work is to be performed and correlate observations with the requirements of the Contract Documents. No allowance will be made for claims of concealed conditions which contractor, in exercise of reasonable diligence in the observation of the site and the review of the local conditions under which the work is to be performed, has learned, or should have learned, unless otherwise specifically agreed by owner and consultant in writing.
- B. Before ordering any materials or performing any work, the contractor shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the drawings. Any discrepancies shall be submitted in writing to the Project Manager and Consultant for consideration before proceeding with the work.

1.7 RELATED SECTIONS

- A. All Division 27 Specification Sections in this Bid Package

- B. The applicable portions of the Governing Requirements (see “Part 1 - General: 1.08 Governing Requirements,” herein) shall be incorporated by reference into each related Specification Section.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.
- D. Division 08 – Openings.
- E. Division 26 – Electrical.
- F. Division 28 - Electronic Safety and Security.

1.8 COMMUNICATIONS CABLING SYSTEMS

- A. The following communications systems are included within this Division:
 - 1. Communications Cabling System: Includes (but is not limited to) copper and fiber cables, patch cables, stations and station connectors, termination blocks, splices and splice enclosures, protectors, patch panels, rack and distribution equipment, equipment required for the build-out of telecommunications rooms and spaces, and other incidental and miscellaneous product and labor as required.

1.9 INTENT AND INTERPRETATIONS

- A. It is the intent of the Construction Documents that the Contractor shall include all items necessary for the proper execution and completion of the Work by the Contractor, resulting in complete and fully operational system(s) ready for the Owner’s use, in full compliance with all applicable standards, codes, and ordinances.
 - 1. Work or product not specifically indicated in the Construction Documents, but which is necessary to result in complete and fully operational system(s) ready for the Owner’s use, shall be provided by the Contractor.
 - 2. The specification of certain products in the Construction Documents shall not be construed as a release from furnishing such additional products and materials necessary to furnish complete and fully operational system(s) ready for the Owner’s use.
- B. In the event that discrepancies exist or required items or details have been omitted in the Construction Documents, the Contractor shall notify the Engineer in writing a minimum (10) working days prior to the bid date. Failure to do so shall be construed as willingness to provide a complete and fully operational system within the amount bid by the Contractor. Where such discrepancies are not brought to the attention of the Engineer, the most stringent requirements shall be construed to be the basis for the Contractor’s bid.
- C. Prior to bidding the project, the Contractor shall visit the site to determine all existing conditions affecting the work, the type of construction to be used, and the nature and extent of work provided by other trades. Failure to do so shall be construed as willingness to provide complete and fully operational system(s) within the amount bid by the Contractor. Site visit to be coordinated with owner/general contractor.

- D. Cable tray and/or Basket Tray loading is the responsibility of the contractor. Contractor shall ensure that no cable tray is filled more than 50% of the total area of the tray. This shall be based upon the actual ability of the tray to "fit" cable, not its loading capacity in terms of weight the tray can support. In the event that discrepancies exist the contractor shall notify the Engineer as described above. Failure to do so shall be acknowledgement by the contractor that the cable tray in all areas will meet the 50% rule and any additions of cable tray that may be required during construction shall be at no additional cost to the owner or the project.
- E. Drawings and Specifications are complementary. Items required by either are binding as though both require them. In the event of conflict between the requirements of the Drawings and the Specifications:
1. With regards to the preparation of proposals and/or bids, the Contractor shall assume the more stringent (costly) condition shall prevail. The Contractor shall notify the Engineer of such discrepancy a minimum ten (10) working days prior to the bid date.
 2. With regards to actual construction, the Contractor shall notify the Engineer and await the Engineer's instruction prior to proceeding with procurement and installation.
 3. The drawings are diagrammatic unless detailed dimensions are included. Drawings show close approximate locations of equipment and devices. Exact locations are subject to the approval of Owner and Owner's representative.
 4. Anything mentioned in the specifications and not shown in the drawings, or shown in the drawings and not mentioned in the specifications, shall be of like effect as if shown and mentioned in both. In case of differences between the specifications and drawings, the stricter provision, as determined by the project coordinator, shall govern. Omissions from the drawings or specifications, or the incorrect description of details of work, which are evidently necessary to carry out the intent of the drawings and specifications, shall not relieve the contractor from performing such work.
- F. The Construction Documents include certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions include:
1. Abbreviated Language: Language used may be abbreviated. Implied words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpreted as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable and where the full context so dictates.
 2. Imperative and Streamlined Language: Imperative and streamlined language is used generally. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 3. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context.

4. Unless otherwise stated, words which have well known technical, or construction industry meanings are used in accordance with such recognized meanings.
5. The terms "directed," "required," "permitted," "ordered," "designated," or "prescribed," as well as similar words shall mean the direction, requirement, permission, order, designation, or prescription of the Engineer.
6. The terms "approved," "acceptable," "satisfactory," and similar words shall mean approved by, acceptable, or satisfactory to the Engineer.
7. The terms "necessary," "reasonable," "proper," "correct" and similar words shall mean necessary, reasonable, proper, or correct in the judgment of the Engineer.

1.10 ASSIGNMENT OF SPECIALISTS

- A. The individual Specification Sections may require that certain specific construction activities be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and such assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling the contract requirements shall remain with the Contractor.
- B. This requirement shall not be interpreted to conflict with the enforcement of local building codes and similar regulations governing the work.
- C. Drawings:
 1. Drawings are diagrammatic and approximate in character, are not intended to show all features of required work, and do not necessarily indicate every required component.
 2. Symbols used on the Drawings are defined in the legend on the Drawings. Symbols indicated on the legend may not necessarily be required.

1.11 DEFINITIONS

- A. The definitions below are applicable to the Division 27 specifications. These definitions expand upon and/or supplement the definitions specified in Division 01. In the event of discrepancies between these definitions and those defined in Division 01, the definitions in Division 01 shall take precedence.
- B. Accepted/Acceptable: Work or materials conforming with the intent of the project, and in general, conforming to the pertinent information in the Construction Documents.
- C. Approved/Approval: The written approval of the Engineer.
- D. Accessible: Easy access. Access attained without requiring extensive removal of other materials to gain access.
- E. Accessible Ceiling: Acoustical tile hanging ceilings ("Hard-lid" ceilings [concealed spine or sheetrock/gypsum ceilings], even when provided with access panels, are not considered an Accessible Ceiling.)
- F. Agreement: The contractual agreement between the Owner and the Contractor.

- G. As Called for: Materials, equipment including the execution specified/shown in the contract documents.
- H. Cable Contractor: Contractor furnishing and installing telecommunications, security, or other cable called out as part of the specifications and drawings. May also be referred to as TC (telecommunications contractor).
- I. Code Requirements: Follow minimum code requirements.
- J. Communications Infrastructure System: A Communications Cabling System (see Communications Systems, herein) combined with a Communications Raceway System (see Communications Systems, herein).
- K. Concealed: Hidden from sight in interstitial building spaces, chases, furred spaces, shafts, crawl spaces, etc.
- L. Construction Documents: Collective term for the entire set of bound or unbound material describing the construction and services required, including all Drawings, Specifications, addenda issued prior to execution of the contract, and modifications issued after execution of the Contract (such as change orders, construction change directives, supplemental instructions, etc.).
- M. Contract Documents: The Agreement (including other documents listed in the Agreement), Conditions of the Contract (General, Supplementary, and other conditions), and the Construction Documents.
- N. The Contract: The Contract Documents form the Contract. The Contract represents the entire and integrated agreement between the Owner and the Contractor and supersedes any prior negotiations, representations, or agreements, either written or oral. The Contract shall not be construed to create a contractual relationship of any kind (1) between the Engineer and the Contractor, (2) between the Owner and a Subcontractor, or (3) between any persons or entities other than the Owner and Contractor.
- O. Contractor: The party responsible for providing the system(s) as indicated herein.
- P. Drawings: The graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location, and dimensions of the Work, generally including (but not limited to) plans, elevations, sections, details, schedules and/or diagrams.
- Q. EC: Electrical Contractor.
- R. Engineer/Consultant: The party responsible for producing the communications system(s) Construction Documents.
- S. Equal/Equivalent: Equally acceptable as determined by Owner's Representative.
- T. Existing: Equipment, device, and material present in an installation location prior to new work.

- U. Exposed: Not concealed (see above) and not installed underground.
- V. Final Completion: The date when the Engineer confirms in writing that the Contractor has completed the work in accordance with the Construction Documents, including completion of all punch list items, cleanup work and delivery of all required guarantees, warranties, licenses, releases, and other required deliverables.
- W. Furnish: To purchase, supply, and deliver to the project materials in new and operable condition, ready for installation.
- X. Governing Requirements: Collective term for regulations, laws, ordinances, codes, rules, standards, requirements, and guidelines that govern the installation and inspection of the work defined in the Contract Documents. See "Part 1 – General, 1.8 Governing Requirements" herein.
- Y. Governing Authorities: Entities or their representatives charged with formation and/or enforcement of Governing Requirements, such as the Authority Having Jurisdiction (AHJ).
- Z. Install: To place in final position in fully operable, tested condition.
- AA. Inside Plant (ISP): Infrastructure within a building.
- BB. Or Equal: Materials approved for use by the Engineer, and which are dimensionally suitable and operationally identical to the specified item.
- CC. Owner: The Owner and the Owner's designated representative(s).
- DD. The Project: The total construction of which the Work performed under the Contract Documents may be the whole or a part, and which may include construction by the Owner and/or separate contractors.
- EE. Provide: To furnish and install, complete, tested and ready for intended use.
- FF. Substantial Completion: The date when all work required by the Construction
- GG. Documents shall be complete (subject to the final punch list to be prepared by the Engineer) and on which the applicable jurisdictional authorities have issued a temporary certification of occupancy.
- HH. Section: An individual section of the Specifications.
- II. Shown on Drawings: Noted, indicated, scheduled, detailed, or any other written reference made on the Drawings.
- JJ. Specifications: The portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work and performance of related services.

