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**IFB NO. Y19-708-JS** **ISSUED: September 25, 2018**

# INVITATION FOR BIDS

# FOR

# ORANGE COUNTY CONVENTION CENTER NORTH/SOUTH BUILDING SMOKE CONTROL SYSTEM UPGRADES

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PART H
TECHNICAL SPECIFICATIONS

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**PART H**
**Volume II**

Re-Issue Bid Documents
Specifications

# Orange County Convention Center North/South Building Smoke Control System Upgrades

September 6, 2018

**DIVISION 1**



**DIVISION 2**

(NOT USED)

**DIVISION 3**

(NOT USED)

**DIVISION 4**

(NOT USED)

**DIVISION 5**

(NOT USED)

**DIVISION 6**

(NOT USED)

**DIVISION 7**

(NOT USED)

**DIVISION 8**



**DIVISION 9**

(NOT USED)

**DIVISION 10**

(NOT USED)

**DIVISION 11**

(NOT USED)

**DIVISION 12**
(NOT USED)

**DIVISION 13**
(NOT USED)

**DIVISION 14**
(NOT USED)

**DIVISION 20**
(NOT USED)

**DIVISION 26**



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**DIVISION 28**



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SECTION 01 11 00 - SUMMARY OF WORK (OCCC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. When the titles such as Engineer, Project Engineer, or Owner are used throughout the specification, this implies Orange County as property Owner and/or an officially appointed County Representative.

1.2 PROJECT DESCRIPTION

A. Performance of all tasks specified in the contract documents shall be the responsibility of the contractor unless specified otherwise.

1.3 SCOPE OF WORK

A. Summary of Work:

1. Separate the existing smoke control system components from the existing BAS system.
2. Simplification of the smoke control zones and sequence of operation.
3. All existing AHUs, dampers, exhaust fans are to remain in place and be re-connected to operate through a proper UL listed smoke controls device for smoke control operations.
4. To accommodate make-up airflow into the main hall area, several existing doors are to be modified to accommodate approved door hardware for smoke control operations.
5. The existing systems airflows and locations of exhaust are not intended to change.
6. New fire fighter smoke control panel and all required additional devices for monitoring and control over smoke equipment.

B. Summary of Bid:

1. Mobilization: Contractor setup, establish storage facilities, laydown areas, secure areas, temp power, site trailers, etc. include spaces
2. Demobilization: Contractor break down, and relocation efforts for each phase, remove and repair site/project areas to pre-construction status
3. Door Hardware/Accessories and Installation: Not limited to the addition of electronic door operators, provide open/close commands, monitor door status and monitor power status, provide wire and conduit to nearest fire alarm control panel. Program doors to operate as indicated on drawings.
4. New UL Listed Fire Fighters Smoke Control System and Installation: Not limited to, the installation of two display screens and one touch screen in each Fire Command Center (north and south and west) for operation as a Smoke Control Override Panel. Screens to display as indicated on drawings. In addition, any and all programming required to interface with existing systems.
5. Lump Sum Base Bid Total: A total lump sum bid for complete project.
6. Additive #1 – Existing Fire Alarm/BAS System Integration and Decommissioning: This includes, but is not limited to, all required programming modification necessary so that the BAS system no longer acts as a FFSC and that any HCAC equipment associated with the FFSC still operates under normal conditions. In a FFSC situation the BAS shall be overridden by the FFSC panel. Additionally, the commissioning includes ensuring that the existing Simplex fire alarm system properly integrates/communicates all existing and new devices with the new FFSC no matter the manufacturer.

| Item # | **Description** | **QTY** | **Unit** | **Bid Amount ($)** |
|---|---|---|---|---|
| 1 | Mobilization<br>Contractor setup, establish storage facilities, laydown areas, secure areas, temp power, site trailers, etc. include spaces | 1 | LS | |
| 2 | Demobilization<br>Contractor break down, and relocation efforts for each phase, remove and repair site/project areas to pre-construction status | 1 | LS | |
| 3 | Door Hardware/Accessories & Installation | 1 | LS | |
| 4 | New UL Listed Fire Fighters Smoke Control System (FFSC) & Installation | 1 | LS | |
| **5** | **Lump Sum Base Bid Total** | **1** | **LS** | |
| **6** | **Additive # 1:<br>Existing Fire Alarm/BAS System Integration & Decommissioning** | **1** | **LS** | |

1.4 CONTRACTOR RESPONSIBILITIES

A. The contractor shall have all submittals approved by the Engineer and accepted by the Owner prior to the start of active construction.

B. The contractor shall have all equipment and material onsite prior to the start of active construction.

C. The contractor shall submit to the Owner prior to the project pre-construction meeting the following:

- Schedule of Values
- Construction Schedule
- Submittal Schedule
- Emergency Telephone List including subcontractors and suppliers

D. The contractor shall field verify existing conditions of construction prior to start of active construction.

E. The contractor shall coordinate with the Owner on the operation of the existing fire alarm system prior to the start of active construction. There shall be an action plan for the operation of the fire alarm system during construction submitted by the contractor to the Owner for acceptance. This action plan shall be in place prior to the start of active construction. Any false fire alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all costs incurred from the local fire department for responding to a false alarm.

F. The contractor is responsible for moving furniture and/or equipment if necessary to perform the work included in the contract. The contractor is responsible for placing the furniture and/or equipment back in its original location. The contractor is responsible for any damages to furniture, equipment, etc., which occur during construction. The contractor shall provide protection for floors, walls, furniture, equipment and any other items that may be subject to

damage during the construction periods and will be required to repair or replace to original or better condition.

G. The contractor shall coordinate with the Owner on the operation of the security alarm system prior to the start of active construction. The contractor shall submit an action plan for operation of the security alarm system during construction to the Owner for acceptance prior to start of active construction. This action plan shall be in place prior to the start of active construction. Any false security alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all cost incurred from the local police and/or sheriff department for responding to a false alarm.

H. The contractor shall take digital pictures or video of pre-existing conditions of the interior and exterior of the building prior to the start of active construction. Failure to provide digital pictures or video prior to start of construction places the responsibility on the Contractor to complete the necessary replacement, repairs, and/or cleaning as determined by the Owner, at no additional cost to the Owner. One CD copy of digital pictures or video of the existing site conditions shall be submitted to the Owner.

I. The contractor shall at all times maintain daily cleanup of construction areas. The Owner will clean areas that are not cleaned by the contractor and those costs shall be charged back to the contractor via change order.

J. The contractor shall provide a construction schedule to the Owner's Project Manager prior to the pre-construction meeting.

K. The contractor shall update the construction schedule weekly and submit it to the Owner's Project Manager for review.

1.5 WORK UNDER OTHER CONTRACTS

A. Other contracts may be awarded to other contractors to perform separate construction work not associated to this contract at this site. The contractor of this project shall allow reasonable access and coordination to the other contractor/s.

1.6 WORK SEQUENCE

A. Portions of the facility shall remain occupied and operational while work is in progress. The facility shall remain occupied and operational while work is in progress. All work shall be fully coordinated in writing with Orange County Convention Center Project Manager prior to commencement of work. Material and equipment deliveries shall be made during normal business hours.

B. The contractor may work on the weekends at his or her discretion with prior written approval from Orange County Convention Center Project Manager. Weekend work shall not be an additional cost to the Owner. The contractor will coordinate with the Orange County Convention Center Project Manager for access to the building on weekends and after hours work.

C. Orange County Convention Center Project Manager shall direct contractor on which days and hours are acceptable for work.

1.7 CONTRACTOR USE OF PREMISES

A. General: During the construction period, the Contractor shall have limited use of the premises for construction operations, including use of the site based on the Owner. The Owner will dictate move in and move out dates based on show schedules. The Contractor shall coordinate which areas are acceptable to Convention Center Staff for use during the life of the project. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portion of the project.

B. General: Limited use of the premises to construction activities in areas indicated within the limit of the premises. The Contractor may only use portion(s) of the site for storage or work areas only with prior approval from Orange County Convention Center Project Manager.

1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
3. Burial of Waste Materials: Do not dispose of organic and hazardous material on site, either by burial or by burning.
4. Where appropriate, maintain the existing building in a watertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
5. Confine construction operations to the areas permitted by the contract documents and other Owner directives.
6. Provide protection and safekeeping of material and equipment stored on premises.
7. Contractor will move any stored material and equipment, which interfere with operations of the Owner or other contractors at no additional cost to the Owner.
8. Comply with Owner's requirements for ingress and egress procedures, prohibitions against firearms, procedures for transportation of workers, safety and fire prevention requirements and all applicable pollution control requirements. Refer to the following reference requirements:
    a) Orange County Safety and Health Manual http://www.orangecountyfl.net/VendorServices/OrangeCountySafetyand HealthManual.aspx
    b) Orange County Policy Manual page 96 regarding Firearms http://www.orangecountyfl.net/portals/0/resource%20library/employment%20-%20volunteerism/Policy%20Manual.pdf
9. Contractor shall require all employees and subcontractors to wear non-objectionable clothing; prohibit revealing clothing and articles of clothing with offensive writings displayed. The contractor shall require offending personnel to leave the premises until such clothing is changed.
10. Contractor employees and subcontractors will not fraternize with County employees or the general public during the entire construction period.
11. Use of sound equipment (such as boom boxes, stereos, radios, etc.) is not allowed.
12. Contractor and their personnel shall abide to Orange County Tobacco free policy while on any Orange County Convention Center property. This policy shall apply to building, parking lots, parks, break areas and worksites. Tobacco is defined as tobacco products, including but not limited to: Cigars, cigarettes, pipes, chewing tobacco and snuff. Failure to abide by the policy may result in civil penalties levied under Chapter 386, Florida
Statutes and/or Contract enforcement remedies. Refer to the following documents:
    a) Orange County Smoking Policy: http://www.orangecountyfl.net/Portals/0/resource%20library/employment%20-

%20volunteerism/Employee%20Handbook.pdf

13. Conduct that is disrespectful, abusive or otherwise objectionable to the Owners' employees or general public will not be allowed at any time during the construction period. Repetitive complaints and violations of the requirements listed above will be cause for dismissal and or permanent removal of offending personnel from the project.
14. Contractor to coordinate with the Owner the site location for storage of equipment, machinery, materials, tools and a construction waste dumpster.
15. Contractor shall at all times keep the premises free of all waste or surplus materials, rubbish and debris, which is caused by contractor employees or subcontractors resulting from their work. Contractor shall maintain a safe work environment to all building occupants during the construction period.

1.8 SECURITY AND IDENTIFICATION

A. All costs for background investigations will be Contractor's responsibility. The County shall have the right to request any additional investigative background information including, but limited to, the employment record, Right-To-Know records, E-Verify system records (if the Contractor uses this service as a means to determine employment eligibility, available through www.uscis.gov), training records, payroll records, position for which hired including site location of any personnel assigned to perform the services. The Contractor shall furnish, in writing, such information to the extent allowed by law, prior to commencement of services. The County reserves the right to conduct its own investigation of any employee of the Contractor.

B. Background checks for the contractor's staff must be approved by Orange County Convention Center Security Team prior to working in any County facility. Contractors are responsible for obtaining the necessary forms for background checks for work at the Orange County Convention Center. All contractor's staff background checks will be sent to the Orange County Convention Center Project Manager for approval.

C. For security purposes and to maintain privacy, please submit a FDLE Background Checks via e-mail the subject line of the email must contain the following **EXEMPT**

D. The Orange County Convention Center will inform the contractor of their Background Check results. Upon Background Check approval, the contractor's staff shall arrange an appointment with the Orange County staff to obtain an+ Orange County photo ID badge. An affidavit of Identity form (issued by the contractor) and a State of Florida ID or Drivers License will be required.

E. Contractor's employees will not be allowed in Orange County Convention Center facilities without completed and approved background investigations.

F. Work hours shall be scheduled around business activity. Business activity is considered to be Orange County Convention Center office/administrative staff located in or adjacent to construction/renovation site or Orange County Convention Center clients renting convention space located in or adjacent to construction/renovation site. Contractor will be required to mobilize more than once to accommodate Orange County Convention Center show schedules.

1.9 OWNER OCCUPANCY

A. Owner Occupancy: The Owner will be occupying the building during construction. Normal occupancy hours are 7:00 a.m. to 6:00 p.m. Monday through Friday, however this may vary with show activity. The contractor shall coordinate with the Owner's representative for areas in the building where work may be performed during normal business hours. Work performed after normal business hours can be done provided the area where work is done is fully

operational and back in original condition prior to beginning of the next business day. Such placing of equipment and partial occupancy shall not constitute acceptance of the total work.

1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.
2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.
3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.10 DISTRIBUTION OF RELATED DOCUMENTS

A. The Contractor is solely responsible for the distribution of ALL related documents/drawings to ALL appropriate vendors/subcontractors to ensure proper coordination of all aspects of the project and its related parts during bidding and construction.

1.11 CONTRACT DOCUMENT FILE

A. Copies of the Contract Documents, Plans, Specifications, Addenda, Change Orders, Engineers Supplemental Instructions, approved Shop Drawings, Substitution Acceptances, etc. shall be placed and maintained at the project site by the Contractor throughout the entire contract period. These said documents shall be filed in a manner that allows for ease of retrieval. Documents shall be made available to the Engineer and the County's representatives throughout this same period.

