

# **DIVISION 27**

## **Section 27 00 10**

**Technology Systems  
Design and Installation Guidelines  
for Architects and Engineers**



**Pinellas County  
Business Technology Services**

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## SECTION 27 00 10 – TECHNOLOGY GENERAL PROVISIONS

### PART 1 - GENERAL

#### 1.1 PURPOSE OF THIS DOCUMENT

- A. The purpose of this specification section is to provide Architects & Engineers (A&E) and Designers of low voltage infrastructure working in construction or renovation projects for Pinellas County Government the design requirements by Pinellas County Business Technology Services (BTS). This document will be a starting point for completing a set of construction documents but **SHALL NOT** be used unedited as a bid document.

#### 1.2 GENERAL CONDITIONS AND DEFINITIONS

- A. Scope: This specification section applies to all Division 27 specification sections. All systems under the specifications indicated above are referenced in this contract document as “technology systems”.
- B. Drawings and Specifications: The words “Drawings” and “Specifications” as used in these specifications, refer to all contract drawings and specifications describing the scope of work of the technology system.
- C. Project Owner: The word “Owner” as used in these specifications, refers to the Pinellas County Florida Board of County Commissioners (BCC).
- D. BTS: Pinellas County Business Technology Services (BTS) is a department within Pinellas County Government responsible for managing and supporting technology systems located in buildings owned and/or operated by Pinellas County Government.
- E. Installer and Contractor: The word “Installer” as used on the drawings and/or specifications without further description shall refer to the Installer of the system. The word “Contractor” as used on the drawings and/or specifications without further description shall refer to the General Contractor (or Construction Manager) holding the prime agreement with the Owner for the construction of the project. Pursuant to Florida Statutes 489.105, the “Contractor” shall be a person or entity qualified to perform work who is registered and licensed under the Florida Department of Business and Professional Regulation (DBPR), and in compliance with local laws or ordinances.
- F. Provide and Install: The word, "Provide" as used on the drawings and/or specifications shall mean, furnish, install, mount, connect, test, complete, document, and make ready for operation. The word "Install" as used on the drawings or specifications shall mean, mount, connect, test, complete, and make ready for operation.

- G. Engineer: The word “Engineer” as used on the drawings and/or specifications refers to the design Engineer of Record (EOR) of the project working for the Project Architect or the Owner. It does not refer to an Engineer working for the General Contractor, Construction Manager, or any of the Installers on the project.
  
- H. Service Provider: A service provider is an organization that provides access to the internet (ISP), telephone (TSP), Television (TVSP), or other services for accessing, using, or participating in voice, data, and Television services. Service Providers may be organized in various forms, such as commercial or privately owned.
  
- I. Types of sites: Ownership of the buildings where Pinellas County Government provides services or executes business, fall into three categories, as follows:
  - 1. Owned Site: A location owned, operated, maintained, and designed by Pinellas County Government.
  - 2. Leased Site: A location defined by a formal agreement between Pinellas County Government and the location Owner in which the location is designed, operated, and maintained by Pinellas County Government for a specific length of time.
  - 3. Temporary Site: A location that is normally short-term for a specific event or emergency on County property or leased space.
  
- J. Types of telecommunication rooms: Telecommunications rooms in buildings owned or leased by Pinellas County fall into one of the following categories:
  - 1. Telecommunication Services Entrance Room (TSER): TSER refers to the Point of Presence (POP) for local service providers. Service personnel will troubleshoot their systems up to this point.
  - 2. Main Distribution Frame (MDF): The MDF also referred to as the Equipment Room (ER) or Telecomm Room (TR), is the first point of technology systems management for any building. This room is often combined with the TSER to save space. This is the location where underground backbone cabling meets building riser cabling and distributes horizontal Uniform Twisted Pair (UTP) cabling. Rack-mounted, active equipment resides here, and wall space is used for individual system termination cabinets. This space can utilize up to 50 watts (w) per square foot (sq. ft.) and five kilowatts (kW) per cabinet or rack. This room requires emergency power.
  - 3. Intermediate Distribution Frame (IDF): The IDF is the horizontal cabling distribution point for a building or a floor. It provides a coverage area with a radius of 295 ft. in all directions. This room is an extension of the campus or building network infrastructure to the MDF. In multi-floor buildings the MDF and IDFs should be stacked and located near the core of the building. This room can use up to 20w per sq. ft. and 5kW per cabinet or rack. This room requires emergency power.