- KK. Specification Section(s): One or more sections of the Specifications. KK. Section(s): An abbreviated form of Specification Section(s).
- LL. Structured Cabling System (SCS): Alternative term for Communications Cabling System
- MM. The Work: The construction and services required by the Contract Documents, whether completed or partially completed, and all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.12 ABBREVIATIONS

- A. Refer to the individual Specification Sections and Drawings for abbreviations and their definitions.

1.13 GOVERNING REQUIREMENTS

- A. All work shall be executed in compliance with the latest version and applicable portions of the codes, regulations, standards, guidelines, and/or recommendations of the following (hereinafter referred to as Governing Requirements):

- B. General:

1. ACI: American Concrete Institute (www.aci-int.org)
2. AHJ: Authority Having Jurisdiction
3. ANSI: American National Standards Institute (www.ansi.org)
4. ASTM: American Society for Testing and Materials (www.astm.org)
5. BICSI: A Telecommunications Association (www.bicsi.org)
6. IBC: International Building Code
7. ICEA: Insulated Cable Engineers Association (www.icea.net)
8. IEEE: Institute of Electrical and Electronic Engineers (www.ieee.org, standards.ieee.org)
9. IES: Illuminating Engineering Society of North America (www.iesna.org)
10. FCC: Federal Communications Commission Rules and Regulations
11. NAB: National Association of Broadcasters
12. NFPA: National Fire Protection Association (www.nfpa.org)
13. NEC: National Electrical Code (NFPA Article 70) (www.nfpa.org, www.necdirect.org)
14. NESC: National Electrical Safety Code (<http://standards.ieee.org/nesc/>)
15. NEMA: National Electrical Manufacturers Association (www.nema.org)
16. OSHA: Occupational Safety and Health Administration (www.osha.gov)
17. RUS: Rural Utilities Service (<http://www.usda.gov/rus/>)
18. TIA/EIA: Telecommunications Industry Association/Electronics Industries Alliance (www.tiaonline.org, www.eia.org)
19. UBC: Uniform Building Code
20. UFC: Uniform Fire Code (www.nfpa.org)
21. UL: Underwriters Laboratories, Inc. (www.ul.com, ulstandardsinfontet.ul.com)
22. State and local codes, ordinances, and regulations
23. Requirements and guidelines of local utility companies
24. Applicable state, local and/or federal specifications

25. Manufacturer installation guidelines and recommendations
- C. Communications Specific:
1. ANSI/TIA-568-C: Commercial Building Telecommunications Cabling Standard
 2. ANSI/TIA-569-C: Commercial Building Standard for Telecommunications Pathways and Spaces
 3. ANSI/TIA-606-B: Administration Standard for Commercial Telecommunications Infrastructure
 4. ANSI/TIA-607-C: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 5. ANSI/TIA-758-B: Customer-owned Outside Plant Telecommunications Infrastructure Standard
 6. TIA-942: Telecommunications Infrastructure Standard for Data Centers
 7. TIA: Technical Service Bulletins (TSBs) (related to the above TIA standards)
 8. IEEE 802.3: Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit and 802.3ae 10 Gigabit Ethernet Standard
 9. IEEE 802.11: Wireless Local Area Network Standard, including the IEEE 802.11a, 802.11b, 802.11g, and 802.11n standards.
 10. BICSI: BICSI Customer Owned Outside Plant Design Manual
 11. BICSI: BICSI LAN and Internetworking Design Manual
 12. BICSI: BICSI Telecommunications Distribution Methods Manual
 13. BICSI: BICSI Telecommunications Cabling Installation Manual
 14. NEC: NFPA 70
 15. NFPA 75: Protection of Electronic Computer and Data Processing Equipment
 16. NFPA 78: Lightning Protection Code
 17. California Title 24
 18. FCC Part 68: Connection of Terminal Equipment to Telephone Network.
 19. FCC Part 76.611: CFR Title 47 Radiation Leakage Standards
- D. Work shall comply with the Governing Requirements in effect at the time of construction, including all addenda, errata, annexes, and technical service bulletins (TSBs), etc., except where a specific date or version is otherwise indicated, or where otherwise mandated by a Governing Authority.
- E. In the event of conflict between the Governing Requirements and/or conflict between the Governing Requirements and the Construction Documents:
1. With regards to the preparation of proposals and/or bids, the Contractor shall assume the more stringent (costly) condition shall prevail. The Contractor shall notify the Engineer of such discrepancy a minimum ten (10) working days prior to the bid date.
 2. With regards to actual construction, the Contractor shall notify the Engineer and await the Engineer's instruction prior to proceeding with procurement and/or installation.
- F. In the event of conflict between a code and a non-code Governing Requirement, or between a code and the Construction Documents, the code shall govern. However, compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the non-code Governing Requirement or Construction Documents which may be in excess of code requirements and not contrary to same.

- G. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.
- H. Errors or omissions in the Construction Documents do not relieve the Contractor from executing the work in accordance with the Governing Requirements.
- I. The Governing Requirements are incorporated by reference into these Specifications.

1.14 QUALITY ASSURANCE

- A. All equipment shall equal or exceed the minimum requirements of NEMA, ASME, ANSI, and Underwriters Laboratories.
- B. All material and equipment furnished shall be new, unused, and free from defects. Equipment shall be clean and free of damage and corrosion, and shall be of the best quality obtainable for the purpose intended.
- C. Where more than one of any specified item of equipment or material is required, such items shall be the product of one manufacturer throughout the facility.
- D. All materials used shall bear labels attesting to Underwriters Laboratory approval, provided a standard is established for the material in question.
- E. All materials shall conform strictly to the standards and specifications set forth in this document. Unless otherwise specified, all products furnished shall be designed, built, and installed in accordance with the latest and best practice of the electrical and telecommunications industry, and shall conform to the standards of the NEMA, ANSI, TIA/EIA, ICEA, IEEE, NEC, and this Specification wherever they apply.

1.15 CONTRACTOR QUALIFICATIONS

- A. The Cable Contractor shall have a full working knowledge of low voltage applications such as, but not limited to data, voice, wireless, video surveillance, access control and audio/visual systems. The contractor shall have the following qualifications:
- B. Possess those licenses/permits required to perform telecommunications and other low voltage installations in the specified jurisdiction.
- C. Have personnel trained and certified in the design and installation of the manufacturer's structured cabling system and equipment.
- D. The Cable Contractor shall provide proof of current certification in the design and installation of the manufacturer's structured cabling system and equipment.
- E. The Cable Contractor shall provide the resume of the project manager assigned to oversee the installation.

- F. The Cable Contractor shall have a minimum of five (5) years of experience and five (5) years in business in this specialized field and shall have completed a minimum of three
- G. (3) projects similar in scope and size to this project.
- H. Have personnel knowledgeable in local, state and national codes and the latest BICSI and Telecommunications Standards.
- I. Provide proof of insurance for liability and workmen's compensation for all personnel on the jobsite.
- J. Contractor personnel will be required to provide and use the proper tools in the performance of each activity. The tools must be in good working order. The Owner reserves the right to review the tool lists and tool maintenance procedures of the Contractor.
- K. Other contractor qualifications as described in Division 27 & 28.

1.16 SITE SAFETY AND ACCESS

- A. Determine from General Contractor all job site requirements such as site access, parking, and material storage areas.
- B. The Contractor working on the job site must follow all safety rules set by the General Contractor. All technicians must furnish their own safety equipment including but not limited to hard hats, safety glasses, proper footwear (confirm if steel toed boots/shoes are required), fall arrest equipment, gloves, and safety vests. All safety equipment must be in good working order.
- C. If required by General Contractor, attend all safety orientations and meetings.
- D. Provide to General Contractor an up to date MSDS binder listing materials planned for use on the job site that require MSDS information. Provide the number of copies requested.

1.17 PERMITS AND FEES

- A. The Contractor shall obtain and pay for all licenses, permits and inspections required by the laws, ordinances and rules governing work specified herein. Such fees shall be included in the bid amount.
- B. The Contractor shall schedule and coordinate all inspections of the work as required, and shall provide all assistance as required by the inspector(s) during their inspection(s).

1.18 SUBSTITUTIONS AND DEVIATIONS

- A. Substitutions and deviations shall be in accordance with the applicable portions of Division 1. The requirements below expand upon and/or supplement the requirements in Division 1. In the event of discrepancies between these requirements and those defined in Division 1, the requirements of Division 01 shall take precedence.