PART 2 - PRODUCTS

2.1 ASBESTOS FREE MATERIAL

A. Contractor shall provide a written and notarized statement on company letterhead(s) to certify and warrant that ONLY ASBESTOS FREE MATERIALS AND PRODUCTS were provided AS REQUIRED BY THE Engineer. Such statement shall be submitted with the final payment request. Final payment shall not be made until such statement is submitted. Contractor agrees that if materials containing asbestos are subsequently discovered at any future time to have been included in the construction, the Contractor shall be liable for all costs related to the redesign or modification of the construction of the project so that materials containing asbestos are removed from the facility. If construction has begun or has been completed pursuant to a design that includes asbestos containing materials, the Contractor shall also be liable for all costs related to the abatement of such asbestos.

PART 3 - EXECUTION (Not applicable).

END OF SECTION

# SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

### 1.2 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 01 Section 01 25 00 Substitution Procedures for administrative procedures for handling requests for substitutions made after award of the Contract.
2. Division 01 Section 01 29 00 Payment Procedures for administrative procedures governing applications for payment.
3. Division 01 Section 01 33 00 Submittal Procedures for requirements for the Contractor's Construction Schedule.

### 1.3 MINOR CHANGES IN THE WORK

A. Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the Contract Lump Sum or Contract Time, will be issued by the Project Manager.

### 1.4 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Lump Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.

1. Proposal requests issued by the Project Manager are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.

2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owner's review, an estimate of cost necessary to execute the proposed change.
   a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
   b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
   d. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amount.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representatives findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Lump Sum and Contract Time.

2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Comply with requirements in Section 01 25 00 Substitution Procedures if the proposed change in the work requires that substitution of one product or system for a product or system not specified.

5. Contractor and subcontractors shall provide a complete detailed labor and material breakdown to justify change order request amounts.

C. Proposal Request Form: Project Manager will transfer the information to the appropriate forms for approval. Use AIA Document G 709 for Change Order Proposal Requests.

D. Proposal Request Form: Use forms provided by the Owner for Change Order Proposals.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Project Manager will issue a Change Order for signatures of the Owner and Contractor on County’s Change Order form, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 29 00 – PAYMENT PROCEDURES

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 01 33 00 Submittals Procedures.

1.3 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than Preconstruction Meeting.

2. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

1. Identification: Include the following project identification on the Schedule of Values:

a. Project name and location.
b. Name of the Engineer
c. Project Number
d. Contractor's name and address
e. Date of submittal

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

a. Generic name
b. Related Specification Section
c. Change Orders (numbers) that have affected value
d. Dollar Value
e. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items:

    a. A value will be given for at least every major specification section (subsections can logically be grouped together).
    b. A single material subcontractor will not be required to be broken down into labor and material unless it is anticipated the materials will be stored and invoiced prior to installation.
    c. All multiple item subcontracts or work items (i.e. mechanical, electrical items, etc.) will be shown broken down at least in labor and material (all taxes, burden and overhead and profit included).
    d. Mobilization (move-on, bond, insurance, temporary office and sanitary service installation) shall not exceed 2 1/2% of contract price.
    e. For multi-story work all items broken down per floor.
    f. HVAC: Typically shown per specification section, labor and material, per floor.
    g. Electrical: same as HVAC.
    h. Logical grouping of specification subsections are permitted.

4. Round amounts off the nearest whole dollar, the total shall equal the Contract Sum.

5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

    a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the contract sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner's representative and paid for by the Owner.

    1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements. See items G, I, J and K of this section.

B. Payment Application Times: The period of construction work covered by each Application of Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use the County's most updated form as the form for Application for Payment. Form given at the Preconstruction Conference.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit four (4) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.

F. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors of sub-subcontractors and suppliers for the construction period covered by the previous application.

1 Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2 When an application shows completion of an item, submit final or full waivers.
3 The Owner reserves the right to designate which entities involved in the work must submit waivers.
4 List all Subcontractor's start and finish dates to substantiate any Notice to Owner received by the Project Manager.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

1. List of principal subcontractors
2. List of principal suppliers and fabricators
3. Schedule of Values
4. Approved Contractor's Construction Schedule (preliminary if not final)
5. Schedule of principal products
6. Schedule of unit prices (if applicable)
7. Submittal schedule (preliminary if not final)
8. List of Contractor's staff assignments
9. List of Contractor's principal consultants
10. Copies of building permits for trades requiring separate permits
11. Copies of authorizations and licenses from governing authorities for performance of the Work
12. Initial progress report
13. Report of Pre-construction Meeting
14. Initial settlement survey and damage report, (if required)

15. Listing of all long lead procurement items monthly applications for payment will be accompanied with updated schedule and review of as-built drawings

H. Interim Application for Payment: Payment will be processed once a month. No applications will be processed without receipt of previous months waiver of lien described in subsection F above. Payment for item will be based on percentage completed as determined and approved by the County Project Manager or invoice for stored materials. Retainage (10%) will be held for all interim applications.

I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Application shall also include all items listed in Part H. above.

J. Administrative actions and submittals that shall proceed or coincide with Substantial Completion Payment. Substantial Completion as defined per General Conditions Section "F" application include:

1. Occupancy permits and similar approvals
2. Warranties (guarantees) and maintenance agreements
3. Test/adjust/balance records
4. Maintenance instructions
5. Start-up performance reports
6. Change-over information related to Owner's occupancy, use, operation and maintenance
7. Final cleaning
8. Application for reduction of retainage, and consent of surety
9. List of incomplete Work, recognized as exceptions to Project Manager's Certificate of Substantial Completion

K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment. Application for Payment includes the following:

1. Completion of Project Close-Out requirements
2. Completion of items specified for completion after Substantial Completion
3. Assurance that unsettled claims will be settled
4. Assurance that all work has been completed and accepted
5. Proof that taxes, fees and similar obligations have been paid
6. Removal of temporary facilities and services
7. Removal of surplus materials, rubbish and similar elements
8. Change of door locks to Owner's access
9. Submission of all close-out documents. Refer to Section 01 77 00 Closeout Procedures.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

# SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

## PART 1 -GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section specifies administrative and supervisory requirements necessary for project coordination including, but not necessarily limited to:

1. Coordination
2. Administrative and supervisory personnel
3. General installation provisions
4. Cleaning and protection

B. Progress meetings, coordination meetings and Pre-installation conferences are included in Section 01 31 19 Project Meetings.

C. Requirements for the Contractor's Construction Schedule are included in Section 01 33 00 Submittal Procedures.

### 1.3 COORDINATION

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specification that are dependent upon each other for proper installation, connection, and operation.

1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required: notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Schedules
2. Installation and removal of temporary facilities
3. Delivery and processing of submittals
4. Progress meetings
5. Project close-out activities

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment (if any) involved in performance of, but not actually incorporated in, the Work.

E. Lack of coordination as specified in this and other sections of the contract documents are grounds for assessment of back charges and/or termination in order to remediate the situation.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the interrelationship of components shown on separate Shop Drawings.

2. Indicate required installation sequences.

3. Comply with requirements contained in Section 01 33 00 Submittal Procedures.

B. Staff Names: At the Preconstruction Conference submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to Project Manager for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Project Manager for final decision.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as directed by the Project Manager and as frequently as necessary to ensure its integrity and safety through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading
2. Excessively high or low temperatures
3. Excessively high or low humidity
4. Air contamination or pollution
5. Water
6. Solvents
7. Chemicals
8. Soiling, staining and corrosion
9. Rodent and insect infestation
10. Combustion
11. Destructive testing
12. Misalignment
13. Excessive weathering
14. Unprotected storage
15. Improper shipping or handling

16. Theft
17. Vandalism

END OF SECTION

SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference
2. Pre-Installation Conference
3. Coordination Meetings
4. Progress Meetings

B. Construction schedules are specified in Section 01 33 00 Submittal Procedures.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than 20 days after execution of the agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: The County's Representative, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:

1. Tentative construction schedule
2. Critical Work sequencing and/coordinating
3. Designation of responsible personnel
4. Procedures for processing field decisions and Change Orders
5. Procedures for processing Applications for Payment
6. Distribution of Contract Documents
7. Submittal of Shop Drawings, Product Data and Samples
8. Preparation of record documents
9. Use of the Premises
10. Office, Work and storage areas
11. Equipment deliveries and priorities
12. Safety procedures
13. First aid
14. Security
15. Housekeeping
16. Working hours

D. Contractor must submit at the time of the meeting at least the following items:

1. Schedule of Values
2. Listing of key personnel including project superintendent and subcontractors with their addresses, telephone numbers, and emergency telephone numbers.
3. Preliminary Construction Schedule
4. Submittal Schedule

1.4 PRE-INSTALLATION CONFERENCE

A. Conduct a Pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise at least 48 hours in advance the Project Manager of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

a. Contract Documents
b. Options
c. Related Change Orders
d. Purchases
e. Deliveries
f. Shop Drawings, Product Data and Quality Control Samples
g. Possible conflicts
h. Compatibility problems
I. Time schedules
j. Weather limitations
k. Manufacturer's recommendations
l. Comparability of materials
m. Acceptability of substrates
n. Temporary facilities
o. Space and access limitations
p. Governing regulations
q. Safety
r. Inspection and testing requirements
s. Required performance results
t. Recording requirements
u. Protection

2. Record significant discussions and agreements and disagreements of each conference along with and approved schedule. Distribute the record of the meeting to everyone concerned promptly including the Owner and Engineer.

3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 COORDINATION MEETINGS

A. Conduct project coordination meeting at weekly intervals on day and time as established by the Project Manager or more frequently, if necessary convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved, to include subcontractors and representatives.

C. Contractor shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at bimonthly intervals or more frequently if necessary as directed by the Project Manager. Notify the Owner at least 48 hours in advance of scheduled meeting time and dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Engineer, each subcontractor, supplier or other entity concerned with current progress of involved in planning, coordination or performance of future activities with the project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time, ahead, or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including such items as:
   a. Interface requirements
   b. Time
   c. Sequences
   d. Deliveries
   e. Off-site fabrication problems
   f. Access
   g. Site utilization
   h. Temporary facilities and services
   I. Hours of work
   j. Hazards and risks
   k. Housekeeping
   l. Quality and work standards
   m. Change Orders

n. Documentation of information for payment requests.

D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, or progress since the previous meeting and report.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:

1. Contractor's Construction Schedule
2. Submittal Schedule
3. Daily Construction Reports
4. Shop Drawings
5. Product Data
6. Samples

B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

1. Permits
2. Applications for Payment
3. Performance and Payment Bonds
4. Insurance Certificates
5. List of Subcontractors with start and finish dates (update as necessary)
6. Schedule of Values
7. Construction Schedule

C. The Schedule of Values submittal is included in Section 012900 "Payment Procedures".

1.3 ELECTRONIC SUBMITTAL PROCEDURES

A. General: Submittals shall be submitted electronically directly to the Engineer from the General/Mechanical/Electrical Contractor.

1. **All shop drawings and other submittals as specified herein, shall be submitted in electronic format.** All electronic CAD generated drawings shall be in Acrobat PDF format and all product data or other information shall be submitted in Acrobat PDF format. Coordinate with Engineer prior to submitting. All electronic submittals shall be posted to the Engineer's FTP site. Information regarding the username and password shall be distributed to all parties prior to the pre-construction meeting.

B. Electronic copies of CAD drawings made from the Construction/Contract Documents will not be provided by Engineer without a written indemnification. Indemnification form will be

provided by the Engineer at Pre-Construction Meeting to the General/Mechanical/Electrical Contractor upon written request.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
2.. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. The Project Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Project Manager will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
b. If an intermediate submittal is necessary, process the same as the initial submittal.
c. Allow two weeks for reprocessing each submittal.
d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
3. Include the following information on label for processing and recording action taken:

a. Project name.
b. Date.
c. Name and address of Engineer.
d. Name and address of Contractor.
e. Name and address of subcontractor.
f. Name and address of supplier.
g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 221116.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 221116.01.A).

2) Where multiple products are shown, highlight/circle or identify product intended to be used

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

E. Contractor shall be responsible for cost of re-review of rejected submittals, shop drawing, etc. Costs for re-review shall be reimbursed to the County by deducting the cost from the Contractors monthly progress payments. Costs to be determined by applying the consultants standard billing rates, plus 10% handling by the County.

F. Substitution request to specified products will be made within 30 days of Notice to Proceed. After the 30 day period, no requests for substitutions from the Contractor will be considered.

1. Substitution submitted within the first 30 days will have product data from specified and requested substitute submitted together and demonstrate better quality, cost savings if of equal quality, or show benefit to the County for excepting the substitute.

G. Once electronic submittals are approved or approved as noted, they will be transmitted to the owner.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the Schedule of Values.

2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.

3. Prepare the schedule on a sheet, series of sheets, stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.

5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.

6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

B. Phasing: Provide notations on the schedule to show how the sequence of the work is affected by requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.

C. Work Stages: Indicate important stages of construction for each major portion of the work, including testing and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating precalculated and actual costs. On the line show dollar-volume of work performed as the dates used for preparation of payment requests.

1. Refer to Section Applications for Payment for cost reporting and payment procedures.

F. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the project meeting room and temporary field office.

1. When revision are made distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

G. Schedule Updating: Revise the schedule monthly or work stage, where revisions have been recognized or made. Issue the updated schedule concurrently with monthly pay request.

1.5 SUBMITTAL LOG

A. After development and acceptance of the Contractor's construction schedule, prepare a complete log of submittals.

1. Coordinate submittals log with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.

2. Prepare the log in chronological order; include all submittals required. Provide the following information:

a. Scheduled date for the first submittal
b. Related Section number
c. Submittal category
d. Name of subcontractor
e. Description of the part of the work covered
f. Scheduled date for resubmittal
g. Scheduled date for the Engineer's final release or approval.