4. Data Center (DC): The DC is used to house computer systems and associated components, such as technology and electronic data storage systems, application servers, redundant back-ups, contingency equipment, and special security systems. The Data Center generally includes redundant or back-up power, communications connections, environment controls, and can use as much as 100w per sq. ft. and 10kW per cabinet.
5. Network Operations Center (NOC): The NOC is designed as a centralized location for network monitoring and control to support systems including: environmental conditions, electrical consumption, security, life safety, or any system that touches the UTP infrastructure. This space often contains user workstations and a video presentation wall.

### **1.3 RESPONSIBILITY MATRIX**

- A. The set of construction documents for a project shall include a Responsibility Matrix for all low voltage systems. This matrix shall be created by the Project Engineer and developed in conjunction with all project stakeholders. The matrix shall consist of the design, procurement, and construction responsibility of all components of the technology systems. A responsibility matrix example is provided below. The information filled out in this matrix is a starting point for Engineers to complete and discuss for each project.

PROJECT NAME					
DESIGN AND CONSTRUCTION RESPONSIBILITIES					
ITEM	SYSTEM	SCOPE	DESIGN RESPONSIBILITY	PROCUREMENT RESPONSIBILITY	CONSTRUCTION RESPONSIBILITY
<b>1.00</b>	<b>VOICE AND DATA SYSTEM FOR ALL AREAS</b>				
1.01	RACEWAYS	Conduit, boxes, cable tray, etc.	A&E	G.C./C.M.	G.C./C.M.
1.02	INSIDE PREMISE WIRING	Structured cabling system	A&E	G.C./C.M.	G.C./C.M.
1.03	OUTSIDE PREMISE WIRING IN PRIVATE CAMPUS	Structured cabling system	A&E	G.C./C.M.	G.C./C.M.
1.04	OUTSIDE PREMISE WIRING FROM SERVICE PROVIDERS	Fiber and copper for services	OWNER/S.P.	OWNER/S.P.	OWNER/S.P.
1.05	PATCHING OF VOICE/DATA LINES	Patching at path panel and work areas	N.A.	N.A.	BTS
1.06	VOICE PHONE SWITCH	Equipment selection, sizing, equipment layout, RFP	BTS	ODP	BTS
1.07	ACTIVE ELECTRONICS (NETWORKING EQUIPMENT, SWITCHES, ROUTERS, SERVERS AND COMPUTERS)	Equipment selection, sizing, equipment layout, RFP	BTS	ODP	BTS
1.08	WIRELESS MODELING	Predictive modeling for Wi-Fi propagation	A&E	N.A.	N.A.
1.09	WIRELESS SURVEY	Wireless survey with spectrum analyzer and documentation	BTS	ODP	N.A.
1.10	WAPs ENCLOSURES	Mounts for WAPs	A&E	G.C./C.M.	G.C./C.M.
1.11	WAPs	Wireless access points, including installation labor, support materials	BTS	ODP	G.C./C.M.
<b>2.00</b>	<b>TELECOM ROOM OUTFIT</b>				
2.01	PLYWOOD AND WALL SLEEVES	Plywood and sleeves for cables	A&E	G.C./C.M.	G.C./C.M.
2.02	GROUNDING SYSTEM	Ground bar and ground bus	A&E	G.C./C.M.	G.C./C.M.
2.02	RACKS, WIRE MANAGERS AND LADDER TRAY	Racks and all passive elements	A&E	G.C./C.M.	G.C./C.M.
<b>3.00</b>	<b>CATV DISTRIBUTION (CABLE TV FOR ALL AREAS)</b>				
3.01	RACEWAYS	Conduit, boxes, cable tray, etc.	A&E	G.C./C.M.	G.C./C.M.
3.02	INSIDE PREMISE WIRING	Coaxial cable	A&E	G.C./C.M.	G.C./C.M.
3.03	DISTRIBUTION DEVICES	TAPS, amplifiers, splitter, DC	A&E	G.C./C.M.	G.C./C.M.
3.04	FLAT PANEL DISPLAYS FOR OFFICES	Displays not part of the system	A&E	ODP	G.C./C.M.
3.05	MOUNTS FOR TFLA PANEL DISPLAYS	Mounts for the displays	A&E	ODP	G.C./C.M.
<b>4.00</b>	<b>AV SYSTEMS/ PAGING</b>				
4.01	RACEWAYS	Conduit, boxes, cable tray, etc.	A&E	G.C./C.M.	G.C./C.M.
4.02	INSIDE PREMISE WIRING	AV wiring for systems	A&E	G.C./C.M.	G.C./C.M.
4.03	ACTIVE ELECTRONICS	Projectors, presentation control system, paging system, etc.	A&E	G.C./C.M.	G.C./C.M.
<b>5.00</b>	<b>SECURITY SYSTEMS, BUILDING CCTV AND ACCESS CONTROL</b>				
5.01	RACEWAYS	Conduit, boxes, cable tray, etc.	A&E	G.C./C.M.	G.C./C.M.
5.02	INSIDE PREMISE WIRING	Cables for cameras and card access	A&E	G.C./C.M.	G.C./C.M.
5.03	ACTIVE ELECTRONICS	Cameras, DVRs, Access control panels, readers, etc.	A&E	G.C./C.M.	G.C./C.M.
5.04	LOCKING DEVICES	Magnets, electric mortise locks	A&E	G.C./C.M.	G.C./C.M.
<b>6.00</b>	<b>EMERGENCY POWER BACKUP (UPS) FOR ACTIVE EQUIPMENT</b>				
6.01	POWER WIRING	Conduit, cables and circuits	A&E	G.C./C.M.	G.C./C.M.
6.02	ACTIVE EQUIPMENT - SMALL UNITS	UPS units in racks or in work areas	BTS	ODP	G.C./C.M.
6.03	ACTIVE EQUIPMENT - LARGE UNITS	Central UPS system	A&E	G.C./C.M.	G.C./C.M.
<b>7.00</b>	<b>FIRE ALARM AND BUILDING MANAGEMENT SYSTEM</b>				
7.01	RACEWAYS & WIRING	Conduit, cables, patch panels, cable tray outlets, etc.	A&E	G.C./C.M.	G.C./C.M.