- B. Prior to award of contract:
 - 1. Bids shall be based on products and methods of construction as specified.
 - a. Substitution of product and deviations from the methods of constructions specified which are used in the Contractor's bid shall be at the sole risk of the Contractor, and as such are subject to rejection without consideration during submittal review, should the Contractor be awarded the contract.

- C. After award of contract:
 - 1. Proposed substitution and deviation requests shall be reviewed during the time of Submittal review.
 - 2. Conditions for Consideration: Substitution and deviation requests will be received and considered only when one or more of following conditions are satisfied:
 - a. The specified product or method of construction cannot be provided within the contract period.
 - b. The specified product or method of construction cannot receive necessary approval by a Governing Authority, and the requested substitution can be approved.
 - c. The specified product or method of construction cannot be provided in a manner that is compatible with other materials.
 - d. A substantial advantage is offered to the Owner, in terms of cost, time, or other considerations of merit.
 - e. The product as specified includes the statement "Or Equal."
 - 3. Conditions for Rejection: Substitution and deviation requests will be rejected for the following reasons, among others:
 - a. The conditions for consideration (see above) have not been met.
 - b. Extensive revisions to the Construction Documents are required to support the proposed changes.
 - c. The proposed changes do not comply with the general intent of the Construction Documents.
 - d. The substitution request is for product which does not include the statement, "Or Equal," or is specified as "no substitute," "substitutions are not acceptable," "provide as specified" or similar.
 - e. The proposed change is solely for the convenience or economic gain of the Contractor.

- D. Approval of substitution and deviation requests:
 - 1. The Contractor shall not proceed with a substitution or deviation without written approval.
 - a. The Contractor shall be responsible for fees incurred by the Engineer for any redesign resulting from the proposed changes, and for the updating of the Construction Documents to reflect such changes.

1.19 SUBMITTALS

- A. Submittals shall be in accordance with the applicable portions of Division 01 and 27. The requirements below expand upon and/or supplement the requirements in Division 01. In the event of discrepancies between these requirements and those defined in Division 01, the requirements of Division 01 shall take precedence.

- B. Submittals shall include product data literature and adequate descriptive literature, catalog cut sheets, and other data necessary for the Technology Designer and Architect/Engineer to ascertain that the proposed equipment and materials comply with the specification requirements.
- C. The Cable Contractor shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed Submittals from the Technology Designer and/or Architect/Engineer.
- D. Review of product data shall not relieve the Cable Contractor from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attention to such deviations at the time of submission and secured written approval.
- E. General:
 - 1. Submittal review is a courtesy extended to the Contractor for the limited purpose of checking for general conformance with the design concept and the information shown in the Construction Documents.
 - 2. The Contractor shall provide submittal information as soon as practicable after the date of Notice to Proceed, but no later than 60 days after contract award and prior to the purchase, delivery, fabrication, and installation of product.
 - 3. In the event of discrepancies or conflict between Submittals and the Construction Documents, either prior to or after review, the requirements of the Construction Documents shall prevail.
 - 4. Submission of material for review, regardless of the outcome of the review, does not alter the Contractor's obligation to follow the intent of the Construction Documents, nor the Contractor's responsibility to comply with the Construction Documents.
 - 5. Submittals will not be reviewed and will be returned to the Contractor without review for the following reasons:
 - a. Submittal package does not conform to the requirements listed herein.
 - b. Submittal is for a product or method of construction not required by the Construction Documents.
 - c. Submittal is partial or incomplete.
 - d. Submittal contains information concerning the proposed implementation of means, methods, procedures, sequences or techniques, temporary aspects of the construction process, or other items, which are the sole responsibility of the Contractor.
 - e. Submittal was not carefully reviewed by the Contractor prior to submission, as evidenced by poor organization, obvious or numerous errors, lack of correlation or cross-referencing, lack of clarity in presentation, or containing Shop Drawings which do not meet the standard of the Construction Drawings.
 - f. Submittal was submitted directly from the Contractor's subcontractor(s) or vendor(s).
 - g. Subcontractor and/or vendor submittal information was not carefully reviewed and/or approved by the Contractor.

- K. Submittal Sections: Submittals shall be sectionalized and shall include sections for Product Data, Shop Drawings, Technical Drawings, Samples, Substitution and Deviation Requests, and Other Information (see Submittal Format herein).
1. Product Data: Submit Product Data information as called for in the individual Specification Sections. Product Data shall include:
 - a. For product which is being provided as specified, do not provide product data. Instead, provide a list of all products to be provided as specified and state in writing that each product in the list is being provided as specified.
 - b. For all other product other than that specified, provide the following product information (as applicable):
 - 1) Specification Section to which the product applies.
 - 2) Catalog cut sheets, manufacturer data sheets, and/or specification sheets detailing the product, item, assembly, and installation.
 - 3) Manufacturer's printed recommendations (if not included in the above).
 - 4) Written description.
 - 5) Notation of dimensions verified by field measurement.
 - 6) Notation of coordination requirements.
 - 7) Compliance with recognized trade association and testing agency standards.
 - 8) Highlighted details within the product data that identifies compliance with the Construction Documents or the intent of the Construction Documents.
 - 9) Highlighted details within the product data that identifies deviations from the Construction Documents or the intent of the Construction Documents.
 - c. For products for which the Contractor is proposing a substitution, include the product as specified in the submittal per the above requirements and list the reference to the proposed substitution in the "Substitution and Deviation Requests" section of the submittal (see below).
 - d. Do not provide product quantities – quantities are the sole responsibility of the Contractor and will not be reviewed.
 2. Shop Drawings: Submit Shop Drawings as called for in the individual Specification Sections. Shop Drawings shall include:
 - a. Shop drawings shall contain design details, fabrication installation drawings, detailed drawings, schedules, diagrams, templates, and other drawings that show adaptation or installation of products. Shop Drawings shall include the following information:
 - 1) Specification Section(s) to which the Show Drawing applies.
 - 2) Dimensions.
 - 3) Identification of products and materials included.
 - 4) Compliance with specified standards.
 - 5) Notation of coordination requirements.
 - 6) Notation of dimensions established by field measurement.
 - 7) Notation of details that identify compliance with the Construction Documents or the intent of the Construction Documents.
 - 8) Notation of deviations from the Construction Documents or the intent of the Construction Documents.
 - 9) Indication of sectionalized manufacturing of equipment (i.e. for oversized equipment that cannot be installed as a single component).

- 10) Shop drawings shall be provided in form, format, and size identical to that of the Construction Drawings (the Construction Drawings set the standard). Shop Drawings that do not meet this standard shall be rejected without review.
 - 11) Title Block: May be the Contractor's Title Block, but shall indicate Project name, manufacturer's name and logo, date of submittal, content of sheet, and sheet number.
 - 12) Floor Plans: Plan titles, scales, north arrows, column lines, line types, fonts, and room names and numbers shall match that of the Construction Drawings.
 - 13) For methods of construction for which the Contractor is proposing a deviation, include the method of construction as specified per the above requirements and list the reference to the proposed deviation in the "Substitution and Deviation Requests" section of the submittal (see below).
3. Technical Drawings: Submit Technical Drawings as called for in the individual Specification Sections.
 4. Samples: Submit Samples as called for in the individual Specification Sections.
 - a. Samples shall be indexed in this section and provided as an attachment to the Submittal.
 5. Substitution and Deviation Requests: For each substitution and/or deviation request, include the following:
 - a. Whether the request is for substitution of product or deviation from a construction method.
 - 1) The Specification Section(s) or Drawing to which the request applies.
 - 2) Reason for the request (Note: the reason must conform to the requirements of "Part 1 – General, Substitutions and Deviations" herein)
 - b. If a substitution, provide:
 - 1) Specified product to which the proposed substitution applies.
 - 2) Product data for the substituted product.
 - 3) Notation of differences between the proposed substitution and the specified item.
 - c. If a deviation, provide:
 - 1) Specified method of construction to which the proposed deviation applies.
 - 2) Shop Drawing data for the deviation.
 - 3) Notation of differences between the proposed deviation and the specified construction method.
 - d. Written statement signed by the Contractor stating that the proposed substitution or deviation is equivalent or superior in function, appearance, and quality to the specified product or construction method and that the proposed substitution or deviation will be at no additional cost to the Owner.
 6. Other Information:
 - a. Contractor Statement of Qualifications.
 - b. Submit Other Information as called for in the individual Specification Sections.