3. All submittals must be received within the first 25% of contract time.

B. Distribution: Following response to initial submittal, print and distribute copies to the Project Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Log Updating: Revise the log after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Project Manager at weekly intervals:

1. List of subcontractors at the site
2. Approximate count of personnel at the site
3. High and low temperatures, general weather conditions
4. Accidents and unusual events
5. Meetings and significant decisions
6. Stoppages, delays, shortages, losses
7. Meter readings and similar recordings
8. Emergency procedures
9. Orders and requests of governing authorities
10. Change Orders received, implemented
11. Services connected, disconnected
12. Equipment or system tests and start-ups
13. Partial completions, occupancies
14. Substantial Completions authorized

1.7 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawings and will be rejected.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. All required dimensions
2. Identification of products and materials included
3. Compliance with specified standards
4. Notation of coordination requirements
5. Notation of dimensions established by field measurement
6. Sheet Size: Except for templates, patterns and similar full-size Drawings on sheets at least 8" x 11" but no larger than 24" x 36".

7. Number of Copies: Submit one (1) electronic copy of each submittal to the County's Representative, unless copies are required for operation and maintenance manuals. Submit one (1) electronic copy where copies are required for operation and maintenance manuals. Engineer will retain 1 electronic copy. Mark up and retain one returned electronic copy as a Project Record Drawing.
8. Submit one (1) hard copy once approved for legal seal stamping if needed at jobsite. Coordinate with Engineer and County's Representative.
9. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.

C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.
2. Submit coordination Drawings for integration of different construction elements. Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.

3. Contractor is not entitled to additional payments due to lack of compliance with this Section.

1.8 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawing".

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

   a. Manufacturer's printed recommendations
   b. Compliance with recognized trade association standards
   c. Compliance with recognized testing agency standards
   d. Application of testing agency labels and seals
   e. Notation of dimensions verified by field measurement
   f. Notation of coordination requirements
   g. Manufacturers local representative and phone number.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.

4. Submittals: Submit six (6) copies of each required submittal. The Project Manager will return two (2) sets to the Contractor marked with action taken and corrections or modifications required.

    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
    a. Do not proceed with installation until an applicable copy of Product Data applicable is in the Installer's possession.
    b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.

1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Engineer's/Owner's Sample. Include the following:

    a. Generic description of the Sample
    b Sample source
    c. Product name or name of manufacturer
    d. Compliance with recognized standards
    e. Availability and delivery time

2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

    a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.

    b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.

3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

    a. Preliminary submittals will be reviewed and returned with the Engineer's/Owner's mark indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.

5. Maintain sets of Samples, as returned, at the project site, for quality comparisons throughout the course of construction.

    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
    b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field Samples specified in individual sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.

    a. Comply with submittal requirements. Process transmittal forms to provide a record of activity.

1.10 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Project Manager will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Engineer/Project Manager will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:

1. Final Unrestricted Release: Where submittals are marked No Exceptions Taken, that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

2. Final-But-Restricted Release: When submittals are marked Made Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

a. Do not permit submittals marked Revise and Resubmit to be used at the Project site, or elsewhere where work is in progress.

4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 33 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 26, 27, 28 sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform Work.

4. Indicate dates when cutting and patching is to be performed.

5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

7. Approval by the Engineer to proceed with cutting and patching does not waive the Engineer's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements.

    a. Foundation construction
    b. Bearing and retaining walls
    c. Structural concrete
    d. Structural steel
    e. Lintels
    f. Timber and primary wood framing
    g. Structural decking
    h. Miscellaneous structural metals
    I. Stair systems
    j. Exterior curtain wall construction
    k. Equipment supports
    l. Piping, ductwork, vessels and equipment

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Refer to Division 26, 27, 28 sections regarding Fire Rated Penetrations.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.

    a. Shoring, bracing and sheeting
    b. Primary operational systems and equipment
    c. Air or smoke barriers
    d. Water, moisture, or vapor barriers
    e. Membranes and flashings
    f. Fire protection systems
    g. Noise and vibration control elements and systems
    h. Control systems
    I. Communication systems
    j. Conveying systems
    k. Electrical wiring systems

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

    a. Processed concrete finishes
    b. Preformed metal panels
    c. Window wall system
    d. Stucco and ornamental plaster
    e. Acoustical ceilings
    f. Carpeting

g. Wall covering
h. HVAC enclosures, cabinets or covers
I. Roofing systems

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise indicated by Engineer/Owner. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas and interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.

4. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.

a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature.

B. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged materials to their original condition.

END OF SECTION

SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification Sections, apply to this Section.

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:

1. Inspection procedures
2. Project record document submittal. (substantial completion requirements)
3. Operating and Maintenance Manual Submittal (substantial completion requirements).
4. Submittal of warranties (substantial completion requirement).
5. Final cleaning

B. Final Payment to be made when the County has received all required close-out documents.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following: List exceptions in the request.

1. In the Application for Payment that coincided with, or first follows, the date Substantial Completion in claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the County's Project Manager will either proceed with inspection or advise the Contractor of unfilled

requirements. The County's Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. Results of the completed inspection will form the basis of requirements for final acceptance.

2. Should the project fail to meet the standards required for Substantial Completion as defined in the documents, the Contractor will pay the expense of a second inspection by the Engineer and the Owner. Cost will be deducted from the Contractor's retainage.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following list exceptions in the request:

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and complete operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Lump Sum.

3. Submit a certified copy of the Engineer or Owner's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager.

4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.

5. Submit consent of surety to final payment.

6. Submit a final liquidated damages settlement statement

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Engineer will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of reinspection, the Engineer will prepare a certification of final acceptance, or advise the contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposed; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation; where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owner's representative.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.

2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.

4. Submit one (1) hardcopy of the most current record set of drawings when the project is considered 50% substantially complete for review and comment by Owner.

5. Organize record drawing sheets, and print suitable titles, dates and other identification on the cover of each set.

5. Provide three (3) additional sets of black line drawing sets of As-Built Drawings.

6. Provide one (1) CD-ROM with all As-Built Drawings in AudoCAD and PDF format.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.

1. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.

D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily

discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Engineer for the Owner's records.

E. Record Sample Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Engineer and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owner's records.

G. Maintenance Manuals: Organize operating and maintenance data into four (4) suitable sets of manageable size and electronically as PDFs on one (1) CD-ROM compact disc. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions
2. Spare parts list
3. Copies of warranties
4. Wiring diagrams
5. Recommended turn-around cycles
6. Inspection procedures
7. Shop Drawings and Product Data
8. Fixture lamping schedule

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSE-OUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that required regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. All items to be provided or competed prior to Certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems

8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments
13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.

B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments

3.2 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide one (1) hardcopy.

B. Bind in commercial quality 8-1/2” x 11" three ring binder, indexed with hardback, cleanable, plastic covers.

C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.

D. Provide table of contents: Neatly typed, in the following sequence:

1. Final Certificate of Occupancy
2. Warranty Service Subcontractors Identification List
3. Final Lien Waivers and Releases
4. Warranties and Guarantees
5. Systems Operations and Maintenance Instruction
6. Manufacturer’s Certificates and Certifications
7. Maintenance Service Contracts
8. Spare Parts Inventory List
9. Special Systems Operating Permits or Approvals
10. Asbestos free materials notarized statement

E. Provide all documents for each section listed. List individual documents in each section in the Table of Contents, in the sequence of the Table of Contents of the Project Manual.

F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the product or work item.

G. Separate each section with index to sheets that are keyed to the Table of Contents listing.

H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.

I. Electronic Close-out DVD: At the completion of the project, submit one copy of a DVD with entire project close out information below in PDF format. All letter, legal and brochure size sheets shall be portrait and the As-build drawings will be landscape. All fonts will be Arial. All items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify words on the scanned documents.

1. Contacts: Set up a separate PDF for the contacts. No bookmarks are needed for this section.
2. As-Builts: All as-built drawings will be landscape.
3. Submittals: All technical submittal items (approved and approved as noted) will be provided and sorted by the 02 – 48 standard divisions. Bookmarks will be needed for the appropriate divisions.
4. Operations and Maintenance Manual: Specify the division name only in the bookmarks (02 – 48). Please note that all items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify works on the scanned documents.
5. Permitting: This should include the Certificate of Occupancy and any other document that the Project Manager may include pertaining to the permitting for the project.

## 3.3 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

    a. Remove labels that are not permanent labels.
    b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
    d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
    e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.

C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01 78 00 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contractor Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General closeout requirements are included in Section 01 77 00 Closeout Procedures.

3. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in this document.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

B. Reinstatement of Warranty. When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligation, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

E. The Owner reserves the right to refuse to accept work for the Project where a special warranty, certification, or similar commitment is required on such work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.4 WARRANTY PERIOD

A. The Contractor shall participate with the County and the Engineer's representative, at the beginning of the tenth month of the warranty period, in conducting an on site review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Engineer/Owner during on the site review.

B. All warranties and guarantees shall commence on the date of Substantial Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the County's acceptance of that work.

C. Warranty period shall be manufacturer's standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

1.5 SUBMITTALS

A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Engineer's Certificate of substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the work, submit written warranties upon request of the Project Manager.

1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen days of completion of that designated portion of the work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for executing by the required parties. Submit a draft to the Engineer for approval prior to final execution.

1. Refer to individual sections for particular requirements for submittal of special warranties.

C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3 ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 1/2“ by 11" paper.

1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title “WARRANTIES AND BONDS’, the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 80 00 - ORANGE COUNTY BCC STANDARDS SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. The following is a summary of key points in the Orange County BCC security standards. It is necessary for vendors to completely understand and follow these requirements in order for products or services to be considered for placement within the Orange County BCC environment. Complete details about these standards can be found in the Orange County Government Standards and Guidelines packet.

1.2 WEB SERVERS

A. Web and Data Placement

1. A database server shall not reside in the same hardware platform as a web server.

B. Anonymous Accounts

1. Web server anonymous accounts shall only have read and execute permissions to folders/files within the web server directories. Change and delete permissions to folders/files that are directly accessible via a web browser shall not be granted to web server anonymous accounts.

1.3 DMZ

A. Web Server Platforms

1. Microsoft Internet Information Server (IIS) version 5.0 or higher shall be the only platform within the DMZ to run as a Web or FTP server.

B. Services and Protocols

1. Traffic using the following protocols from the DMZ to the internal network shall not be allowed: Kerberos, NetBIOS, Microsoft- DS, Microsoft's Well Known Ports, LDAP, RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.

C. Encrypted Data

1. Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: Name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information. The OCGBCC DMZ shall not have access to data containing bank information. The OCGBCC DMZ shall not have access to social security information.

D. Data Access

1. The OCGBCC DMZ shall have read only access to live data, if such data is also used by applications residing in the internal OCGBCC network.

1.4 ANTIVIRUS

A. Virus scanning

1. Antivirus software shall be running at all times on the computers which it is installed.

1.5 MICROSOFT SECURITY PATCHES

A. Patch Installation

1. MS Security Patches may be applied immediately upon release by Microsoft. All vendors must support their applications in this environment.

1.6 DESKTOP COMPUTING STANDARDS

A. AUTHORIZED PRODUCTS

1. Hardware-Provide one Personal Computer as follows:

a) Dell Desktop minitower and small form factor (SFF) PC
b) Dell GX960
c) Energy Smart system enabled
d) Intel Core 2 Duo processor or better
e) Minimum 2 Gb of Memory
f) Maximum 4 Gb Memory
g) USB Keyboard and Mouse
h) 160 GB SATA Hard drive
i) DVD+/- RW
j) 19" HD LCD Monitor
k) 4 Year Basic Limited Warranty and 4 year Onsite Service
l) Intel vPro enabled

B. OPERATING SYSTEMS and PROTOCOLS

1. Desktop
   a) Microsoft Windows 7 Professional with IE 8 (for new PCs)
   b) Microsoft Windows XP Service Pack 3 (for existing PCs)
   c) Internet Explorer 8.0- IE8 is current County Standard included with Windows 7. IE7 is available for backwards compatibility.
   d) Application software may specifically require a certain Internet Explorer version. Contact ISS for assistance as needed. ServiceCenter@ocfl.net
   e) Microsoft Office 2003 or greater (Standard or Professional Suite)
2. Portable Devices
   a) Blackberry OS
3. Network Connectivity
   a) Cisco Wireless Access Points, Cisco 802.11 LAN Card
   b) TCP/IP
   c) Sprint Wireless AirCard

C. CLIENT DATABASES

1. Desktop/Workstations Only, Single User Only
   a) Microsoft Access (user databases not supported)
   b) Oracle Client
   c) SQL Server Client

D. PERIPHERALS and ACCESSORIES

1. HP LaserJet series
   a) Black and White LaserJet
   b) P1606dn < 4 users
   c) P3015dn (supports secure printing – PIN)
   d) P4015dn 8+ users (supports secure printing – PIN)
2. Color LaserJet
   a) CP2025dn
   b) CP4525dn 7+ users (supports secure printing – PIN)
   c) 5550dn 15+ users (supports secure printing – PIN)

3. Desktop Copier and combo unit purchases directly connected to the PC must be reviewed and approved by ISS. Contact ServiceCenter@ocfl.net for more information and assistance.