PROJECT NAME					
DESIGN AND CONSTRUCTION RESPONSIBILITIES					
ITEM	SYSTEM	SCOPE	DESIGN RESPONSIBILITY	PROCUREMENT RESPONSIBILITY	CONSTRUCTION RESPONSIBILITY
7.02	ACTIVE ELECTRONICS	Data gathering panels, sensors, etc	A&E	G.C./C.M.	G.C./C.M.
<b>8.00</b>	<b>DISTRIBUTED ANTENNA SYSTEM (LIFESAFETY)</b>				
8.01	RACEWAYS & WIRING	Conduit, cables, patch panels, cable tray outlets, etc	A&E	G.C./C.M.	G.C./C.M.
8.02	INSIDE PREMISE WIRING	Cable . grounding	A&E	G.C./C.M.	G.C./C.M.
8.01	ACTIVE ELECTRONICS	Head end system and antennas	A&E	G.C./C.M.	G.C./C.M.
<b>9.00</b>	<b>DISTRIBUTED ANTENNA SYSTEM (CELL PHONES)</b>				
9.01	RACEWAYS & WIRING	Conduit, cables, patch panels, cable tray outlets, etc	A&E	G.C./C.M.	G.C./C.M.
9.02	INSIDE PREMISE WIRING	Cable . grounding	TBD	TBD	TBD
9.01	ACTIVE ELECTRONICS	Head end system and antennas	TBD	TBD	TBD

NOTES: C.M./G.C.: CONSTRUCTION MANAGER OR GENERAL CONSTRUCTOR  
A&E; ARCHITECT AND ENGINEER  
N.A.: NOT APPLICABLE  
BTS: PINELLAS COUNTY BTS  
ODP: OWNER DIRECT PURCHASE  
TBD: TO BE DETERMINED  
S.P.: SERVICE PROVIDER

#### 1.4 ABBREVIATIONS

See **Appendix A: Abbreviations** in **Division 27 Appendices** document.