L. Submittal Review:

1. The submittal review will not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of work with other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor.
 2. Corrections or comments made on the Submittal by the reviewer during the submittal review do not relieve the Contractor from compliance with the requirements of the Construction Documents.
 3. Review of a specific item shall not indicate that the reviewer has reviewed the entire assembly of which the item is a component.
 4. Review does not relieve the Contractor from responsibility for errors, which may exist in the submitted data.
 5. Review of substitutions and deviations:
 - a. The reviewer shall not be responsible for review of substitutions and/or deviations that were not brought to the attention of the reviewer by specific inclusion of the substitution and/or deviation in the Substitution and Deviation Requests section of the Submittal.
 - b. Where a substitution and/or deviation is not included in the Substitution and Deviation Requests section of the Submittal, the procurement and installation of the substitution and/or deviation is at the sole risk of the Contractor.
 - c. If the Reviewer does not specifically note substitutions and/or deviations, it remains the Contractor's responsibility to comply with the Construction Documents.
- M. After review, submittals shall be returned together with review comments and specific actions (if required) to be taken by the Contractor. Typical comments and actions will be:
1. No Exceptions Taken
 2. Revise and Resubmit - Re-Submittal Required
 3. Make Corrections Noted - Re-submittal not Required
 4. Submit Specified Items
 5. Rejected
 6. Submittal Not Required & Not Reviewed
- N. The Contractor shall perform no portion of the Work requiring a submittal until the respective submittal has been approved by the Architect/Engineer/General Contractor. Such Work shall be in accordance with the approved submittal.
- O. Re-submission of submittals:
1. Submittals shall continue to be re-submitted and reviewed until all submitted items are marked by the Engineer as "No Exceptions Taken" or "Make Corrections Noted (Re-submittal Not Required)."
 2. Re-submittals shall be clearly identified as a re-submittal and shall identify changes on a separate Revisions page inserted after the Table of Contents page(s).
 3. The Contractor shall be responsible for fees incurred by the Engineer resulting from subsequent review of re-submittals that fail to meet the requirements herein. Such fees will be incurred after the Engineer has reviewed the original submission and one re-submission.

1.20 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in full compliance with the manufacturer's recommendations and/or instructions, using means and methods that will prevent damage, deterioration, and loss (including theft).
- B. The Contractor shall protect product until final acceptance.
- C. Protection of product is the sole responsibility of the Contractor. The Contractor shall be responsible for replacing damaged, deteriorated, or lost product at no additional cost to the Owner.
- D. Products subject to damage by the elements shall be stored above ground, under cover, in a weather tight enclosure, with ventilation adequate to prevent condensation. Temperature and humidity shall be maintained within the manufacturer's recommendations.
- E. The Contractor shall make provisions for receiving and storing product, including Owner furnished product to be installed by the Contractor as part of the work.
- F. Product shall be carefully inspected for damage upon delivery. Defective or damaged product shall be marked "Rejected," removed from the site, and shall not be installed.
- G. The Contractor shall arrange product deliveries in accordance with the construction schedule. Deliveries shall be scheduled to maintain the progress of work, to avoid conflict with the work of other Trades, and to accommodate site conditions.
- H. Product shall be delivered to the site in the manufacturer's original containers, complete with labels and instructions for the proper handling, storage, unpacking, protection and installation.
- I. The Contractor shall ensure that product to be installed is not temporarily used as steps, ladders, platforms, scaffolds, or for storage by the Contractor or by other Trades during the construction process. Equipment found used in such a manner will be considered "damaged," shall not be installed, and shall be replaced at no additional cost to the Owner.

1.21 COORDINATION

- A. The Contractor shall contact the Engineering PLUS project manager once project is awarded and prior to construction to discuss project approach, schedule, and coordination.
- B. The Contractor shall thoroughly examine the Construction Documents, including Drawings and specification Sections of other Divisions, for construction details and methods that are dependent upon or will affect the work of other trades. The Contractor is responsible for identifying coordination issues and dependencies, and for preparing Shop Drawings, work plans and schedules to accommodate and/or mitigate coordination issues and dependencies before they arise.

1. Changes necessitated by the failure of the Contractor to coordinate with the work of other trades shall be at no additional cost to the Owner or project.
- C. The Contractor shall confer and cooperate with the other trades, throughout the entire construction process, in order to coordinate the work in the proper sequence. Typical coordination issues include but are not limited to:
1. Electrical work, including electrical receptacles, power panels, transformers, telecommunications grounding system, and the installation of raceway, device boxes, conduits, and sleeves for the Communications Cabling System.
 2. Location of cabinets, counters, and doors so that communications outlets, other system outlets and equipment are clear from and in proper relation to these items.
 3. Mechanical work, including HVAC systems and ductwork, piping, and mechanical chases.
 4. Ceiling cavity spaces.
 5. Installation of acoustical ceiling tiles and similar finishes that may conceal the work.
 6. Build-in of oversized equipment during structure construction.
 7. Required separation distances.
 8. Access routes for equipment through the construction
 9. Cutting/coring of floor, ceiling, or wall structures.
- D. Digital format copies of bid drawings will be furnished to the successful bidder. Augment bid documents with additional information to ensure coordination between trades. Provide digital format communications systems drawings showing all ceiling devices, raceways and cable tray locations and routing to mechanical contractor to be used for coordination drawings provided by mechanical contractor. Include dimensions and elevations of devices, raceway, and cable tray.
- E. The Contractor shall coordinate communications service installations with the Owner, Owner Vendors and with the Service Provider(s) as required.
- F. Existing communications service outages shall be coordinated and scheduled in advance with the Owner at a time and duration acceptable to the Owner. Outages scheduled at times other than the normal working hours shall not entitle the Contractor to additional compensation beyond the original amount bid. Outages without advance notice and prior approval by the Owner are not acceptable.
- G. The Contractor shall review the Drawings and Specifications of other Divisions for locations of devices and equipment requiring communications connectivity not specified in this Division or shown on the Communications Drawings. The Contractor shall coordinate the locations of these items with the other trades, and shall verify locations with the Engineer and Owner prior to rough-in.
- H. Verify that the physical dimensions of each item of equipment fit the available space, promptly notify the Engineer of any potential conflicts, and await the Engineer's direction prior to purchase and rough-in of the equipment.
- I. Coordinate locations of devices, outlets, etc. with field conditions, unless such locations are specifically dimensioned or otherwise noted in the Construction Documents. If so noted, verify location with other affected trades and against existing field conditions,

promptly notify the Engineer of any potential conflicts, and await the Engineer's direction prior to purchase and rough-in of the equipment.

- J. Consult the architectural drawings for the exact height and location of all communications and nurse call equipment not specified herein or shown on the drawings. Make any minor changes (less than 6" horizontal) in the location of the raceways, outlets, boxes, devices, cabling, etc., from those shown on the drawings without extra charge, where coordination requires or if so directed by the Architect before rough-in.
- K. Coordinate locations for chases, slots, sleeves, and openings in the building structure. For new concrete coordinate, locate and provide chases, slots, sleeves, and openings prior to the pouring of the concrete.

1.22 RECORD DOCUMENTS

- A. The Contractor shall maintain a set of Record Documents showing all additions, changes, and deletions that have been made to the original Drawings and Specifications throughout the course of construction, as well as reviewed Submittal data.
 - 1. Items to be noted shall include but shall not be limited to:
 - a. Routing of concealed raceways/pathways;
 - b. Raceways/pathways located more than 2 feet from where shown on the original Contract Documents;
 - c. Raceways and main pathways (pathways with more than 30 cables) not shown on the Contract Documents;
 - d. Concealed equipment;
 - e. Stub-outs; actual equipment locations, sizes and dimensions;
 - f. Building outline changes;
 - g. Addenda, accepted Alternates, Change Orders, other document revisions which occurred after the award of the Contract and/or the start of construction activities;
 - h. System component labels and identifiers for all major components.
 - i. Telecom Room detail sheets
 - 2. Notations shall be handwritten in a neat and legible manner and shall be noted as follows:
 - a. Red – for additions and changes
 - b. Green – for deletions
 - c. Blue – for notes
- B. Record Documents shall:
 - 1. Be kept current (i.e. no more than one week behind actual construction) throughout the course of construction.
 - 2. Be retained at the job site until Final Acceptance.
 - 3. Be made readily available at all times to the Owner's representative.
 - 4. Not be the Contractor's working documents.
 - 5. Be protected from deterioration and loss in a secure, fire-resistive location.
 - 6. Be made readily available to the Engineer for review of completeness and accuracy throughout the course of construction.
 - 7. At project closeout, be updated with the items on the Known Exceptions/Deviations List per the requirements of subsection "3.22 Project Close-Out" herein. Include only those items marked "Approved" by the Engineer.

- C. Submission: The Record Drawings shall be submitted to the Engineer as part of the Operating and Maintenance Manual (see subsection "1.23 Operating and Maintenance Manual" herein).
 - 1. Handwritten notations on the Record Drawings shall be REVIT drafted by the Contractor onto a final, fresh set of Construction Drawings prior to submission. Record Drawings shall be provided in form, format, size, and REVIT version identical to that of the Construction Drawings (the Construction Drawings set the standard). Record Drawings that do not meet this standard shall be rejected without review.
 - 2. The Record Drawings shall be reviewed by the Contractor for accuracy and completeness prior to submission.

1.23 OPERATING AND MAINTENANCE (O&M) MANUALS

A. General:

- 1. O&M Manuals shall be submitted in accordance with the applicable portions of Division 1.
- 2. O&M Manuals shall be submitted as a single package and shall include subcontractor and vendor O&M information.
- 3. Catalog pages and data included in O&M Manuals shall be originals. Where not possible to obtain original copies in sufficient quantity, catalog pages and data shall be neat, clean copies of the originals.
- 4. O&M Manual Requirements: O&M Manuals shall include Product Data, Service, Spare Parts, Tests/Measurements/Calibration Settings, Record Drawings, Warranty information, and Other Information as required.
- 5. Product Data: Include the product data provided in the Submittal reflecting product as supplied and installed, as well as additional information such as installation, operation, and routine maintenance information.
- 6. Service: Assemble service information (cleaning, adjustments, frequency, etc.) for each device requiring service. For devices requiring qualified service, compile an index of qualified service providers (and their contact information) able to service these devices.
- 7. Tests: Assemble all test documentation made for each system and/or device requiring testing.
- 8. Record Drawings: Provide Record Drawings per the requirements of – subsection "V" herein.
- 9. Warranty: Provide warranty documentation per the requirements of the individual Specification Sections.
- 10. O&M Manual contents shall also be submitted in soft/electronic copy on compact disc.