E. UNSUPPORTED PRODUCTS

1. Hardware
   a) Pre-Pentium class desktop systems
   b) Non-Dell PCs
   c) Non-Blackberry Smartphones
2. Operating Systems and Protocols
   a) Microsoft Windows 2000
   b) Microsoft Windows NT 4.0
   c) Microsoft Windows 3.x, Windows 95 and 98
   d) MAC OS
3. Client Databases
   a) Dbase
   b) RBASE
   c) Paradox
   d) FOXPRO
4. Desktop Applications:
   a) Desktop/Workstation
      1. MS Office platforms prior to Office 2000
      2. ProComm
      3. Microsoft Internet Explorer, 4.x, 5.x
      4. McAfee Viruscan **Trend Micro is OCGOV standard*
      5. WordPerfect
      6. Quattro
      7. Hotmetal
      8. Freelance
      9. Harvard Graphics
      10. Lotus Suite
      11. Netscape, Opera, Firefox Browsers
      12. Rumba
      13. LAN Workplace
      14. Exceed
      15. Visio 3.x and older
      16. SHL Vision & Vision Express, WIN9x/WINNT/UNIX
      17. McAfee Remote Desktop32
      18. Reflection version 9 or lower
      19. PC Anywhere
5. Peripherals and Accessories
   a) HP LaserJet Series 4 and older printers
   b) Inkjet printers

F. PROHIBITED PRODUCTS

1. Hardware
   a) Personal (non-County) PCs
   b) Any network (voice or data) device not operated, administered or expressly approved by Orange County ISS.
   c) Any internet access device not operated, administered or expressly approved by Orange County ISS.

2. Operating System and Protocols
   a) Windows 9x
   b) Windows Vista
   c) 64 bit operating systems
3. Network Protocols
   a) NETBUI
   b) AppleTalk
   c) Token Ring
   d) Any network (voice or data) software or service not operated, administered or expressly approved by Orange County ISS.
   e) Any internet access service not operated, administered or expressly approved by Orange County ISS.
4. Applications
   a) Any Alpha/Beta Software not operated, administered or expressly approved by Orange County ISS
   b) Anti-virus products other than Trend Micro
   c) Personal firewall products
   d) Network scanning tools
   e) Remote access software other than ISS authorized VPN
   f) User installed screen savers
   g) Games
   h) 3rd Party Desktops
   i) Disk Compression
   j) Non-Static BITMAP Backgrounds or screen savers
   k) iTunes (or other content sharing applications)
   l) P2P software
5. Peripherals and Accessories
   a) Portable music devices
   b) Personal (non-County) mass storage devices (hard drives, thumb drives, etc)
   c) Webcams

1.7 VOICE AND DATA COMMUNICATIONS NETWORK STANDARDS AND PRACTICES

A. PROTOCOL NODE NAMES AND ADDRESSES

1. The ONLY protocol allowed on the Orange County Data Network is the Internet Protocol referred to as IP or TCP/IP version 4.
2. There can be only one unique address for each node on the network. Node naming and addressing conventions will conform to the guidelines established here.
3. The NOC assigns all addresses for all devices connecting to the Orange County Network.
4. All IP addresses conform to R.F.C. 1918:
   a) 10.0.0.0 10.255.255.255/8
   b) 172.16.0.0 172.31.255.255/12
   c) 192.168.0.0 192.168.255.255/16
5. The NOC maintains an addressing plan and uses the plan to assign addresses. The Internet Addressing Authority, as a private entity, has assigned a block of addresses for Orange County, which are maintained and assigned by the NOC.
6. The use of Registered Internet addresses on the county network is not allowed.

7. All network numbers for “special function” TCP/IP networks will be assigned by the NOC.
8. No INTERNET connections are allowed from any node, modem, or communications device on the network without NOC and Enterprise Security approval.
9. A network-wide, shared use INTERNET connection is available to all entities.
10. TCP/IP DOMAIN NAME SERVERS (DNS) are provided for use as an alternative to local administration and maintenance of a “hosts” file. Any Divisions, Elected Officials, or agencies wishing to use the DNS may send a list of I.P addresses to be included in the DNS to the ISS Service Center, 836-2929, which will be routed to NOC staff.
11. Entities who have dedicated network staff and wish to be assigned their own I.P. address space will request the assignment from the NOC through the ISS Service Center, 8362929. These entities will provision their own DNS and be responsible for administration of their own I.P. address spaces. (As assigned by the NOC for the agency to administer). Only routed networks with at least 254 I.P. nodes are eligible for this option.
12. DHCP (Dynamic Host Configuration Protocol) Is provided by the NOC.
13. No shared device (printer, server) may use a DHCP address.
14. Static IP addresses are available in limited amounts on request.

B. BRIDGES, ROUTERS, GATEWAYS

1. Routers will be used at points in the network where traffic control and/or broadcast domain segmentation needs exist.
2. Routers will be used on all Wide Area Network connections.
3. Protocol conversion is not supported on this network, as one common protocol (TCP/IP) is standard for all nodes.

C. NETWORK SECURITY

1. All default accounts on all processors connected to the network will either be disabled or have the default password changed. No accounts are allowed without passwords.
2. The default “privileged password” on all network electronics will be changed.
3. All dial-up access must be provided through secure access servers. No direct access via dial-up lines is allowed to any type of device, processor, terminal, server, or PC connected to the network.
4. The NOC provides and maintains a secure access server for Dial-up use. The requesting employees supervisor must contact the ISS Service Center 836-2929 and approve permission for remote access for the requesting employee. The request is handled by the Enterprise Security Team, and final approval is decided.
5. Administration. The requesting department will provide the Hardware and Software for the employee’s home use, unless the employee provides their own.
6. Vendor field service is provided remote access through the NOC provided access servers. A V.90 dial-up server is available. A CISCO VPN concentrator is also available for use with CISCO VPN client.
7. No entity on the network shall make any connection to the INTERNET, dial-up service, wireless provider or wireless access-point without written permission from the ISS Enterprise Security Team and Network Operations.
8. An INTERNET gateway is provided for all entities on the network to use.

9. Any entity that chooses to directly connect their network to the INTERNET may not remain connected to the County Network due to the security risks. If the Internet connected entity supplies, at their own expense, an acceptable Firewall between their networks and the County networks, the County network connection can resume via the Firewall provided.
10. All PC's on the network will be provisioned with virus detection and correction software. This software must be kept current by procuring new updates from the virus software vendor.
11. Any PC software loaded via network download or from magnetic media will be virusscanned by the PC user.
12. Wireless LAN (Ethernet)
    a) All 802.11x wireless LANs must use a DOT1X supplicant for network admission control.
    b) All 802.11x clients must use VPN triple DES or AES encryption. Client authentication via RADIUS server is required. The RADIUS server is provided and administered by ISS Enterprise Security.
13. All access points attached to the BCC network must be LWAP. (No stand alone AP's are permitted)
14. Wireless WAN
    a) The contracted wireless provider. Access to the network using any other wireless provider is prohibited.

D. NETWORK COMPONENTS

1. TRANSMISSION MEDIA: Fiber-optic, category 5, 5e, and 6, and category 3 UTP (Unshielded Twisted Pair), STP (Shielded Twisted Pair), and radio (802.11x) are all permitted for IP and ATM data communications in the network.
2. TRANSMISSION METHODS: Optical, metallic cable, leased data circuits (analog, digital), private (analog, digital), and wireless (802.11x) are all permitted for IP and ATM data communications in the network.
3. SUPPORTED LAN TYPES: ETHERNET, 802.3, 10 BASE T, 100 BASE TX, 100 BASE FX, 1000 BASE xx (Gigabit), 802.11x (wireless Ethernet), 10 GIGABIT, 10GbE, 10GIGE
4. Etherchannel: The only Etherchannel protocol that is supported by the BCC is 802.3ad

E. NETWORK CIRCUITS

1. The NOC will design all WAN networks and if required, procure leased data communications circuits from the Carrier.
2. The NOC will act as the central point of contact between all entities using WAN circuits.
3. The NOC will be notified by the affected entity and/or the ISS Service Center of service affecting WAN outages. The ISS Service Center, 836-2929, and the NOC will be responsible for coordinating successful repair of WAN circuits.
4. The NOC will be responsible for ordering the disconnection and termination of leased data circuits.
5. Critical LANs and/or WANs may be designed with duplicate, automatic, redundant circuits and electronics to provide automatic recovery of data communications.

6. Circuits leased by any entity other than the BCC will be managed by that entity's technical staff.

7. A Remote Site is available for recovery of certain critical applications and BCC networks in the event of a formally declared disaster. This site is located in Tallahassee at the Northwest Regional Data Center. (NWRDC). The NWRDC is permanently connected to the BCC networks, available and operational 24x7x365.

F. INSTALLATION

1. In situations where installation of network equipment by one entity may affect other customers from other entities, the installation will be jointly coordinated by representatives of the NOC and the other entities.

2. The NOC will design and install all LAN and WAN networks, except in special circumstances.

G. TROUBLE REPORTING

1. Customers who are exclusively confined to applications delivered by networks supplied by the NOC will call or e-mail the ISS Service Center, 836-2929 to report trouble, request service, and get technical advice. The ISS Service Center will screen all calls, resolve any problems it is able to with ISS Service Center staff, and refer unresolved network problems to the NOC.

2. Customers who are exclusively confined to applications on networks supplied by other entities will call that entity's network staff to report trouble, request service, and get technical advice.

3. Customers who are on a mix of processors and networks supplied by the NOC and other entity's processors and networks will call the ISS Service Center, 836-2929 to report trouble, request service, and get technical advice.

4. The NOC employs a variety of network management and troubleshooting tools and systems. These network management systems are used by the NOC staff to perform testing, troubleshooting, and diagnosis of all devices attached to the network.

5. All LAN equipment attached to the network must support SNMP (Simple Network Management Protocol) and/or SNMP-2. RMON (Remote Monitoring) is also allowed, but not instead of SNMP. RMON is in addition to SNMP. Older equipment not supporting these standards will be phased out.

6. Network problems, which can be repaired by the NOC, will be scheduled in a repair queue. The repair priority is based on the severity of the problem and the quantity of customers affected.

7. All devices attached to the network will have at least a minimum SNMP profile entered, consisting of the entity's name, address, and technical support staff phones number. This will assist NOC staff in locating which network the equipment is on when troubleshooting.

H. PERFORMANCE MANAGEMENT

1. The NOC is responsible for monitoring all LAN and WAN performance. This includes all SNMP (Simple Network Management Protocol) and RMON (Remote Monitoring). Only the NOC is allowed to run SNMP/RMON on CISCO network devices.

2. The NOC will redesign networks, which sustain traffic loads that adversely affect customer interactive response times and/or reliability.

3. The NOC will assist other entities with managing the performance of their networks as requested.

I. DOCUMENTATION

1. Each entity on the network will provide the NOC with a current diagram of network topology, equipment location, and configuration (including building address and floor location).
2. The NOC will provide a diagram of the complete network as well as tables and listings of all physical and logical components to any requesting entity.
3. Each entity on the network will provide on-going, updated information to the NOC reflecting components, circuits and logical changes.
4. The NOC will add this information to its diagram and database, and will provide the revised network documents to all requesting entities.

J. TELEPHONY STANDARDS

1. All telecom related applications must be certified under the Avaya DevConnect program and must be compatible with Orange County's current level of Avaya Communications Manager for the appropriate site.
2. Any peripheral applications or software must be approved by the Telecom Unit prior to purchasing.

K. IP TELEPHONY

1. IP telephony is defined as telephones and PBX with an integral Ethernet NIC, using the IP protocol to communicate.
2. IP phones must derive their electrical power from the CAT-5e Ethernet cable. (POE type-1, 802.af standard)
3. Ethernet switches in the closets will be used to provide in-line DC power through the CAT5e patch panels. All Ethernet electronics used in this configuration will have a UPS attached.
4. If the IP phone has a provision to connect the desktop PC into the same Ethernet as the phone, then the IP phone must use Ethernet switch technology. A hub/repeater is not allowed.
5. IP phones must operate in a separate subnet from the attached PC.
6. IP phone packets will be given the highest priority of all IP communications traffic on the LAN, WAN, and MAN. Other non-telephony applications will have their "IP Precedence" bit modified at the Ethernet switch to conform to this standard.
7. IP phone access to the network through the internet provider will use the ISS provided VPN services. Direct access to internal devices is prohibited.

L. VIDEO

1. Enterprise Security is responsible for ISS video service, however deployment of video equipment on the local government network must be discussed prior to purchase with Network Services to determine compatibility, bandwidth, network equipment requirements and installation feasibility.
2. Multicast is generally not supported on BCC networks, except in certain special cases.

PART 2 - SECURITY

2.1 SECURITY STANDARDS

A. UNIX ENVIRONMENT

1. Purpose: To establish requirements which shall be met by all computers connected to the Orange County government network to ensure effective operating system and system integrity.
2. Scope: This policy applies to all Orange County government computers running any version of the UNIX/AIX Operating Systems. This includes, but is not limited to, servers, workstations and all other appliances with operating systems that are connected to a network.
3. Policy
   a) Software Selection
      1. Business Applications Software shall not have a web interface that allows users to access the system as a privileged account. This includes – but is not limited to – root or the application account owner's ID.
      2. Business Application Software shall not run root processes.
      3. Business Application Software shall be installed using a unique user ID and unique group ID. This unique user id (UID) will be considered a privileged account.
      4. Business Application Software shall not be installed in any file system that is part of rootvg. This includes /opt and /usr.
      5. Business Application Software shall not write log files to any file system that is part of rootvg. This includes /var.
      6. Business Application Software should not use /tmp for storage. If an application does use /tmp, these files shall be purge-able by root without affecting the business application's integrity. No notification will be given when these purges occur.
      7. Business Application Software shall not use a .rhost file and shall not use any "r" commands.
      8. Business Application Software shall not update root system's files during installation.
      9. Business Application Software shall use the file system names provided by Orange County's UNIX administrators.
      10. Business Application Software shall be maintained at vendor (IBM) supported operating system (AIX/Linux) levels.
      11. Business Application Vendors shall provide a method of purging obsolete / temporary / log files created by the application software.
      12. Orange County's Storage Administrators will determine the appropriate storage architecture (LUN / meta-LUNs / RAID levels).
   b) System Requirement - Hardware
      1. The Business Application Vendor shall provide, at a minimum, the following for each environment (development / testing / production / etc.):
         (a) Initial pre-production storage requirements.