## **1.5 CODES AND STANDARDS**

- A. Code compliance: It is the responsibility of the EOR to confirm that plans and specifications used for building low voltage systems are compliant with County and City building codes. Any requirement indicated in these specifications contrary to any building codes shall be waived.
- B. Requirements: All articles, products, materials, fixtures, forms, or types of construction covered in the specifications will be required to meet or exceed all applicable standards of manufacturer testing, performance, capabilities, procedures, and installation according to the requirements of American National Standards Institute (ANSI), National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronics Engineers (IEEE), National Electrical Code (NEC), Building Industry Consultant Services International (BICSI), and Telecommunication Industry Association (TIA) referenced documents when indicated and the manufacturer's recommended practices. Requirements provided on the contract documents which exceed but are not contrary to governing codes shall be followed.
- C. UL Labels: All materials shall be new and free of defects, and shall be UL listed, bear the UL labels, or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. No equipment shall be installed if there is no labeling or listing service available for such equipment.

## **1.6 MATERIAL ALTERNATES AND SUBSTITUTIONS**

- A. Definitions:
  - 1. Basis of design: A product or group of products from an identified manufacturer that was used as the basis of systems layouts, installation details, and part of the contract documents.
  - 2. Prototype: A product or a group of products that are not yet ready for commercial use; they are in the testing phase (Beta) of product development.
  - 3. Alternates: Products or manufacturers listed in the contract documents as acceptable as compared to the basis of design. The use of alternates shall follow the same system architecture as the basis of design.
  - 4. Obsolete: A product that has been discontinued by the manufacturer or declared end of life and is no longer being manufactured.

5. Substitution: A product not listed in the contract documents but capable of similar characteristics as the basis of design operating as a direct replacement in the system referenced. The Installer can propose a substitution if all requirements are met as indicated in this specification.
  6. Substitutions that create a change in system architecture are products that create a different system configuration impacting other trades (i.e., change in power/cooling requirements, changes in raceways layout or sizes, changes in equipment space requirements, changes in low voltage wiring layouts, types, and quantities, etc.) but providing a similar result as the system/products basis of design.
- B. Use of Prototype: Prototypes are not permitted in any technology system.
- C. Use of alternates: Alternates are permitted when the Installer follows these requirements:
1. Where several brand names, make, or manufacturers are listed as acceptable alternates each shall be regarded as equally acceptable, based on the design selection. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to Engineer review and acceptance. Where three or more manufacturers are listed, one of the listed manufacturers shall be submitted for acceptance.
  2. The use of alternate products does not allow change of system architecture with such products.
  3. If an alternate is submitted, BTS must be notified in writing and provide approval.

- D. Use of substitutions: Substitutions are permitted only when they meet the following requirements:
1. Substitutions are only allowed when a particular specification section for a technology system allows the use of substitutions for that system.
  2. The performance of all substitution components must meet or exceed those of the basis of design. Should an Installer wish to submit a substitution product, or a product set stated in the construction documents as 'acceptable', it shall be the responsibility of the Installer to submit to the Engineer an item-for-item CROSS-REFERENCE for all specifications of the product, all related specifications, and product data sheets for the proposed substitution. See **Appendix B – Substitution Request Form** in **Division 27 Appendices** document.
  3. BTS must be informed of any substitutions.
  4. BTS has the authority to reject a substitution without cause and the Installer shall provide the basis of design with no additional compensation.
  5. Substitutions of unnamed manufacturers are not acceptable.
  6. When a basis of design is specified to be in accordance with a trade association or government standard requested by the Engineer, the Installer shall provide a certificate that the substitution complies with the referenced standard. Upon request of Engineer, Contractor shall submit supporting test data to substantiate compliance.
  7. Substitutions that create a change in system architecture are not permitted.
- E. Obsolete:
1. Obsolete products should be brought to the attention of BTS at which time an alternate product will be provided.

## **1.7 SHOP DRAWINGS AND SUBMITTALS**

- A. Shop drawings shall be submitted for equipment and material as indicated in the individual specification section for each system.
- B. All low voltage submittals shall be approved by the A&E and BTS. Materials not approved by BTS can be requested to be changed at no additional cost to the Owner.
- C. When manufacturer cut sheets of products are submitted with multiple model numbers or variations of the same product, the cut sheet shall be highlighted by the Installer to indicate the specific product being provided for the project. Submittals of unhighlighted cut sheets will be rejected.