B. O&M Manual format:

- 1. O&M Manuals shall be bound in one letter-sized (8-1/2 x 11 inch) hard cover (hard back or loose leaf) binder.
- 2. Front cover of the O&M Manual shall indicate the name of the project, the project number, the name of the Owner, year of completion, the title "Communications O&M Manual," and the names of the Engineer and Contractor, as well as the General Contractor.
- 3. Side cover of the O&M Manual shall indicate the name of the project, the project number, the name of the Owner, and the title "Telecommunications O&M Manual."

4. O&M Manual shall include the following sections, indexed (with tab dividers) accordingly.
 - a. Product Data
 - b. Service
 - c. Spare Parts
 - d. Tests
 - e. Calibration/Configuration Settings
 - f. Record Drawings
 - g. Final Punch list
 - h. Certificates of Inspection
 - i. Warranty
- C. Contractor's Warranty Certificate
 1. Manufacturer's Warranty Certificate (as applicable)
- D. Other Information (as applicable)
 1. O&M Manuals shall include tab dividers, titled (not numbered) for each section. Tab dividers shall not be handwritten.
 2. O&M Manuals shall include a table of contents identifying sections and page numbers.
 3. Pages within each section shall be numbered.
 4. Drawings (excluding full size Record Drawings) shall be bound and accordion folded to 8-1/2 x 11-inch size.
- E. O&M Manual submission:
 1. The Contractor shall submit one draft copy of the O&M Manual for review and approval by the Engineer.
 - a. The submission will be reviewed for accuracy, completeness, and compliance to the requirements herein. A submission which fails to meet these requirements will be rejected and returned to the Contractor together with review comments and specific actions to be taken by the Contractor. The Contractor shall revise the O&M Manual and re-submit for review and approval.
 - b. The O&M Manual shall continue to be re-submitted and reviewed until such time as the O&M Manual is approved by the Engineer.
 - c. The Contractor shall be responsible for fees incurred by the Engineer resulting from subsequent review of O&M Manuals that fail to meet the requirements herein. Such fees will be incurred after the Engineer has reviewed the original submission and one re-submission.
- F. Upon approval of the draft copy, the Contractor shall submit final copies in quantities per the requirements of Division 01.
- G. Final payment to the Contractor will not be authorized until the final copies of the O&M Manuals (including Record Documents) have been received and approved by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide materials that meet the following minimum requirements:
1. Cabling and components shall be by the manufacturer specified or an approved equal unless no substitutions are allowed. Where no manufacturer is specified, components shall meet or exceed the performance specifications given.
 2. Electrical equipment and systems shall meet UL standards and requirements of the NEC. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.
 3. Equipment shall meet all applicable FCC regulations.
 4. All materials, unless otherwise specified, shall be new, unused and the standard products of the manufacturer. Used equipment or damaged material will be rejected.
 5. The listing of a manufacturer as "acceptable" does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the Specifications and meet the quality of the design make.
 6. Where applicable, all materials and equipment shall bear the label and listing of Underwriters Laboratory. Application and installation of all equipment and materials shall be in accordance with such labeling and listing
 7. The Contractor is responsible for providing all incidental and/or miscellaneous tools, scaffolding, consumable items, testing equipment appliances, and other hardware not explicitly specified or shown on the Drawings required for the installation of a complete and operable telecommunications infrastructure system ready for the Owner's use.
- B. Products shall be:
1. New (except as otherwise indicated) and free from defects.
 2. Standard products of manufacturers regularly engaged in the production of such products.
 3. Of the manufacturer's latest standard design.
 4. Designed to ensure satisfactory operation and life in the environmental conditions that prevail in their installation location.
- C. Where systems are indicated, provide component products manufactured by a single system manufacturer.
- D. Prior to ordering and delivery of equipment, the Contractor shall:
1. Verify that the equipment shall adequately pass through building openings and passageways with unobstructed access to the final equipment location. When building openings and passageways will not permit the equipment to pass through unobstructed, equipment shall be manufactured and shipped in sections for final assembly at the equipment location. Submittals shall indicate sectionalized manufacturing of equipment.
 2. Verify that the equipment shall properly fit the space allocated, that required clearances could be maintained, and that the equipment can be located without interference from other systems, structural elements, or the work of other trades.

2.2 WORKMANSHIP, SUBSTITUTIONS, AND WARRANTY

- A. Materials and workmanship shall meet or exceed industry standards and be fully eligible for the maximum guarantee offered by the manufacturer. All components, material, and workmanship not covered by the manufacturer's system warranty shall be guaranteed for two years after the date of final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested, and guaranteed as free from defects, transpositions, opens, shorts, kinks, damaged jacket insulation, or similar conditions that may compromise system performance.
- B. All labor must be thoroughly competent and skilled, and all work shall be executed in strict accordance with the best practice of the trades.
- C. Cable Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, appliances, improper installation, or poor workmanship.
- D. Approval of alternate or substitute equipment or material in no way voids Contract document requirements.
- E. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Cable Contractor submit to the Owner all evidence to support his contention that the item proposed for substitution is equal to the contract specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.
- F. The Contractor is to be certified by the manufacturer to install the cabling system and to furnish to the Owner a system warranty that has a minimum period of 25 years. Such warranty will cover all cable and components installed as part of the manufacturer's cabling system and shall include a performance warranty that guarantees the horizontal and backbone cabling system will support the performance specifications as stated in ANSI/TIA/EIA 568-B. Copper links shall be warranted to the link performance minimum expected results defined in ANSI/TIA/EIA-568-B.2-1. Fiber- optic links shall be warranted to the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-B.1.
- G. The Contractor at the time of Bid is not required to be certified.
- H. The Cable Contractor shall provide a certified warranty for both parts and labor for a minimum period of 25 years upon final acceptance of the system by Owner. The Contractor shall provide a copy of the warranty certificate to the Architect/Engineer and Owner for review.

PART 3 - EXECUTION

3.1 STRUCTURED CABLING

- A. All material and equipment shall be installed in a neat and workmanlike manner.

- B. All material and equipment shall be installed per manufacturer's specifications, using methods and tools approved by the manufacturer.
- C. All material and equipment shall be installed per the drawings.
- D. The installation shall be in compliance with the requirements of the OSHPD, NEC, OSHA and the rules, regulations, and requirements of the FCC.
- E. The installation shall be in compliance with federal, state, county and city laws, regulations, ordinances, and codes applicable to the installation.
- F. The locations of floor boxes, stub-ups, outlets, panels, equipment racks and other related equipment as indicated on the drawings are approximate and are understood to be subject to such revision as may be found necessary at the time of installation. The Contractor should have exact and definite locations accepted by the Owner before proceeding with the installation.
- G. For telecommunications outlets in wall mounted applications, the Electrical Contractor shall furnish and install electrical backboxes with a single-gang mud ring reducer for flush mounting single gang faceplates in the wall space along with conduit from the gang box to wire ways located in accessible spaces. See backbox and conduit schedule in Drawings for sizing requirements.
- H. For telecommunications outlets in floor mounted applications, the Electrical Contractor shall furnish and install floor boxes within the floors and any floor duct or conduits necessary to convey cable to wire ways in accessible spaces.
- I. The Contractor shall furnish and install wire pathways to fully support all installed cable. Pathways may consist of J-hooks rated for Category 6/6A cable, basket tray or ladder rack as called out in the drawings and/or specifications. The Contractor shall coordinate wire raceway installation with other trades so as not to impede their work.
- J. The Contractor shall furnish and install ladder rack and wire raceways within the TDR(s) and TEC. The ladder rack and wire raceways shall include all accessories for a complete routing system.
- K. The Contractor shall furnish and install equipment racks, frames or cabinets as called out in the drawings and/or specifications.
- L. Provide all cable hangers, horizontal and vertical wire managers, cross-connect managers, and other cable management hardware for a neat and orderly installation.
- M. Horizontal cabling shall not be spliced and must be continuous from the cross-connect to the workstation outlets.
- N. All copper backbone cabling shall not be spliced but must be continuous from termination point to termination point.

- O. All fiber optic backbone cables shall be plenum rated armored terminated with LC connectors unless otherwise specified.
- P. The proximity of horizontal and backbone cabling to electrical facilities that generate high levels of electromagnetic interference (EMI) shall be taken into account. These facilities include, but are not limited to copiers, motors, transformers, and fluorescent lighting. TIA/EIA 569-C standards shall provide separation requirements.
- Q. All horizontal cables shall be terminated according to the T568-B wiring scheme unless otherwise specified.