(b) Initial pre-production RAM requirements.

(c) Initial pre-production CPU requirements.

(d) Supported OS levels and necessary patches/APARS.

(e) Architecture (32 or 64 bit kernel).

(f) Production initial storage requirements and growth projections.

(g) Production initial RAM requirements and growth projections.

(h) Production initial CPU requirements and growth projections

c) Software Requirement - Software

1. Prior to any installation, the Business Application Vendor shall supply the necessary documentation for the installation.
2. Prior to any installation the Business Application Vendor shall provide a list of all user and group accounts required for installation and testing.
3. Prior to any installation, Business Application Software shall have been previously downloaded or available on a CD.
4. If root access is required, the Business Application Software will be installed by an Orange County UNIX Administrator under the Business Application Vendor's direction.
5. Business Application Vendor shall support backups/restores using Orange County's Enterprise Backup Tool. Currently, Orange County's standard is CommVault's Galaxy iData-Agents.

d) Business Application Vendor Access and Permissions

1. Business Application Vendors shall not have root access. Any installations needing root access will be performed by an Orange County UNIX Administrator under the direction of the Business Application Vendor. After installation, Business Application Software shall be owned by a unique user ID and group.
2. No ftp processes shall be done using the login of the application's owner
3. Business Application Vendors shall not log into the server using a privileged account ID.
4. Remote access privileges will be determined by the Security and Network team.
5. If Business Application Vendor access is approved, the Business Application Vendor shall have a unique login assigned by the Security team.
6. Telnet and the "r" commands are disabled on all UNIX servers.
7. If the Business Application Vendor is allowed to access the server, the Business Application Vendor shall comply with Orange County's Change Management Policies.

e) Guidelines

1. These standards, polices, and guidelines shall be followed.

f) Enforcement

1. Exceptions to the guidelines shall be considered if overriding justification is provided. Upon Orange County's considerations of the overriding rationale, exceptions may be approved and a waiver may be granted.

g) Definitions

h) Revision History

B. WINDOWS ENVIRONMENT

1. Purpose: To establish requirements which shall be met by all computers connected to the Orange County government network to ensure effective operating system and system integrity.

2. Scope: This policy applies to all Orange County government computers running any version of the Microsoft Server Operating Systems. This includes, but is not limited to, servers, workstations and all other appliances with server operating systems that are connected to a network.

3. Policy:

a) General

1. Installations of Business Applications Software required for production and non-production environments shall be hosted in a virtual environment. Possible Exceptions are:

(a) Business Applications with high network traffic or high disk utilization. (b) Servers requiring expansion cards.

2. Server load shall be calculated based on total concurrent users; not possible users.

3. Operating System Software shall be installed on RAID 1 (mirrored drives).

4. The C: Partition shall be equal or greater than 20GB.

b) Software Selection

1. Business Application Software, Business Application Data, and IIS shall not be installed on the C: partition.

2. Business Application Data shall be SAN attached.

3. Databases (i.e. SQL) shall not reside on the same server as the Business Application Software or IIS.

4. Business Application Vendors shall support backups/restores using Orange County's Enterprise Backup Tool. Currently, Orange County's standard is CommVault's Galaxy iData-Agents.

5. Business Application service accounts shall not be a member of the domain administrators group.

6. Business Application support staff, including vendors, shall be added to the local administrators group for installations and upgrades. Upon completion of business application software installation, local administrator accounts will be removed.

7. If the Business Application Vendor is allowed to access the server, the Business Application Vendor shall comply with Orange County's Change Management Policies.

8. Business Application Software shall run as a service. Business Applications that require a user account to remain logged in to a server shall not be approved.

c) System Requirement - Hardware

1. Servers shall be rack mounted.
2. Servers shall have dual power, dual NIC's, dual processors, and dual HBA's (if SAN attached).
3. Servers shall have a minimum of 4 GB of RAM and two (2) 72 GB hard drive.
4. The following table lists, in order of preference, the currently approved models for purchase:

| Virtual Server on ESX Host | IBM HS21, HS22 Blade Center | Dell 1U (currently PowerEdge 1950) | Dell 2U (currently PowerEdge 2950) | Dell 4U (currently PowerEdge 6850) |
|---|---|---|---|---|
| Preferred | If application does not work in VM environment or Application is too hardware intensive for VMWare (to be determined by OC ISS VMWare Team. | If dedicated NIC's are required (ie connection to content switch) | If add-on cards (ie HBA's) or a large amount of local storage is required | If 4 processors are required (ie ESX Host) |

4. Guidelines

a) These standards, polices, and guidelines shall be followed.

5. Enforcement

a) Exceptions to the guidelines shall be considered if overriding justification is provided. Upon Orange County's considerations of the overriding rationale, exceptions may be approved and a waiver may be granted.

6. Definitions

C. ORACLE ENVIRONMENT

1. Purpose: To establish requirements which shall be met by all business application software installed on any computers connected to the Orange County government network to ensure effective database operation and database integrity.
2. Scope: This policy applies to all Orange County government computers running any version of the Oracle Relational Database Management System.
3. Policy:

a) General

1. Orange County supported Oracle versions are Oracle Enterprise Edition 10g or higher.
2. Orange County supported environment for Oracle databases is UNIX, running on an IBM AIX supported OS.

3. Database setup shall be compliant with Oracle's OFA (Optimal Flexible Architecture – file naming conventions)
4. Business Application Software shall be installed under separate schema not requiring DBA privileges or DBA type privileges.
5. Business Application Software shall not require or use the Unix Oracle account.
6. Business Application Software shall provide a security module to manage user ids and permissions.
7. Business Application Vendors shall provide all database creation scripts and any other required scripts to build, maintain and support the database environment.
8. Business Application Vendors shall provide all documentation related to all database creation scripts and any other required scripts to build, maintain and support the database environment. (General item number 3.a).7.).
9. Business Application Vendors shall supply initial database sizing requirements (1st yr). Prefer sizing figures for 1yr/3yr/5yr view.
10. Installations of Databases shall be performed by Orange County's staff using vendor provided scripts, initialization parameters, and any special performance related parameters.
11. Business Application Vendors shall identify all Oracle versions and products to which their applications are certified to run on.
12. Business Application Software/Vendor shall not be required to operate using the Oracle's Administrator (SYSADM) account. NOTE: If SYSADM privileges are required for installation, an Orange County Database Administrator shall perform the installation vendor supplied scripts under the Business Application Vendor's direction.
13. If the Business Application Vendor is allowed to access the server, the Business Application Vendor shall comply with Orange County's Change Management Policies.
14. Business Application Vendors shall support application database backups/restores through Oracle's backup tools.

4. Guidelines:
   a) These standards, polices, and guidelines shall be followed.
5. Enforcement
   a) Exceptions to the guidelines shall be considered if overriding justification is provided. Upon Orange County's considerations of the overriding rationale, exceptions may be approved and a waiver may be granted.
6. Definitions
7. Revision History:
   a) September 2008 – version revision
   b) February 2009 – version revision

D. SQL SERVER ENVIRONMENT

1. Purpose: To establish requirements which shall be met by all business application software installed on any computers connected to the Orange County government network to ensure effective database operation and database integrity.
2. Scope: This policy applies to all Orange County government computers running any version of the SQL Server Relational Database Management System.
3. Policy:
    a) General
        1. Orange County Supported Microsoft SQL Server versions are Server 2005 (Standard) or higher.
        2. Database installations shall be on a separate server from the application executables and support files.
        3. Business Applications executables and/or supported files shall not be installed on the C: drive of the Windows Server. The Business Application installation program shall allow the Orange County Database Administrator to specify the drives and directories where the database files will reside.
        4. Business Applications Software that only support the MSDE or SQL Server Express Editions shall not be permitted.
        5. Business Application Software shall support SQL Servers Integrated Security model.
        6. Business Application Software shall contain a security module to manage user ID's and permissions. No blank or hard-coded passwords shall be allowed.
        7. Business Application Software/Vendor shall not be required to operate using the SQL Server System Administrator (sa) privileges account. NOTE: If sa privileges are required for installation, an Orange County Database Administrator shall perform the installation vendor supplied scripts under the Business Application Vendor's direction.
        8. If the Business Application Vendor is allowed to access the server, the Business Application Vendor shall comply with Orange County's Change Management Policies.
        9. Business Application Software shall not require the creation, update, or deletion of any files on the database server outside the constructs of the database engine.
        10. Business Application Software shall not create new databases or persistent database objects as part of its operation.
        11. Business Application Vendor shall support application database backups/restores using Orange County's Enterprise Backup Tool. Currently, Orange County standard is CommVault's Galaxy iData-Agent for SQL Server.
        12. Business Application Software shall provide an audit mechanism to record the date, time, and user id that last modified a given row in an application table.
        13. Business Application Software shall utilize database referential integrity to eliminate the possibility of orphaned data.
4. Guidelines

a) These standards, polices, and guidelines shall be followed.

5. Enforcement

a) Exceptions to the guidelines shall be considered if overriding justification is provided. Upon Orange County's considerations of the overriding rationale, exceptions may be approved and a waiver may be granted.

6. Definitions

7. Revision History

a) September 2008 – version revision

b) February 2009 – version revision

E. ANTIVIRUS STANDARDS

1. Purpose: The purpose of this document is to establish requirements which must be met by all computers connected to the Orange County Government Board of County Commissioners (OCGBCC) network to ensure effective virus detection and prevention.

2. Scope: This document applies to all OCGBCC computers running any version of the Microsoft Windows Operating Systems. This includes, but is not limited to, all servers, desktop computers, laptop computers, PC-based printers and appliances.

3. Policy:

a) Virus Software – Servers:

1. Trend Micro Server Protect shall be installed and enabled on all OCGBCC computers running any server version of the Microsoft Windows Operating Systems.

b) Virus Software – Workstations

1. Trend Micro OfficeScan shall be installed and enabled on all OCGBCC computers running any nonserver version of the Microsoft Windows Operating Systems.

c) Virus Software – Exchange Servers

1. Trend Micro ScanMail shall be installed and enabled on all OCGBCC computers running Microsoft Exchange Server.

d) Virus Software – Internet Mail

1. All incoming and outgoing internet email shall be scanned by Trend Micro Interscan Messaging

2. Security Suite before being delivered.

e) Virus Scanning

1. Antivirus software shall be running at all times on the computers on which it is installed. Antivirus scans of servers shall be executed on a weekly basis in accordance with the schedules set in Trend Micro Server Protect. Antivirus scans of workstations shall be executed on a weekly basis in accordance with the schedules set in Trend Micro OfficeScan.

4. Guidelines

a) When employees receive unwanted and unsolicited emails, they should be deleted and should avoid replying to the sender. These messages should not be forwarded.

b) Employees should never open any files or macros attached to an email from an unknown, suspicious or untrustworthy source. These attachments should be deleted immediately. These messages should not be forwarded.

c) Employees should never download files from unknown or suspicious sources.

5. Enforcement

a) Trend Micro's antivirus products are installed on all servers and workstations during the initial installation of the operating systems, and are continuously monitored to ensure they are running. Any employee or temporary found to have willfully stopped and/or paused these programs will be considered to be violating these policies and may be subject to disciplinary action, up to and including termination of employment.

6. Definitions

7. Revision History:

a) Term Definition: Virus A program or piece of code that is loaded onto your computer without your knowledge and runs against your wishes. Viruses can also replicate themselves. All computer viruses are manmade. A simple virus that can make a copy of its self over and over again is relatively easy to produce. Even such a simple virus is dangerous because it will quickly use all available memory and bring the system to a halt. An even more dangerous type of virus is one capable of transmitting itself across networks and bypassing security systems.

F. DMZ SECURITY STANDARD

1. Purpose: The purpose of this document is to establish requirements that will better manage and secure all platforms within the Orange County Government Board of County Commissioners (OCGBCC). The DMZ is a secure environment with limited access to the OCGBCC internal network.

2. Scope: The scope of this document applies to all platforms located within the OCGBCC DMZ.

3. Policies

a) Activity

1. Any and all activity within and through the OCGBCC DMZ shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

b) Web Servers

1. All internal ISS-ESU policies apply to the OCGBCC DMZ and are augmented by the DMZ Security Standard. The following differences are noted:

(a) Microsoft Internet Information Server (IIS) version 5.0 or higher shall be the only platform within the OCGBCC DMZ to run as a Web or FTP server.

(b) All platforms within the OCGBCC DMZ shall be patched immediately upon the release and testing by the ISS-ESU.

c) Administrative Rights

1. ISS-ESU shall be the only group with administrative rights to servers in the DMZ.

d) Production Servers

1. The OCGBCC DMZ shall host production servers only.

e) Remote Access

1. Remote Access to the OCGBCC DMZ shall be allowed only using Microsoft Terminal Services or Microsoft Remote Desktop protocols.

f) Traffic

1. Internet Activity
2. HTTP/HTTPS/FTP/SMTP/IMAPS are the only protocols allowed from the Internet into the DMZ.
3. Internal Activity
4. Traffic using the following protocols from the DMZ to the internal network shall
5. not be allowed: Kerberos, NetBIOS, Microsoft-DS, Microsoft's Well Known Ports
6. (88, 135, 137, 138, 139, 389, 445, 464, 530, 543, 544, 636, 749, 3389), LDAP,
7. RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.
8. Routing
   (a) All approved access from the DMZ to the internal network shall be routed through a proxy server residing in the DMZ.
   (b) The Enterprise DMZ proxy server shall only use firewall conduits to access approved resources within the OCGBCC network.

g) Data

1. Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.
2. Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: Name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information.
3. The OCGBCC DMZ shall not have access to data containing bank information.
4. The OCGBCC DMZ shall not have access to social security information.
5. The OCGBCC DMZ shall have read only access to live data, if such data is also used by applications residing in the internal OCGBCC network.