- D. All active electronic equipment prone to obsolescence with lead times less than three months shall be submitted for approval no sooner than 12 months before the set date of substantial completion of the project. Electronic equipment prone to obsolescence includes devices such as, but not limited to, flat panel displays, transceivers, servers, players, workstations, and routers.
- E. Equipment and materials installed not in accordance with the approved shop drawings shall be replaced at Installer's expense.
- F. Multiple stages of shop drawings shall be required as indicated in each specification section. For final completion and testing, the Installer shall provide a submittal with the following information:
  - 1. Detailed course syllabus for each type of training required in the specifications.
  - 2. A proposed schedule of training sessions in compliance with the specification section indicating where the training will take place.
  - 3. A copy of all training material to be used during each session.
  - 4. Test result sheets for all testing done by the Installer prior to the system acceptance test.

## PART 2 - PRODUCTS

### 2.1 IDENTIFICATION AND LABELING TAGS

- A. All conduit, cabinets, cables, wires, wiring forms, terminal blocks, and terminals shall be clearly identified with pre-printed labels or tags.
- B. Approved types of labels for inside premise environments for any technology systems are:
  - 1. Non-laminated thermal transfer labels printed with a high-quality thermal transfer printer.
  - 2. Laminated thermal transfer labels printed with a high-quality thermal transfer printer.
  - 3. Thermal transfer polyolefin tape printed with a high-quality thermal transfer printer.
  - 4. Self-laminated dot-matrix labels printed with a high-quality dot-matrix printer.
  - 5. Non-laminated dot-matrix labels printed with a high-quality dot-matrix printer.
- C. For labeling of cables or equipment in outdoor environments use only marker plates attached to cable or equipment with cable ties. Do not use any labels with adhesive materials. Use different color plates for different cable types. Use only waterproof ink for writing on marker plates.

- D. Any type of write-on labels (except for outdoor marker plates), handwriting on cable jackets or directly on equipment, labels made with masking tape, or any other type of tape not listed in previous paragraph are not acceptable and shall be corrected with approved labeling methods at no additional cost to the Owner.
- E. Approved manufacturers:
  - 1. Brady
  - 2. Panduit
  - 3. Or an approved equal

## **2.2 TECHNOLOGY EQUIPMENT AND MATERIALS**

- A. General: Each item of equipment or material shall be manufactured by a company regularly engaged in the manufacturer of the type and size of equipment. Each item shall be suitable for the environment in which it is to be installed, shall be approved for its purpose, environment, application, and bear a label as indicated in paragraph 1.5. C of Codes and Standards.
- B. Installation Requirements: Each item of equipment or material shall be installed in accordance with instructions and recommendations of the manufacturer and the contract documents on a separate patch panel.
- C. Required Accessories: All equipment specified in the technology systems shall be provided with all required accessories for proper operation and mounting. Typically, these accessories are not specifically indicated in the design drawings but shall be provided per this specification section. Such accessories include items such as power supplies, power cords, rack ears, rack rails, bolts, lugs, faceplates, etc.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION PRACTICES**

- A. Workmanship: The installation of materials and equipment shall be performed in a neat, workmanlike, and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the contract documents. They shall be skilled in the methods and craftsmanship needed to produce a quality level of workmanship. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.
- B. Standard of quality: To define good workmanship, all installation practices described in BICSI standards shall be followed.

- C. Protection of equipment: Equipment for technology systems shall always, during construction, be adequately protected against mechanical/chemical damage by the elements or work performed by other trades. Equipment shall be stored in dry permanent shelters. If equipment or materials have been damaged, such equipment shall be replaced at no additional cost or time extension to the contract. Damaged equipment and materials include the following conditions:
1. Equipment that has visible scratches, cracks, or equipment that has paint or finished surface peeled off.
  2. Equipment with visible indication of rust or water intrusion.
  3. Equipment that has dents on the metal enclosures and are clearly visible to the end user.
  4. Equipment that has been sprayed with paint, fire proofing materials, or other type of chemicals, when the equipment was not intended to have this type of material applied to it, per contract documents.
  5. Equipment that has been burnt by controlled fires, power surges, power sags, or lightning.
  6. Equipment that has known damage to any parts, electronic board, or component, even if such component or board has no specific use in the project.
  7. Cables that have visible damage to the jackets even if cables are not broken and still provide electrical continuity.
  8. Cables sprayed with paints that affect the warranty of the cable as defined by the cable manufacturer.
  9. Equipment with screws with stripped heads.
- D. Clean equipment: All equipment installed in spaces accessible to the building occupants such as racks, cabinets, wall-mounted panels, credenzas, etc., shall be free of dust upon receipt of the final Certificate of Occupancy (CO), and upon the acceptance test by the A&E. Clean equipment is defined as being wiped with a finger, on any surface, not leaving visible debris and dust on the finger to include dust inside equipment such as ventilation fans.
- E. Identification and tagging: All technology systems shall be labeled and identified as specified in the contract documents. Such identification shall be in addition to the manufacturer's nameplates, shall serve to identify the item's function, and the equipment or system which it serves or controls. Refer to Identification Section of the specifications for additional information. All labels of equipment and wiring shall match the labeling used in the shop drawings for the system.