3.2 CONDUITS

- A. Conduit shall be of the appropriate type required by code and as required by Electrical Division 26.
- B. Adequate access shall be available where cables enter conduits
- C. Bond and ground all metallic conduits and boxes in accordance with national or local requirements and with TIA-607 – “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
- D. Install conduits in the most direct route possible, running parallel to building lines
- E. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
- F. Flexible conduits may only be used where specifically allowed by these contract documents.
 - 1. Flexible conduit sections shall be less than 20 feet (6.1 m) in length.
- G. No continuous section of a conduit may exceed 100 feet (30.5 m) without a pullbox.
- H. For structured cabling, no more than (2) 90° bends, or equivalent will be allowed between pullboxes.
- I. The minimum bend radius for conduits is
 - 1. (6) times the inside diameter for 2 inches (50.8 mm) conduits or less.
 - 2. (10) times the inside diameter for conduits greater than 2 inches (50.8 mm).
- J. Any single conduit run may not serve more than (1) outlet location unless expressly indicated on the drawings.
- K. Where building entrance conduits (for service provider and owner’s WAN cabling) do not enter the building directly into the Communications Entrance Room/Facility, extend those entrance conduits via RMC or IMC into the Communications Entrance Room/Facility.
 - 1. Coordinate with Contractor for Division 27 Sections “Communications Backbone Cabling” and “Communications Horizontal Cabling” for potential other pathways where IMC/RMC are required.

- L. Conduits shall contain no electrical condulets (also known as LBs).
 - 1. Exception: Pre-approved (by the Design Consultant) condulets specifically manufactured for communications cabling and will maintain minimum bend radius for cabling to be installed. These locations are to be called out on the shop drawings.

- M. Underground Conduit Requirements
 - 1. For Structured Cabling System horizontal cabling and pathways within the footprint of the building and serving voice and data outlets exterior to the building, such as emergency phones/towers, security cameras and wireless access points attached to exterior light poles, etc
 - 2. Requirements
 - a. Refer to applicable details on drawings for illustrative requirements.
 - b. Wherever practical, slab-on-grade floorboxes shall have conduit extended underground or in-slab from box to serving communications room or equipment cabinet.
 - 1) Only one horizontal bend is allowed, 90 degrees or less.
 - 2) Indicate proposed routing and stub-up locations on shop drawings.
 - c. Route all underground conduit so there is no more than (3) 90 degree bends, including stub-up bend at communications room/equipment cabinet.
 - 1) For underground conduit serving outlets/boxes outside the footprint of the building that require more than (3) 90 degree bends, provide appropriately-sized handhole(s). Coordinate location with Architect and Owner, indicate proposed location(s) on shop drawings, and include product information in pre-construction submittals. In general, handholes are not to be located in roadways, parking lots, sidewalks, or any location that may be subject to vehicular traffic.
 - d. Approved conduit types:
 - 1) When routed in slab-on-grade:
 - a) Horizontal conduit shall be RMC or Schedule 40 PVC, including horizontal bends. If PVC is installed, also install tracer wire.
 - b) Vertical bends shall be RMC.
 - 2) When routed below slab-on-grade or outside the footprint of the building:
 - a) Horizontal conduit shall be RMC or Schedule 40 PVC a minimum of 12" below grade. If PVC is installed, also install tracer wire.
 - b) All vertical and horizontal bends shall be RMC.

- N. Install approved expansion/deflection fittings where raceways pass through or over building expansion joints.

- O. Route raceway through roof openings for piping and ductwork or through roof seals approved by the Architect, the roofing contractor, or both. Obtain approval for all roof penetrations and seal types from the Architect, Owner, roofing contractor, or all three as required to maintain new or existing roofing warranties.

3.3 OUTLET BOXES

- A. No outlet boxes shall be located back-to-back in a wall cavity.
 - 1. Where possible offset to next stud cavity, with a minimum of 6 inch separation.

- B. Outlet boxes shall be within 3 feet (0.9 m) of nearest electrical outlet.
- C. Outlet boxes located in fire-rated walls are to have the appropriate firestopping for backboxes. These locations are to be identified on shop drawings.
- D. Where cabling enters a backbox directly (not via conduit), provide black rubber grommet on knockout.

3.4 PULL BOXES

- A. Pullboxes shall be placed in Conveniently Accessible locations.
- B. Coordinate the location and installation of all pullboxes to ensure adequate access is provided.
- C. Pullboxes above an accessible ceiling shall:
 - 1. Be aligned directly over the ceiling grid to allow access
 - 2. Be installed with a minimum of 3 inches (76.2 mm) clearance to ceiling grid and tiles
- D. No directional changes shall be allowed in pullboxes. Conduit shall continue in the same direction as it enters and then change direction via an appropriately sized bend in the conduit.
- E. Size pullboxes according to the following chart (all sizes are minimums):

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit (of same size)
1" or smaller	4"	4"	2-1/8"	Not applicable
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	27"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	8"

3.5 CABLE TRAY

- A. Cable trays shall be installed in accordance with the applicable electrical code and standards.
- B. The inside of the cable support system shall be free of burrs, sharp edges or projections that can damage cable insulation. Abrasive supports (e.g., threaded rod) installed within the cable fill area shall have that portion within the tray rigidly protected with a smooth, non-scratching covering so that cable can be pulled without physical damage such as appropriately rated (plenum) plastic tubing.

- C. Cables shall remain unattached to its pathway and shall simply lay at rest on the supports provided by its pathway. Wire ties, velcro straps, electrical tape or other methods shall not be used to attach cables to cable supports; UON.
- D. Installation of cables shall not exceed the fill requirements stated above.
- E. Cable trays shall not extend through fire-rated walls and walls for noise critical spaces.
- F. Cable trays shall not extend over 6' lengths (or greater) of inaccessible ceilings. Stop cable trays just before the inaccessible ceiling and provide overhead conduits of quantity and size bridging the two sections of cable tray so that conduit cable capacity (square inches per fill ratio) is equal to that of the cable tray.
 - 1. The cable fill ratio for cable tray shall be 50%.
 - 2. The cable fill ratio for conduits shall be 40%.
 - 3. Example: a 4" x 12" cable tray has 48 square inches of total capacity, and 24 square inches of cable capacity. Per the NEC, a 4" trade size EMT conduit has a 40% cable capacity of 4.62 inches. 24 divided by 4.62, rounding up to the next whole number equals (6) 4" conduits shall be provided for a 4" x 12" cable tray.
- G. Cable trays and cable runways shall not be used as walkways or ladders.
- H. A minimum of 12 inches (300 mm) access headroom shall be provided and maintained above a cable tray system or cable runway.
- I. Care shall be taken to ensure that other building components (e.g., air conditioning ducts, pipes, conduits) do not restrict access.
- J. Basket cable trays shall be supported according to manufacturer's instruction via one of the following:
 - 1. Trapeze/Unistrut under the cable connected to the cable tray and to (2) 3/8" (or greater) rods to structure above.
 - a. Center-hung, single-rod supports are not allowed.
 - 2. Shelf or L-brackets attached to wood or metal studs.
- K. Test cable tray systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with maximum grounding resistance.

3.6 GROUNDING AND BONDING

- A. Grounding shall meet the requirements as noted in the Division 27 specifications and practices of applicable authorities and codes. In addition, telecommunications grounding and bonding shall conform to ANSI/TIA Standard 607-B.
- B. A telecommunications grounding bus bar (TGB) shall be installed by the electrical contractor in each telecommunications data/equipment room. The TGB shall be connected to the main building ground system.
- C. The Contractor shall ground all equipment racks, frames, cabinets, ladder rack and basket tray to room TGB using minimum #6 AWG wire with green sheath. Use bonding

jumpers between each section of ladder rack or basket tray and between ladder racks or basket trays and equipment racks, frames, and cabinets.

3.7 LABELING

- A. Cable labels shall provide a unique identification scheme that shall ease cable tracing. The Contractor shall coordinate with Owner to determine any Owner required labeling schemes prior to administering cable management techniques. If Owner does not furnish a cabling administration scheme, the Contractor shall submit intended labeling scheme to the Technology Designer, Architect/Engineer and Owner for approval.
- B. Labels shall be permanent, waterproof, and readable from one foot with permanent lettering and shall not be removable by normal cable handling or normal operations. As part of the final installation, no hand-written labels will be allowed. All labels shall be typed, or computer generated.
- C. Verify labeling for all cables, termination blocks, patch panels, and racks with Owner prior to installation.
- D. All cables shall be computer generated labeled at each end, for proper administration, additional cable labeling may be required on the cable at intermediate locations such as conduit ends and along cable tray and cable support runs.
- E. Labels are to be installed on:
 - 1. All firestopping systems. For wall and floor penetrations, label on both sides. See Firestopping later in this section.
 - 2. All pathways (e.g., conduit, innerduct, etc.) installed under this work
 - a. Label all conduit and innerduct with "TELECOM" or "AV" according to the intended system/use of the installed (or future) cabling. Conduit labels shall utilize text readable from a standing position on the finished floor. Conduit sleeves which pass through a single wall or floor need not be labeled.
 - 1) For wall stub-up locations, label overhead only.
 - 2) For conduits greater than 10', label both ends of conduit with far end location and Room/Number.
 - a) Example – "AV to AV Rack R01".
 - 3) For conduits that stub directly up or into a Communications Room, label both ends of conduit.
 - a) Example: underslab conduit from Telecom Room 1A to the Floor Box in Confence Room 101A shall be labeled as follows:
 - b) Conduit stub-up location in Telecom Room 1A – "Telecom to Conf. Rm 101A Floorbox"
 - c) Bottom of floorbox, immediately adjacent to serving Telecom conduit – "Telecom to Telecom Room 1A"
 - b. All pullboxes and junction boxes for Communications shall be labeled such as "TELECOM PULLBOX", "AV JUNCTION BOX", "TV", etc. on the cover, such that the text is of sufficient size to be readable from a standing position on the finished floor.
 - 1) Conduits entering and exiting all pullboxes and junction boxes shall be labeled with their destination/room number – ie "To AV Box Q:212:01 in Control Rm 212".