4. Guidelines

a) Should databases in policy 3.7.4 need to receive updates by the OCGBCC DMZ, the write operations should be made to a physically separate "staging" data repository. This separate data repository should contain only updates for the specific records being changed. An application server within the internal network should be used to apply the changes in the staging data repository to the live database.

b) The DMZ should access data repositories in the internal OCGBCC network using SQL database calls.

5. Enforcement

   a) Any server found within the OCGBCC DMZ that does not met the above criteria shall be immediately

   b) disconnected from the OCGBCC DMZ. Any employee found to have violated this policy may be subject to disciplinary action, up to and including termination of employment.

6. Definitions

   a) Term Definition:

      1. Bank Information Checking account numbers, credit card numbers, or any unique number from a bank institution.

      2. HTTP HyperText Transfer Protocol – The underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions web servers and browsers should take in response to various commands.

      3. HTTPS HyperText Transfer Protocol over Secure Socket Layer (SSL) – By convention, URLs that require an SSL connection start with https: instead of just http:.

      4. FTP File Transfer Protocol – The protocol for exchanging files over theInternet. FTP works in the same way as HTTP for transferring web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.

      5. SMTP Simple Mail Transfer Protocol – A protocol for sending e-mail messages between servers. In addition, SMTP is generally used to send messages from a mail client to a mail server.

      6. IMAPS Internet Message Access Protocol – A protocol for retrieving e-mail messages. With IMAP4, you can search through your e-mail messages for keywords while the messages are still on mail server and, then, choose which messages to download to your machine.

      7. LDAP Lightweight Directory Access Protocol – A set of protocols for accessing information directories.

      8. DNS Domain Name System (or Service or Server) – An Internet service that translates domain names into IP addresses. Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on numeric IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address.

      9. SQL Structured query language – SQL is a standardized query language for requesting information from a database.

      10. DMZ Demilitarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.

      11. SSL Secure Sockets Layer – A protocol for transmitting private documents via the Internet. SSL uses a cryptographic system that uses two keys to encrypt data - a public key known to everyone and a private or secret key known only to the recipient of the message.

G. ENCRYPTION AND CERTIFICATION AUTHORITIES

1. Purpose: The purpose of this document is to ensure that all Orange County Government Board of County Commissioner's (OCGBCC) sensitive data is secured by using strong encryption algorithms that have received substantial public review and have been proven to work effectively. Orange County Information Systems and Services Enterprise Security unit (ISS-ESU) provides access to a variety of Encryption Services and Enterprise Certification Authorities (CA).
2. Scope: This document applies to all data transmitted and stored within the OCGBCC information systems. It applies to all OCGBCC employees, consultants, and all other affiliated third parties operating within the OCGBCC information systems and networks.
3. Policies:
   a) Activity
      1. Any and all activity within and through the OCGBCC information systems involving encryption shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).
      2. The ISS-ESU shall approve the storage and transfer of any data containing personal information and/or residing in the DMZ.
   b) Encryption Algorithms
      1. One of the following standard encryption ciphers shall be used to encrypt data. The key length for these algorithms shall be no less than 128bits:
         (a) Triple-DES (3DES)
         (b) Rijndael (AES)
         (c) RSA
         (d) Blowfish
         (e) Twofish
         (f) CAST
      2. PGP is an approved encryption standard provided that the PGP private key used to encrypt and /or sign data has been generated using a cipher meeting the requirements in section 3.b)1.
   c) Data Hashing
      1. The following standard data hashing algorithms shall be used to hash data. The key length for the algorithms shall be no less than 128bits.
         (a) MD5
         (b) SHA-1
         (c) SHA-2
   d) SSL Certificates
      1. Web Server, SSH, IMAPS, SMTPS SSL certificates should have key lengths of no less than 128bits.
   e) Sensitive Data
      1. Any data containing sensitive information, including, but not limited to: name, addresses, phone numbers, email addresses, birthdates, federal/state/local

document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information, should be encrypted when stored and during network transfers.

f) DMZ

1. Any and all activity within and through the OCGBCC DMZ shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).
2. Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.
3. Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information.

g) Data Backups

1. Any backup of OCGBCC should be encrypted. Sensitive Data as listed in 3.e) of this document shall be backed up using encryption algorithm standards found in 3.b) Encryption Algorithms.

h) Laptops and Removal Devices

1. All laptop hard drives should be encrypted.
2. Any sensitive data (see section 3.e) Sensitive Data of this document) stored on laptops and removable devices shall be encrypted.
3. All individuals who work with sensitive data (see section 3.e) Sensitive Data of this document) shall have their laptop hard drives encrypted.

4. Guidelines

a) SSL certificates issued to servers and applications used by internet users should be provided by commercial CA authorities (i.e. Verisign, Thawte) to avoid security warnings from being presented to the end users.

b) SSL certificates issued to servers and applications used by internal OCGBCC resources should be issued by OCGBCC's Certification Authority.

5. Enforcement

a) Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.

6. Definitions

7. Revision History

a) Term Definition: Encryption Transforming understandable data into a form that is incomprehensible and that looks like random noise.

1. Hashing An algorithm that takes an entire message and, through process of shuffling, manipulating, and processing the bytes using logical operations, generates a small message digest of the data.
2. DMZ De-Militarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.

3. Certification Authority (CA) In cryptography, a certificate authority or certification authority (CA) is an entity which issues digital certificates for use by other parties.

H. WEB SECURITY STANDARD

1. Purpose: The purpose of this document is to establish requirements that will better manage and secure all web server platforms within the Orange County Government Board

of County Commissioners (OCGBCC).

2. Scope: The scope of this document applies to all web server platforms located within the
OCGBCC.

3. Policies

a) Activity

1. Any and all web server installations, removals or modifications shall require the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

b) Hardware

1. All hardware platforms operating as a web server shall abide by all standards,

2. policies and guidelines of the OCGBCC Enterprise Systems unit.

3. All hardware platforms operating as a web server shall reside on server 4.

hardware. Any exception shall require a documented wavier by the

Information 5. Systems and Services Enterprise Security unit (ISS-ESU).

c) Software

1. Web Server Platforms

(a) Microsoft: Microsoft's Internet Information Server (IIS) is the approved, supported web server platform for OCGBCC.

(b) Apache Software Foundation: Apache Software Foundation's HTTP Server (Apache) is approved but is unsupported. Any production use of (Apache) shall include an appropriate support model that is approved by the ISS-ESU.

(c) Other: Other web server platforms may qualify for use, but shall require an evaluation, approval and a documented wavier by the ISS-ESU.

2. Databases

(a) Location: A database server shall not reside on the same hardware platform as a web server.

d) Security

(a) General

(1) All web servers shall comply with all other documented ISS-ESU standards to include, but not limited to: virus, patch and account management.

(b) Account Management

(1) Local Account Access: Only accounts with local administrator privileges shall be allowed to log on locally to a web server.

(2) Process/Application Accounts: All web server processes and applications shall run only under a low privilege local account. Web server processes shall not run under an account with domain, power user or a local administrator privileges.

(3) Web Server Anonymous Accounts: Web server anonymous accounts shall only have read and execute permissions to folders/files within the web server directories. Change and delete permissions to folders/files that are directly accessible via a web browser shall not be granted to web server anonymous accounts.

(c) Permissions

(1) Operating System Permissions: ISS-ESU shall secure the operating system's file/folder permissions and security policies of all web servers. These permissions are to be modified solely by ISS-ESU.

(2) Vendor/Third Party Access: Local administrator privileges on web servers are for authorized personnel only. Access to vendors and any other third party shall be provided solely on a temporarily, case-by-case basis through ISS-ESU.

(3) Developer Access: Developer access to web server content directories shall be available by WebDav or FrontPage server extensions only. Developers shall be granted "Author Pages" rights with the FrontPage Server Extensions

(4) Java Server Engines: Java server engines are approved but are not supported. Any production use of a Java server engine shall include an appropriate support model that is approved by (ISSESU).

(5) FTP: Web servers that also run an FTP server shall not map FTP directories to directories accessible via a web browser.

(6) IIS Virtual Directories, Application Pools, Settings: Any and all creations, removals or modifications to IIS Settings, Virtual Directories, Application Directories, and Application Pools shall require the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISSESU).

(7) Other:

(i) Shares are not allowed on any directory accessible via web browser.

(ii) Microsoft Windows web servers and any web application shall not be installed on the same drive as the host operating system.

(iii) Executable files (.exe, .com, .bat, .dll, etc) shall not be placed into directories accessible via a web browser without the direct involvement and documented approval

by the Information Systems and Service Enterprise Security unit (ISSESU).

4. Guidelines:

   a) It is recommended that all web applications use the enterprise FTP and SMTP servers for all FTP/SMTP traffic.

5. Enforcement

   a) Any web server not meeting the above criteria may be immediately disconnected from the OCGBCC network. Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.

6. Definitions

   a) Term Definition

      1. FTP File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring Web pages from a server

         to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server. WebDav Web-based Distributed Authoring and Versioning Extensions to HTTP that allows users to collaboratively edit and manage files on remote Web servers.

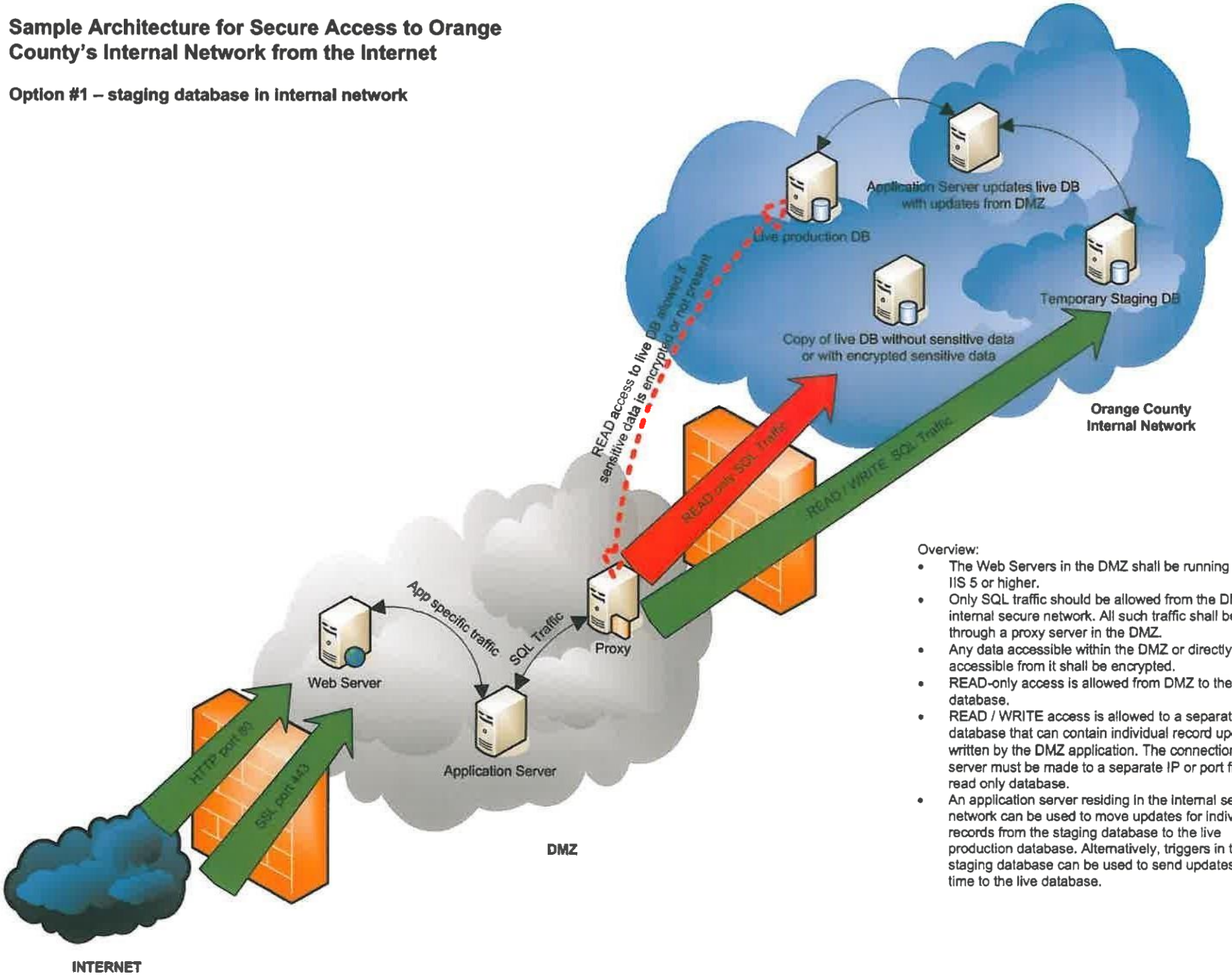
      2. Front Page Extensions A series of scripts that can be employed using Microsoft FrontPage, visual HTML editor.