### 3.2 TELECOM ROOM/EQUIPMENT ROOM READINESS

- A. In any project where the technology system requires the use of network equipment (switches, routers, firewalls, etc.) provided by BTS, the Contractor shall complete all telecom rooms to a point where they are suitable for the Owner to deploy such equipment. At a minimum, the following conditions shall be met in all telecom rooms for the installation of the equipment:
1. All power outlets in telecom rooms shall be fed from a permanent source of power. Temporary power shall not be provided.
  2. Backup power (generator and/or Uninterruptible Power Supply (UPS)) shall be operational, tested, and connected to the final power distribution system.
  3. The mechanical equipment providing cooling for telecom rooms shall be fully operational. Temporary cooling shall not be accepted.
  4. Fire suppression system (sprinkler or gas-based) protecting telecom rooms shall be fully operational and tested.
  5. All light fixtures in telecom room shall be fully operational.
  6. All walls to telecom rooms shall be completed and include the last coat of paint. (Including plywood walls). Plywood fire ratings shall be visible.
  7. Ceiling and flooring of telecom rooms shall be finished.
  8. All horizontal and backbone cabling systems as part of the Structured Cabling System (SCS) shall be installed, terminated, and tested.
  9. Final and permanent doors to telecom rooms shall be installed with a keycore different from all other construction cores on the site.
  10. Telecom rooms shall be cleared of any materials being stored inside the room and shall not be used as storage rooms.
  11. Telecom rooms shall be clean. Clean will be measured as not having any debris left in the room and not having dust in rack, cabinets, or wall-mounted panels. If wiping a finger on any surface of equipment leaves visible dust residue on the finger, the room will not be considered clean.
  12. Hallways and rooms leading into telecom rooms must be finished to avoid dust from these spaces moving into the telecom rooms.
  13. Prior to the Owner deploying the equipment in these rooms, the Contractor shall provide disposable sticky mats at the entrance of each telecom room to capture dust and/or dirt from shoes or boots coming into the room. The sticky mats shall cover the width of the door opening. Sticky mats shall contain no less than 60 sheets in each unit. Used sheets of the mats shall be replaced no less than daily or if worn out before the end of the day. Sticky mats shall be provided until the project receives the final CO.
- B. All telecom rooms shall be ready for deployment of equipment no less than 30 days prior to the required completion date of the project or the date established for the Temporary Certificate of Occupancy (TCO) of the project.

### 3.3 SYSTEMS WARRANTY AND SERVICE

- A. General: At a minimum, all technology systems shall include a warranty from the manufacturer and Installer of the system for no less than one year with the following exceptions:
1. Structured cabling systems shall have a warranty longer than one year as indicated in specification section 12.6 Systems Warranty and Service.
  2. When specific equipment or software manufacturers include a warranty longer than one year, the manufacturer's warranty shall be transferred to the Owner in the same terms as indicated by the manufacturer.
- B. Warranty coverage: The warranty for the technology system shall cover the following elements:
1. All equipment parts, cabling, and materials.
  2. Any software updates/patches issued during the warranty period by the manufacturer.
  3. The labor to replace parts and programming time to re-configure equipment.
  4. Shipping and freight charges to send equipment back and forth from the manufacturer and/or site.
  5. Tool rentals such as scaffold or lifts to access equipment.
  6. Troubleshooting time to detect faults in the system.
  7. All travel time and expenses associated with the service.
- C. Start of warranty: The warranty period for the technology systems starts the day the project receives the CO, for new construction projects. For retrofit jobs of a particular system, the warranty starts when the project is accepted by the A&E. For most equipment/software manufacturer's the warranty period starts when the equipment is shipped from the factory, therefore it is the responsibility of the Installer of each system to provide additional warranty coverage from the manufacturer to cover the additional time of warranty up to the CO date, plus one year.