3. In general, the label is to be provided and installed by whomever installed the item that is being labeled.
4. Refer to individual Division 27 Communications sections and to the drawings for additional information on labeling requirements.

3.8 FIRESTOPPING

A. General

1. Provide fire-resistant materials of the type and composition necessary to restore fire ratings to all wall, floor, or ceiling penetrations, including membrane penetrations. All materials shall be classified or listed as a complete system by UL or an approved NRTL recognized by the Design Consultant and AHJ, and shall meet NEC Article 300.21, IBC, and all local codes.
 - a. Partial systems or components of systems are not permitted unless specifically identified in the Contract Documents.
 - b. Comply with Section 07 84 00 – Firestopping for additional material and performance requirements.
2. All penetrations through fire-rated floors, walls, or ceilings shall be sealed to prevent the passage of smoke, flame, toxic gas, or water through the penetration before, during, or after a fire.
 - a. The fire rating (F and T) of each penetration seal shall be equal to or greater than that of the assembly penetrated, maintaining the original rating of the barrier.
 - b. Assume all floors are fire-rated unless noted otherwise.
 - c. Install firestops at all additional locations indicated on the Drawings or required by code.
3. Firestop Testing Standards:
 - a. Through-penetrations – ASTM E814 / UL 1479
 - b. Joints and heads-of-wall – ASTM E1966 / UL 2079
 - c. Floor-to-floor or wet conditions – W-rating where applicable
4. Provide labeling on both sides of each fire-rated assembly at all firestop locations including:
 - a. Manufacturer name
 - b. Installer and company name
 - c. Date installed
 - d. UL or NRTL system number with all relevant ratings indicated
5. In each Telecommunications Room (MDF/IDF), apply a 2-inch block-letter stencil label on the inside face of each fire-rated barrier identifying the wall or floor rating.
6. Provide firestop systems as identified on the Drawings and specified herein. At locations where cabling passes through fire-rated barriers, provide fire-rated pathway devices sized for all installed cables plus 25 percent spare capacity for future growth.
7. All firestopping work shall be performed by personnel certified by the manufacturer of the firestopping product being installed (e.g., Hilti, 3M, STI).
8. Where cable, conduit, or tray is removed, restore all openings to their original fire-resistance rating using the same type of listed system originally installed.
9. Submittals: Provide a Firestop System Schedule including for each condition:
 - a. Assembly type and fire rating
 - b. UL or NRTL system number
 - c. Product manufacturer and model

d. Installer certification documentation

B. Penetration Sealant – Conduits

1. Provide a listed firestop system to seal openings around conduits or sleeves passing through fire-rated walls, floors, or partitions in accordance with the tested system listing and manufacturer's instructions.
2. Sealant shall remain resilient and re-enterable to permit removal or addition of cables without drilling new openings. It shall adhere to itself for repair, and accommodate normal vibration, expansion, or contraction without cracking or loss of seal.
3. No flammable material may be used to line the chase or opening in which the firestop is installed.
4. Firestop sealants shall be tested and rated in accordance with ASTM E814 / UL 1479 and meet or exceed the fire-exposure and hose-stream endurance requirements for the assembly type.

C. Penetration Sealant – Voids, Cavities, and Openings

1. Install firestop materials in framed openings through fire-rated partitions in accordance with the Architect's Drawings, the tested system listing, and manufacturer's instructions.
2. Firestop all voids, cavities, and abandoned openings left by removal of cabling, conduit, sleeves, or trays associated with the communications systems.
3. Install systems per manufacturer's instructions, the UL or NRTL system listing, and all applicable codes.

D. Fire-Rated Pathway Device

1. Provide UL-classified fire-rated pathway devices (e.g., EZ-Path, Hilti Speed Sleeve) wherever cables are required to pass through fire-rated walls, floors, or partitions.
2. Install devices at all locations indicated on the Drawings or where required by field routing; devices may be arranged individually or in ganged configurations as approved.
3. Install devices in strict accordance with the manufacturer's published instructions and approved shop drawings.
4. Apply all required factory-supplied gasketing materials prior to wall plate installation.
5. Secure wall plates and accessories per manufacturer's recommendations to ensure the rated seal is maintained.

3.9 TESTING

- A. The Contractor shall test 100% of all cables installed. Telecommunications cables shall meet or exceed the ANSI/TIA-568-C specifications for the category of cable installed. All test reports shall be printed and included in the final record documentation package.

3.10 UTP COPPER CABLING

- A. The Cable Contractor shall be responsible for recording all test data and per the specifications.

- B. Copies of all test results are to be submitted to the Owner or authorized representative for review as part of the final record documentation package and remain with the Owner for their records.
- C. Category 6/ 6A cabling systems shall be performance verified using an automated test set. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved. The test shall be a permanent link test and test for the following performance parameters:
 - 1. Wire Map
 - 2. Length
 - 3. Insertion Loss
 - 4. Pair-to-Pair Near End Crosstalk (NEXT)
 - 5. Power Sum Near End Crosstalk (PSNEXT)
 - 6. Equal Level Far End Crosstalk (ELFEXT)
 - 7. Power Sum Equal Level Far End Crosstalk (PSEFFEXT)
 - 8. Return Loss (RL)
 - 9. Propagation Delay
 - 10. Delay Skew

3.11 FIBER OPTIC BACKBONE CABLING

- A. Follow procedures described in TIA/EIA TSB-140 for Tier 1 tests when testing intra-building fiber optic backbone cables. Multimode links are to be tested at 850 nm and 1300 nm in accordance with ANSI/TIA/EIA-526-14-A, Method B, One Reference Jumper. Single-mode links are to be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper. Test fibers in one direction unless otherwise directed.
- B. Test for system attenuation using a power meter and light source set to the same wavelength. Power meter must be calibrated and traceable to the National Institute for Standards and Technologies (NIST).
- C. Test jumpers must be of the same optical fiber core size as the cabling system (e.g. test 50/125µm systems using 50/125 µm jumpers).
- D. Test 100% of installed fiber. Provide printed test reports for inclusion in final record documentation package. Test reports will show measured loss for each fiber in dB and length of each fiber in feet.
- E. End to end testing is considered to be from the equipment end through the cross-connect to the terminal end.
- F. TSB 140 Tier 2 to include OTDR testing.

3.12 OTHER CABLES

- A. Other cables include:

1. Security and Access control cables.
2. Video surveillance UTP cables.
3. Camera power and control cables other than UTP.
4. Intercom and paging cables.
5. Coaxial cables.
6. Audio and Visual cables.
7. Elapsed Timer cables.
8. Other systems defined on drawing and specs.
9. Test all cables for continuity.
10. Test cables per manufacture specifications.
11. Test cables per Division 27 specifications

3.13 IDENTIFICATION

- A. All contractor personnel shall be clearly identified by uniform and/or company badge with photo ID, employee's name, and company name. Contractor vehicles shall be equipped with signs on both sides of vehicle identifying the Contractor's company name.
- B. All Owner provided Contractor IDs shall be returned at or before project closeout.
- C. Completed work shall present a neat and professionally installed appearance. The appearance of the work shall be of equal importance to its operation. Failure to present a neat and professionally installed appearance shall be considered sufficient reason for rejection of the system in part or in whole.
- D. Completed work shall demonstrate quality workmanship. Quality workmanship shall be of equal importance to its operation. Failure to demonstrate quality workmanship shall be considered sufficient reason for rejection of the system in part or in whole.

3.14 PERMITS AND FEES

- A. The Contractor shall make arrangements to obtain and pay for necessary permits, licenses, and inspections.
- B. No work shall be started prior to obtaining necessary permits and payment of required fees. Work installed prior to obtaining proper permits shall, if required by the Governing Authority (AHJ), be redone in compliance with requirements at no additional cost to the Owner.

3.15 ACCESS

- A. Install equipment such that it is readily accessible for operation and maintenance.
- B. Access to equipment shall not be blocked or concealed by conduits, supporting devices, boxes, or other items.
- C. Do not install equipment such that it interferes with the normal operation or maintenance requirements of other equipment.

- D. Place equipment labels and/or other identification where the label and/or identification can be easily seen and read without difficulty.

3.16 BUILDING ATTACHMENTS

- A. Equipment shall be installed level, plumb, parallel, and perpendicular to building structures and to other building systems and components, except where otherwise indicated.
- B. Equipment shall be securely fastened. Select fasteners so that the load applied to any one fastener does not exceed 25 percent of the proof-test load.
- C. Attachment of hanger rods, support cables, diagonal wall bracing, and any other connections made to the building structure after the fireproofing contractor has completed his work, shall be made with minimal impact to the existing fireproofing. The Contractor making such connections is responsible for:
 - 1. Removal of fire stopping where attachment is required.
 - 2. Scorings and over-cut as required for connection only. Contractor shall be held responsible for costs associated with the patch back of excessively removed fire stopping material by the General Contractor.