      3. SMTP Simple Mail Transfer Protocol – A protocol for sending e-mail messages

Attachments
Option #1: Staging Database in Internal Network
Option #2: Staging Database in DMZ
Option #3: Share Point in DMZ

# Sample Architecture for Secure Access to Orange County's Internal Network from the Internet

## Option #1 – staging database in internal network

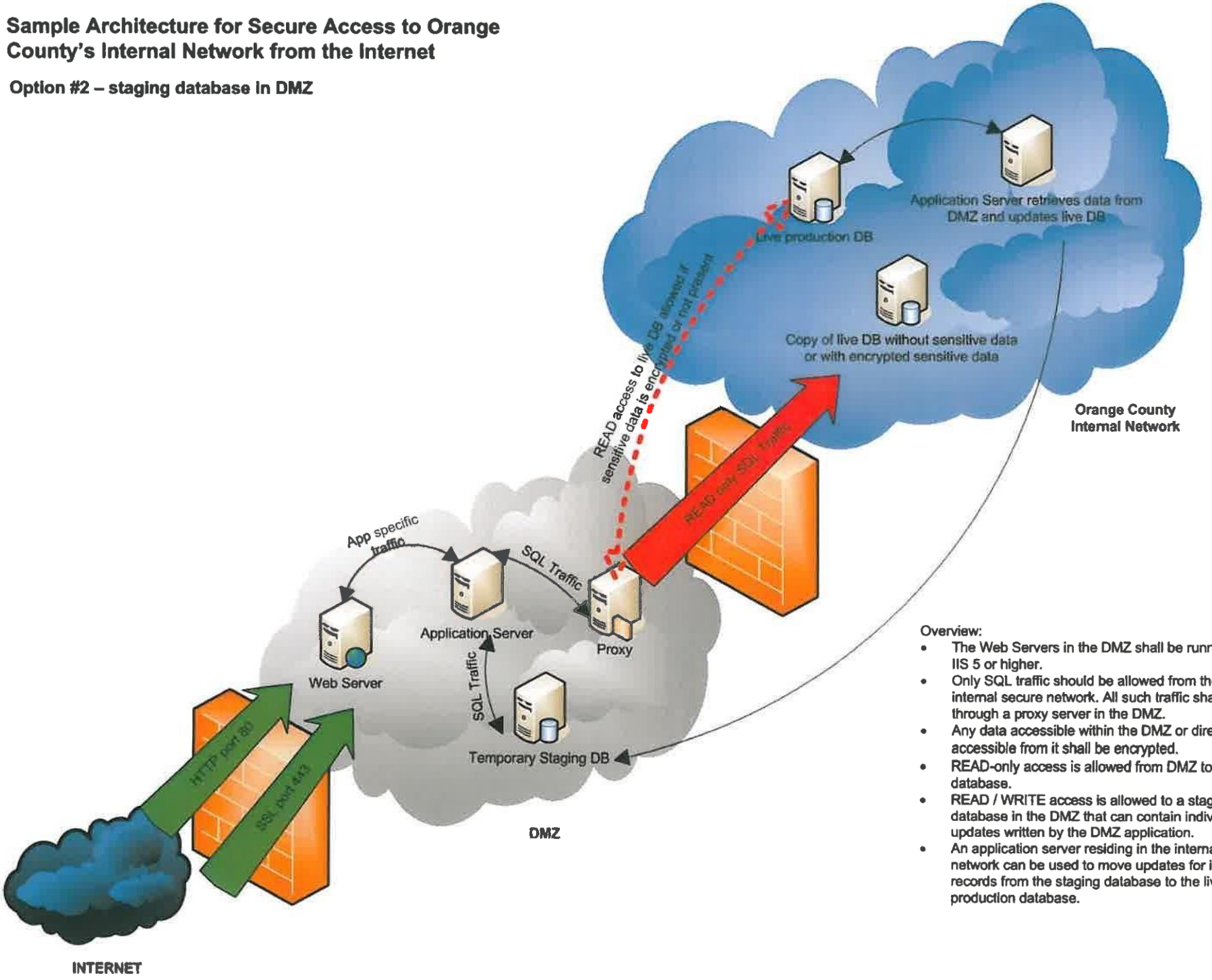



Overview:

- The Web Servers in the DMZ shall be running Microsoft IIS 5 or higher.
- Only SQL traffic should be allowed from the DMZ to the internal secure network. All such traffic shall be routed through a proxy server in the DMZ.
- Any data accessible within the DMZ or directly accessible from it shall be encrypted.
- READ-only access is allowed from DMZ to the live database.
- READ / WRITE access is allowed to a separate staging database that can contain individual record updates written by the DMZ application. The connection to this server must be made to a separate IP or port from the read only database.
- An application server residing in the internal secure network can be used to move updates for individual records from the staging database to the live production database. Alternatively, triggers in the staging database can be used to send updates in real-time to the live database.

# Sample Architecture for Secure Access to Orange County's Internal Network from the Internet

## Option #2 – staging database in DMZ

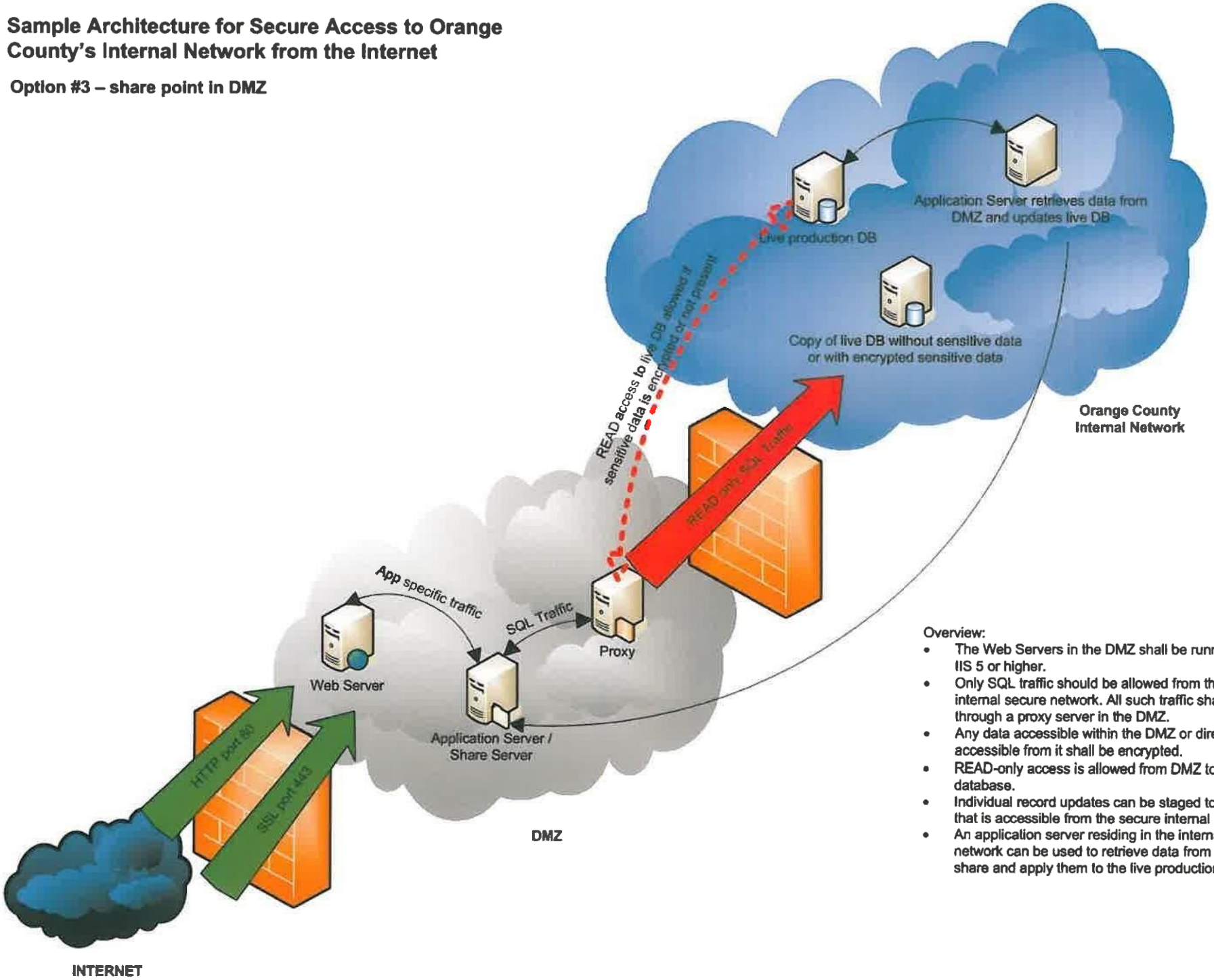



Overview:

- The Web Servers in the DMZ shall be running Microsoft IIS 5 or higher.
- Only SQL traffic should be allowed from the DMZ to the internal secure network. All such traffic shall be routed through a proxy server in the DMZ.
- Any data accessible within the DMZ or directly accessible from it shall be encrypted.
- READ-only access is allowed from DMZ to the live database.
- READ / WRITE access is allowed to a staging database in the DMZ that can contain individual record updates written by the DMZ application.
- An application server residing in the internal secure network can be used to move updates for individual records from the staging database to the live production database.

## Sample Architecture for Secure Access to Orange County's Internal Network from the Internet

**Option #3 – share point in DMZ**




Overview:

- The Web Servers in the DMZ shall be running Microsoft IIS 5 or higher.
- Only SQL traffic should be allowed from the DMZ to the internal secure network. All such traffic shall be routed through a proxy server in the DMZ.
- Any data accessible within the DMZ or directly accessible from it shall be encrypted.
- READ-only access is allowed from DMZ to the live database.
- Individual record updates can be staged to a file share that is accessible from the secure internal network.
- An application server residing in the internal secure network can be used to retrieve data from the above share and apply them to the live production database.

SECTION 08 71 13
AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of automatic door operators:
   1. Exterior and interior, automatic door operators, low energy, with visible header mounting.
   2. Automatic door operators shall be configured for doors as follows:
      a. Simultaneous pairs.
      b. Simultaneous pairs, with single operator.
      c. Single doors.

B. Related Sections:
   1. Division 26 Sections for electrical connections provided separately including conduit and wiring for power to, and control of, automatic door operators.

1.3 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. Underwriters Laboratories (UL):
   1. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
   2. UL 10C – Positive Pressure Fire Tests of Door Assemblies

C. American National Standards Institute (ANSI)/Builders' Hardware Manufacturers Association (BHMA):
   1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors.
   2. ANSI/BHMA A156.19: Standard for Power Assist and Low Energy Power Operated Doors.

D. American Society for Testing and Materials (ASTM):
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. American Association of Automatic Door Manufacturers (AAADM):

F. National Fire Protection Association (NFPA):
   1. NFPA 101 – Life Safety Code.
   2. NFPA 70 – National Electric Code.

G. International Code Council (ICC):
   1. IBC: International Building Code

H. Building Officials and Code Administrators International (BOCA), 1999:

I. International Standards Organization (ISO):
1. ISO 9001 - Standard for Manufacturing Quality Management Systems

J. National Association of Architectural Metal Manufacturers (NAAMM):
1. Metal Finishes Manual for Architectural and Metal Products.

K. American Architectural Manufacturers Association (AAMA):
1. AAMA 606.1 – Integral Color Anodic Finishes for Architectural Aluminum.
2. AAMA 607.1 - Clear Anodic Finishes for Architectural Aluminum.
3. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.

1.4 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide automatic door operators capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).

C. Opening-Force Requirements for Egress Doors: In the event power failure to the operator, swinging automatic entrance doors shall open with a manual force, not to exceed 30 lbf (133 N) applied at 1” (25 mm) form the latch edge of the door.

D. Break Away Requirements: Automatic door operators shall breakaway with no more than 30 lbf (133 N) applied at 1” (25 mm) from the latch edge of the door.

1.6 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 submittal procedures.

B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work. Indicate wiring for electrical supply.

C. Color Samples for selection of factory-applied color finishes.

D. Closeout Submittals: Provide the following with project close-out documents.
1. Owner’s Manual.
2. Warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.

C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.

D. Certifications: Automatic door operators shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
1. ANSI/BHMA A156.10 and A156.19.
2. NFPA 101.
3. UL 325 Listed.
4. UL 10C Listed.
5. IBC 2009 and 2012.
6. BOCA.

E. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.

F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of swinging doors equipped with automatic door operators and are based on the specific system indicated. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

G. Power Operated Door Standard: ANSI/BHMA A156.19.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

I. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for swinging automatic entrance doors serving as a required means of egress.

1.8 PROJECT CONDITIONS

A. Field Measurements: General Contractor shall verify openings to receive automatic door operators by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.

C. Other trades: General Contractor Advise of any inadequate conditions or equipment.

1.9 COORDINATION

A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to, power supplies, remote activation devices, and electric door latching hardware.

C. System Integration: Integrate automatic door operators with other systems as required for a complete working installation. Where required for proper operation, provide a time delay relay to signal automatic door operator to activate only after electric lock system is released.

1.10 WARRANTY

A. Automatic door operators shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.

C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 AUTOMATIC DOOR OPERATORS

A. Manufacturer: Stanley Access Technologies; Magic-Force™ Series automatic door operator.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Headers: 6063-T6.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Sheet and Plate: ASTM B 209.

2.3 COMPONENTS

A. Header Case: Header case shall not exceed 6” (152 mm) square in section and shall be fabricated from extruded aluminum with structurally integrated end caps, designed to conceal door operators and controls. The operator shall be sealed against dust, dirt, and corrosion within the header case. Access to the operator and electronic control box shall be provided by a full-length removable cover, edge rabbetted to the header to ensure a flush fit. Removable cover shall be secured to prevent unauthorized access.