- D. Service calls: During the warranty period, the Installer shall support the system when called by the Owner/Contractor for service. All equipment/software service shall be done by personnel with the same qualifications as the personnel who installed the system and as indicated in each technology system specification section. Service calls shall be taken during business hours (same time zone as the project) for normal service and 24 hours, 365 days in the year for emergency service. Emergency service shall be defined as the loss or failure of any critical component necessary to maintain the overall integrity and operation of the system. Normal service shall be defined as the loss or failure of a system component that does not compromise the complete operation of the system and allows the Owner to operate the system at a minimum of 90% of its capacity. See individual specification sections from Manufacturer for delineation on critical components and normal service.
- E. Response time for service: The maximum allowed response time after a service call for emergency service shall be four hours, and for normal service shall be two business days.
- F. Equipment registration: All equipment/software parts of the technology system shall be registered to the Owner with the manufacturer of the equipment/software for warranty and support. Equipment/software registered with the manufacturer to the name of the Contractor or Installer shall be removed from the project and replaced with equal equipment registered to the Owner at no additional cost.
- G. Periodic preventive maintenance visits: During the warranty period, the Installer of the system shall provide no less than two preventive maintenance services. These services shall be provided six months from the start of the warranty period and a few weeks before the end of the warranty period. The Installer of the system shall coordinate with the Owner the precise dates for this type of service. During these visits, the following tasks shall be performed:
1. Clean-up of any active equipment that shows visible accumulation of dirt, dust, or debris of any kind
  2. Replacement of any consumable parts in the system that require replacement per manufacturer's instructions during the warranty period, such as but not limited to filters
  3. Oiling/greasing of any mechanical parts that require periodic maintenance as per manufacturer's instructions during the warranty period
  4. Run manufacturer's recommended tests for each piece of equipment installed. The Installer shall provide, at the end of the service, a report of such test
  5. Visual observation of all devices in the system to spot any anomalies.
  6. Review of error logs from any system components and analysis of such logs with explanation to Owner on the cause of errors

- H. Extended service agreement: Prior to final acceptance testing, and within 30 days of project completion, the Installer of each technology system shall submit to the Owner an option to purchase extended service coverage. This proposal shall provide for the purchase option of one, three, or five-year coverage. Coverage shall include, at a minimum, the same provisions as during the warranty period.

### 3.4 BTS FINAL ACCEPTANCE TEST

- A. The technology systems shall be tested during installation by the Installer as frequently as required to solve any installation issues and non-compliance of system specifications. Technology systems will not be considered delivered to the Owner until final acceptance test is passed. The final acceptance test shall be done in presence of the A&E and/or BTS. The Installer shall request in writing, two weeks in advance, the presence of the A&E and/or Owner for the final acceptance test.
- B. For the Installer of the system to request final acceptance, the following tasks shall be completed:
  - 1. All components shall be inspected to ensure they have been properly installed, securely attached, and remain clean and unmarred.
  - 2. All equipment shall be properly adjusted, clearly labeled, and fully operational.
  - 3. The Installer shall have tested the system to ensure the final acceptance test will be successful. Detailed proof of test shall be sent to the A&E with the request for final acceptance.
  - 4. All permanent and final labels as requested in section 12.3 Identification and Tagging are completed.
  - 5. No temporary conditions shall be present in the system.
  - 6. All batteries on all system components shall be connected.
  - 7. All system programming shall be completed as indicated in each technology system specification.
- C. All test equipment required for the final acceptance shall be provided by the Installer of the system unless specifically indicated by the A&E and/or BTS.
- D. The A&E shall define the scope of the testing, but the Installer shall be prepared for testing every single component of the system. During the day of the test, the A&E will indicate the testing process and procedures for each system. Tests could include operation of the system during power outages. The Installer of the system shall be available during the complete testing process to answer questions from the Engineer and to demonstrate specific parts of the system. If personnel from the Installer or test equipment is not available, the test will be marked as a failure.

- E. A punch list of the items to be corrected will be prepared by the A&E during the final acceptance test. The Installer shall correct all items and request a second day for verification of all punch list items by the A&E and Owner. During the second test, no additional punch list items shall be expected and only the items in the punch list will be tested.
- F. If during the testing process, the A&E and/or Owner consider that the rate of failure is too high (more than five failures or non-compliance with specifications within a one hour testing duration), the test will be cancelled unilaterally by the A&E and/or Owner. The Installer shall correct all items and re-schedule the final acceptance test. The new test will start over from the beginning, and nothing previously tested will be accepted. The Installer shall not be entitled to additional compensation to test the system under these conditions.
- G. Upon successful completion of the final acceptance test, the Installer of the system will receive a written notice by the A&E and/or Owner acknowledging the acceptance.
- H. See individual specification sections for system specific requirements for testing.