3.17 SUPERVISION

- A. The Contractor shall appoint a Project Manager who will be the single point of contact for all work accomplished under this Project and will be vested by the Contractor with the authority to make decisions on behalf of the Contractor.
- B. The Project Manager will be responsible to represent the Contractor and coordinate all aspects of this Project, including but not limited to:
 - 1. Overall and specific project responsibility
 - 2. Thorough knowledge of Project Specifications and Drawings
 - 3. Creation and maintenance of a project schedule, including milestones, task definitions and resource allocations
 - 4. Attendance at all Project Management meetings
 - 5. Supervision and direction of all Contractor personnel
 - 6. Documentation, including submittals and change orders
 - 7. Quality assurance of Project
- C. The Project Manager initially assigned to the Project shall be assigned to the Project for the duration of the Project. Once assigned by the Contractor, the Project Manager shall not be changed by the Contractor without Engineer and Owner approval.
- D. The Contractor shall assign a qualified Foreman to the Project and shall keep the Foremen on site and in charge of the work at all times. The Foreman shall be equipped with a mobile phone during project working hours.
- E. The Foreman initially assigned to the Project shall be assigned to the Project for the duration of the Project. Once assigned by the Contractor, the Foreman shall not be changed by the Contractor without Engineer and Owner approval.

3.18 DRAWINGS

- A. Unless specifically dimensioned or detailed, Drawings indicate approximate locations, arrangement, and general character. To avoid interference with structural members and equipment of other trades, or for the convenience of the Owner, it may be necessary to adjust the locations shown on the Drawings prior to installation. Unless specifically dimensioned or detailed, and with the exception of locations of equipment and raceway in Telecommunications Data/Equipment Rooms, the Contractor may make minor location adjustments without obtaining the Engineer's prior approval. All other adjustments require prior approval from the Engineer.
- B. Minor adjustments are defined as distances not to exceed:
 - 1. 1 foot at grade, floor ceiling, and roof level in any direction in the horizontal plane.
 - 2. 1 foot on walls in a horizontal direction within the vertical plane.
 - 3. Particular attention shall be paid to door swings, piping, ductwork, and structural steel:
 - 4. In general, waste and vent lines, large pipe mains, and ductwork shall be given priority for the locations and spaces shown.
 - 5. In general, electrical lighting fixtures shall be given priority for ceiling space.
 - 6. Where minor location adjustments are required, such adjustments shall be made at no cost to the Owner or project.

3.19 PENETRATIONS, PATCHING, AND PAINTING

- A. Penetrations (openings, holes, chases, sleeves, slots, cuts, etc.):
- B. Properly size and locate penetrations required as construction progresses. For new concrete or masonry, the Contractor shall coordinate, locate, and provide required openings prior to the pouring of concrete or construction of masonry.
- C. Obtain written approval from the Structural Engineer/Architect for penetration of structural elements prior to penetration.
- D. Penetration for OSHPD rated buildings must be OSHPD approved penetrations.
- E. Penetration of concrete and structural elements shall be avoided where possible. Where not possible, penetrations shall be performed in a manner that will not reduce structural element load-carrying capacity or load-deflection ratio.
- F. Penetrations shall be performed by workers qualified and skilled in the trades involved.
- G. Penetrations shall not be exposed on the exterior or in occupied spaces in a manner that would, in the Engineer's opinion, reduce the aesthetic qualities of the structure or result in visual evidence of penetration and patching.
- H. Penetrations shall be constructed using methods least likely to damage elements to be retained or adjoining construction.
- I. Provide temporary support for the work to be penetrated.

- J. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not for hammering or chopping. Cut holes and slots neatly to required size with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- K. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring of existing finished surfaces.
- L. Cut through concrete and masonry using a cutting device such as a Carborundum saw or diamond core drill.
- M. Voids around penetrations shall be properly sealed, caulked or grouted as required.
- N. Fire stopping: Penetrations (through and membrane) of fire rated barriers shall be fire stopped and sealed.
- O. The fire rating of the barrier shall be maintained.
- P. Material shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.
- Q. Existing elements:
 - 1. The Contractor shall be responsible for identifying, locating, and protecting existing embedded conduits, pipe, ductwork, etc. when penetrating existing structures.
 - 2. Cap, valve, plug or seal remaining portions of cut pipes or conduit to prevent entrance of moisture or other foreign matter.
 - 3. The Contractor shall be responsible for repairing and/or replacing existing conduits, pipe, ductwork, etc. damaged by the Contractor during construction of penetrations. Repair and/or replacement shall be at no additional cost to the Owner.
 - 4. Penetrations (and subsequent patching) resulting from the Contractor's failure to properly coordinate penetrations shall be at no additional cost to the Owner.
- R. Patching:
 - 1. Patching in every instance consists of completing the work to match and blend with the adjoining existing work insofar as methods, materials, colors, and workmanship are concerned
 - 2. Patching shall be performed by workers qualified and skilled in the trades involved.
 - 3. The Contractor shall be responsible for replacing improperly matched, blended, or poorly constructed patches at no additional cost to the Owner.
- S. Painting:
 - 1. Painting shall consist of cleaning, surface preparation, painting (primer, intermediate, and finish) and finishing surfaces and items, new and existing, affected by the work of the Contractor.
 - 2. Surface painting shall match and blend with existing adjoining surfaces.
 - 3. Scratched, chipped, or otherwise marred equipment shall be repainted to match original finish.
 - 4. The areas around penetrations, once sealed, shall be painted.

5. Painting shall be performed by workers qualified and skilled in the trades involved.
6. The Contractor shall be responsible for refinishing and repainting improperly matched, blended, or poorly painted surfaces and items at no additional cost to the Owner.

3.20 HOUSEKEEPING

- A. During the course of construction:
- B. At the conclusion of each day's work, remove empty boxes, crates, and other debris, and sweep clean all work areas affected by the Contractor's work of the day.
- C. At project completion:
 1. Remove all tools and scaffolding.
 2. Equipment and facilities shall be thoroughly cleaned inside and out and residue removed.
 3. Remove temporary labels and adhesives.
 4. Thoroughly vacuum the interior of enclosures to remove debris.
 5. Surplus product, materials and debris shall be cleared from the job site.
 6. The Contractor is solely responsible for the appropriate disposal of all surplus product, materials and debris.

3.21 SUBSTANTIAL COMPLETION

- A. Pre-Substantial Completion Submittal: Three weeks prior to Substantial Completion, the Contractor shall prepare and submit the following:
 1. Station References and Labels Spreadsheet per the requirements of Division 27 05 53 Identification for Communications Systems
- B. Known Exceptions/Deviations List:
 1. A thorough list of known exceptions/deviations (in materials, construction, and/or workmanship) from that specified in the Contract Documents, and for which there was not associated documentation in the form of Change Orders (CO), Construction Change Directives (CCD), Architects Supplemental Instructions (ASI), or responses to a Request for Information (RFI).
 2. The Contractor shall submit the list to the Engineer for review. The Engineer shall review each item and mark as either Accepted or Not Approved.
 3. Items marked "Not Approved" shall be corrected by the Contractor to conform with the intent of the Contract Documents at no additional cost to the Owner.
 4. The Contractor shall perform corrective action for "Not Approved" items prior to notifying the Engineer that the work is Substantially Complete.
- C. Notice of Substantial Completion: When the Work nears Substantial Completion, the Contractor shall notify the Engineer in writing the date that the work will be Substantially Complete and ready for review by the Engineer.

3.22 PROJECT CLOSE-OUT

- A. Punch List:

1. Once notice of Substantial Completion is received, the Engineer shall visit the site to review the Work, and shall prepare a punch list of items determined to be incomplete, deficient, or otherwise not in compliance with the intent of the Contract Documents.
2. During the review of the Work, if the Engineer finds that the Known Exceptions/Deviations List provided by the Contractor was insufficiently thorough, that the Work is not Substantially Complete, or that deficiencies in the work are excessive, the Engineer will cease review and inform the Contractor that the work is not Substantially Complete. The Contractor shall be responsible for fees incurred by the Engineer for this partial review.
3. The Contractor shall perform corrective action for each item noted in the punch list. When complete, the Contractor shall submit the original punch list with each item initialed attesting to the fact that the item was corrected.
4. If necessary, the Engineer will perform a subsequent review after receipt of the Contractor initialed punch list.
5. Should additional reviews beyond the original punch list review be required of the Engineer due to the Contractor's failure to correct all incomplete, deficient, or non-compliant work, the Contractor shall be responsible for fees incurred by the Engineer for the additional reviews.
6. Provide O&M Manuals per the requirements of subsection "1.23 Operating and Maintenance (O&M) Manuals" herein.

3.23 FOLLOW UP

- A. After the system(s) and facility have been placed in operation and are in use by the Owner, provide technical assistance for the first two months of operation on a standby basis for troubleshooting, education, and problem solving.

END OF SECTION 27 05 00