### **3.5 TRAINING AND INSTRUCTION**

- A. Training for each technology system shall be provided as indicated in this specification and in the individual specification section for each system.
- B. The following training guidelines shall be followed for all technology systems:
  - 1. Training shall not be scheduled in a way that attendee or presenter shall be required to attend more than six hours of training per day.
  - 2. Prior to starting all training, the training submittal shall be approved.
  - 3. No training shall be scheduled prior to the system being completed and accepted by the A&E.
  - 4. Training shall be conducted during normal business hours of the client, at a date and time of mutual convenience to the Owner and Installer. All training sessions need to be scheduled by the Installer at least two weeks in advance. The Owner shall be notified in writing by the Installer with the proposed dates for each session.
  - 5. All different types of training shall be recorded and delivered to the Owner as part of the closeout information in digital format. All recordings shall be recorded in high quality electronic media and submitted to the Owner.
  - 6. The Installer is responsible for completing the list of attendants for each session of training. All these sheets shall be submitted as part of the closeout information.

### 3.6 AS-BUILT DOCUMENTS

- A. Production: During a project, the Contractor shall maintain record "As-Built drawings". One set shall always be maintained at the site. It shall be accurate, clear, and complete, showing the actual location of all equipment as installed. The "As-Built drawings" shall show all technology systems work installed complete to the present stage of progress. These drawings shall be available at any time for review by the A&E's field representatives.
- B. Completion: At the completion of the work, transfer all changes marked in color onto the second set of drawings and submit to the A&E.
- C. Final: Upon Installer's completion of the Engineer's final punch list, transfer all "As-Built" conditions and all requirements by the Engineer to a reproducible set of drawings. Submit full-size drawings and one set of CAD/Autodesk Revit© disks for review and acceptance.
- D. Additional documents: At project completion, the Installer of the technology system shall provide, as part of the "As-Built" documents, updated tables, equipment schedules, configuration worksheets, and labeling system used. See individual system specification section for more details on these documents.
- E. See individual specification sections for each system for additional requirements for "As-Built" documents.

### 3.7 CLOSEOUT DOCUMENTS

- A. Closeout information shall be provided to BTS at the end of the project. The file shall be organized by each system and shall follow this organization:
  - 1. Part 1 – Operation and Maintenance manuals. Operation and Maintenance manuals as issued by the manufacturer of each system's component. Such manuals shall include all maintenance procedures required to be done by the Owner. When required by each individual specification section, a short form operation guide, prepared by Installer for the system, shall be provided.
  - 2. Part 2 – Inventory of Equipment installed. A detailed list of all relevant active equipment (equipment with electronic components with a market value over \$200) installed in the project including the following information and presented in electronic format (Microsoft Excel):
    - a. Make
    - b. Model
    - c. Serial number
    - d. Room location
    - e. Warranty period, including manufacturer's extended warranties

3. Part 3 – Proof Ownership, Delivery, and Acceptance.  
The following letters/documents shall be attached in this part:
  - a. Acceptance letter signed by A&E for each of the technology systems installed.
  - b. Proof of training by submitting sign in sheets for each training session.
  - c. Signed transmittal for all training videos and training material.
  - d. Signed transmittals for all spare parts and consumables delivered to the Owner.
  - e. A list of all usernames and passwords for all software programs used by the technology systems and any equipment with password codes. All levels of passwords shall be provided, from the lowest hierarchy to the highest. Not to be sent via email or any unsecure method.
  - f. Provide at least four copies of all physical keys to the different devices of the technology systems. Each key shall be individually tagged in a key ring. All keys shall be included and organized inside a key ring management enclosure.
  - g. A list of all software modules and licenses delivered to the Owner. The list shall include part numbers, serial numbers, license certificate of authenticity, hardware key (dongles) numbers, and software version. This list shall have a clear signature, name, and date of the person that received this software by the Owner.
  - h. A copy of all official equipment and software registrations with manufacturer.
4. Part 4 – As-Built Documents. All “As-Built” documents as indicated in this specification section

**END OF SECTION 27 00 10**