B. Door Arms: A combination of door arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung, center pivot, and offset pivot-hung doors.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

D. Signage: Provide signage in accordance with ANSI/BHMA A156.19.

2.4 SWINGING DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operators: Self-contained unit powered by a minimum 3/16 horsepower, permanent-magnet DC motor; through a high torque reduction gear system.
1. Operation: Power opening and spring closing.
2. Operator Type: Low energy; readily convertible to full energy; no tools required to change type.
3. Handing: Non-handed; no tools required to change handing.
4. Capacity: Rated for door panels weighing up to 350 lb (159 kg).

5. Mounting: Visible
6. Features:
   a. Adjustable opening and closing speeds.
   b. Adjustable opening and closing force.
   c. Adjustable back-check.
   d. Adjustable hold-open time between 0 and 30 seconds.
   e. Reverse on obstruction.
   f. Closed loop speed control with active braking and acceleration.
   g. Variable obstruction recycle time delay.
   h. Optional Switch to open/Switch to close operation.
   i. Optional push to activate operation.
   j. When operators are provided in pairs, adjustable features are independently adjustable for each operator.

C. Field Adjustable Spring Closing Operation: The operator shall close the door by spring energy employing the motor, as a dynamic brake to provide closing speed control. The closing spring shall be a helical compression spring, adjustable for positive closing action. The spring shall be adjustable, without removing the operator from the header, to accommodate a wide range of field conditions.

D. Independent Adjustable Closing and Latching Speed Control: The operator shall employ a rheostat module to allow for independent field adjustment of closing and latching speeds using the motor as a dynamic brake.

E. Field Adjustable Open Stop: The operator shall provide a field adjustable open stop to accommodate opening angles from 80 to 135 degrees without the need for additional components.

F. Consistent Cycle: The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open. Additionally, the range of the force shall be field adjustable to accommodate a wide range of on-site conditions.

G. Quiet Performance: The operator shall be designed to output audible noise ratios less than or equal to 50dba.

H. Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power. The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.

I. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

2.5 ELECTRICAL CONTROLS

A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position. Systems utilizing external magnets and magnetic switches are not acceptable.

B. Performance Data: The microprocessor shall collect and store performance data as follows:
   1. Counter: A non-resettable counter to track operating cycles.
   2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
   3. LED Display: Display presenting the current operating state of the controller.

C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
   1. Automatic Reset Upon Power Up.
   2. Main Fuse Protection.
   3. Electronic Surge Protection.
   4. Internal Power Supply Protection.
   5. Resetable sensor supply fuse protection.
   6. Motor Protection, over-current protection.

D. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.

E. Obstruction Recycle: Provide system to recycle the swinging panels when an obstruction is encountered during the closing cycle.

F. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be a software driven handheld interface. The following parameters may be adjusted via the configuration tool.
   1. Operating speeds and forces as required to meet ANSI/BHMA A156.19.
   2. Adjustable and variable features as specified in 2.4, B.
   3. Firmware update.
   4. Trouble Shooting
      a. I/O Status.
      b. Electrical component monitoring including parameter summary.
   5. Software for local configuration tool shall be available as a free download from the sliding automatic entrance manufacturer’s internet site. Software shall be compatible with the following operating system platforms: Palm®, Android®, and Windows Mobile®.

G. Emergency Breakout Switch: A cam actuated emergency breakout switch shall be provided to disconnect power to the motor when an in-swinging door is manually pushed in the emergency out direction. The operator will then automatically reset and power will be resumed.

H. Control Switch: Automatic door operators shall be equipped with a three position function switch to control the operation of the door. Control switch shall provide three modes of operation, Automatic, Off, and Hold-Open.

I. Power Switch: Automatic door operators shall be equipped with a two position On/Off switch to control power to the door.

2.6 ACTIVATION DEVICES

A. Push Plates: Provide 4 ½ inch (114 mm) square push plates with UL recognized SPDT switch. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and “Push To Open”. Push plates shall be wall mounted in single or double gang electrical boxes and hardwired to door operator controls.

2.7 ALUMINUM FINISHES

A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.40 mils minimum complying with AAMA 611-98, and the following:

1. AAMA 607.1
2. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.70 mils minimum complying with AAMA 611-98, and the following:
1. Color: Dark Bronze.
2. AAMA 606.1
3. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of swinging automatic entrance doors. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.

B. Mounting: Install automatic door operators/headers plumb and true in alignment with established lines and grades. Anchor securely in place.
1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, arms and linkages level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.

3.3 FIELD QUALITY CONTROL

A. Testing Services: Factory Trained Installer shall test and inspect each swinging automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.19 by AAADM Certified Technician.

3.5 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation. Remove excess sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

END OF SECTION 08 71 13

SECTION 26 05 07 - SUBMITTALS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Requirements for submittals specifically applicable to Division 26, 27, 28 Sections.

B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE"EQUIPMENT/PRODUCT

A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addenda, Contractor represents that he:

1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.

2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.

3. Waives all claims for additional costs related to substitution which may subsequently become apparent.

4. Will provide the same warranties for the substitution as for the product specified.

5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.

6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

1.4 SUBMITTALS

A. Submittals shall consist of a minimum of one view type 3-ring binder, white, sized to hold 81/2" x 11" sheets for "ELECTRICAL SUBMITTALS" (Power and Lighting).

1. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).

2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for Submittals included at end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting.

B. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.
3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).
5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
    a) Fabrication and erection dimensions.
    b) Arrangements and sectional views.
    c) Necessary details, including complete information for making connections with other work.
    d) Kinds of materials and finishes.
    e) Descriptive names of equipment.
    f) Modifications and options to standard equipment required by the work.
    g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).
    h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
    i) Conduit/raceway rough-in drawings.
    j) Items requiring shop drawings include (but not limited to):
        1. Each section of fire alarm, television, etc.
        2. Special and/or modified equipment
        3. U.L. listed fire and smoke stopping assemblies for each applicable penetration
    k) See specific sections of Specifications for further requirements.
6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
    a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.

b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.

c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.

B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:

1. Project Addresses
2. Index
3. Separation Sheets
4. Basic Materials
5. Panelboards

C. Remainder of submittals are to be submitted no later then 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.

D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.

E. Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.

F. Shop Drawings: For custom fabricated items and systems shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.

G. Shop Drawing Review Notation.

| | Action | Description |
|---|---|---|
| 1. | No Exception Noted | No exceptions taken. Resubmittal not required. |
| 2. | Rejected | Not in compliance with Contract Documents. Resubmit. |
| 3. | Submit Specific Item | Resubmit item as specified. |
| 4. | Make Corrections Noted | Make corrections noted, resubmittal not required. |
| 5. | Revise and Resubmit | Make corrections noted, resubmittal is required |
| 6. | Review not Required | Not required for review. No action taken. Copy retained for reference. |

H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet, and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.

I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict, unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

1.6 DELAYS

A. Contractor is responsible for delays in job progress accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

1.7 RE-SUBMITTALS

A. The A/E shall be reimbursed for all costs to review resubmittals subsequent to the second submission for the same product. Cost will be billed to Contractor at Engineer's standard hourly rate.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 26 05 09 - REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Reference Standards and Regulatory Requirements applicable to Divisions 26, 27 28 sections.

1.3 REFERENCES

A. The following references may be referenced within these specifications:

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| ADA | Americans with Disabilities Act |
| AHERA | Asbestos Hazard Emergency Response Act |
| AIA | American Institute of Architects |
| ANSI | American National Standards Institute |
| ASCE | American Society of Civil Engineers |
| ASHRAE | American Society of Heating, Refrigerating and Air Conditioning Engineers |
| ASME | ASME International<br>American Society of Mechanical Engineers International |
| ASTM | ASTM International<br>American Society for Testing and Materials International |
| BOR | Board of Regents |
| BICSI | BICSI, Inc. |
| BOCC | Board of County Commissioners St Johns County |
| CRSI | Concrete Reinforcing Steel Institute |
| DCA-ADAIA | Department of Community Affairs - Florida Americans with Disabilities Accessibility Implementation Act |
| DCA-ADAAG | Department of Community Affairs - Florida Americans with Disabilities Act Accessibility Guidelines |
| DCA-ARM | Department of Community Affairs - Accessibility Requirements Manual |

| | |
|---|---|
| DER Rule 17-761 | Department of Environmental Regulation, Chapter 17-761 on Underground Storage Tank Systems |
| DER Rule 17-762 | Department of Environmental Regulation, Chapter 17-762 on Above Ground Storage Tank Systems. |
| DMS/DOC | Department of Management Services<br>Division of Communications |
| DOCA or DCA | State of Florida Department of Community Affairs |
| EIA/TIA | Electronics Industries Alliance/Telecommunications Industry Association |
| EJCDC | Engineers Joint Contract Documents Committee<br>American Consulting Engineers Council |
| FAC | Florida Administrative Code |
| FBC | Florida Building Code |
| FCC | Federal Communications Commission |
| FEMA | Federal Emergency Management Agency |
| FFPC | Florida Fire Prevention Code |
| FGC | Florida Building Code (Fuel Gas) |
| FLA | State of Florida |
| FMC | Florida Building Code (Mechanical) |
| FMG | FM Global (formerly Factory Mutual System) |
| FPC | Florida Building Code (Plumbing) |
| FS | Florida Statutes |
| HL | Hospital Licensure |
| ICC | International Code Council |
| IEEE | Institute of Electrical and Electronics Engineers, Inc |
| IES | Illumination Engineering Society of North America |
| ICPEA | International Power Cable Engineer's Association |
| IMCFMR | Intermediate Care Facilities for the Mentally Retarded |
| LPCR | Local Power Company Requirements |

| | |
|---|---|
| LPI | Lightning Protection Institute |
| LTCR | Local Telephone Company Requirements |
| NEC | National Electrical Code |
| NECPA | National Energy Conservation Policy Act |
| NESC | National Electrical Safety Code |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| NHRF | Nursing Homes and Related Facilities |
| OCPS | Orange County Public Schools Standards, Guidelines, and Guide Specifications |
| OCS | Orange County Schools Design Guidelines |
| OEF | Office of Educational Facilities |
| OSHA | Occupational Safety and Health Act |
| SBE | State Board of Education |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association |
| UFSRS | Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal |
| UL | Underwriters Laboratories, Inc. |
| FBC | Florida Building Code Section 423 State Requirements for Educational Facilities |
| UFCS | University of Florida Construction Standards by the Physical Plant Division. |
| SUSCCG | SUS Cost Containment Guidelines for the State University System of Florida, Office of Capital Improvements. |
| FAC | Florida Administrative Codes, Chapter 33-8, Rules of the Department of Corrections, County and Municipal Detention Facilities. |

## 1.4 REGULATORY REQUIREMENTS

A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc.. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.

1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority Having Jurisdiction):

   a) Americans with Disabilities Act of 1990, as amended
   b) ADA Standards for Accessible Design, 2010
   c) American National Standards Institute
   d) American Society of Heating, Refrigerating and Air Conditioning Engineers
   e) American Society of Mechanical Engineers
   f) American Society for Testing and Materials
   g) Concrete Reinforcing Steel Institute
   h) Department of Community Affairs
   i) Electronics Industries Association/Telecommunications Industry Association
   j) Florida Building Code, 2010
   k) Florida Fire Prevention Code, 2010
   l) Institute of Electrical and Electronics Engineers
   m) Illumination Engineering Society
   n) Local Power Company Requirements
   o) Lightning Protection Institute
   p) Local Telephone Company Requirements
   q) National Electrical Code, 2008
   r) National Energy Conservation Policy Act
   s) National Electrical Safety Code
   t) National Electrical Manufacturers Association
   u) NFPA 1 Fire Code, 2009
   v) NFPA 101 Life Safety Code, 2009
   w) Occupational Safety and Health Act
   x) Safety Code for Elevators and Escalators
      A17.1a, 2008 and A17.1b, 2009 Addenda
   y) Safety Code for Existing Elevators and Escalators
      A17.3, 1996
   z) Sheet Metal and Air Conditioning Contractors
   aa) Underwriters Laboratories, Inc.
   bb) Applicable Federal, State, Local Codes, Laws and Ordinances, Florida Statutes and Referenced Codes/Standards

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

# SECTION 26 05 19 - BUILDING WIRE AND CABLE

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes requirements for provision and installation of building wire and cable.

B. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete and operating system for the following:

1. Building wire and cable.
2. Wiring connectors and connections.

C. No aluminum wiring shall be permitted.

D. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM/kcmil).

### 1.3 REFERENCES:

A. ANSI/NFPA 70 National Electrical Code
B. UL 486A-486B

### 1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

### 1.5 SUBMITTALS

A. Product Data: Submit catalog cut sheet showing, type and UL listing of each type of conductor, connector and termination.

### 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

### 1.7 PROJECT CONDITIONS

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

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

### 1.8 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70, Type THHN/THWN and XHHW. PART 3 - EXECUTION

3.1 GENERAL

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

B. Conductors #10 AWG shall be 600 volt type THWN/THHN unless noted otherwise, rated 90 degrees C. dry, 75 degrees C. wet.

C. Conductors #8 AWG and larger shall be Type THWN-2/THHN unless noted otherwise, rated 90 degrees C, wet or dry.

D. Use solid conductor for feeders and branch circuits 10 AWG and smaller (except for control circuits).

E. Use conductor no smaller than #10 AWG for power and lighting circuits.

F. Neatly train and lace wiring inside boxes, equipment, and panelboards.

G. All conductors shall be installed in raceway.

H. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit, unless noted otherwise on the Drawings or in these Specifications.

I. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).

J. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.

K. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

3.2 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.

3.3 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.4 WIRING METHODS

A. Use only building wire type (THHN/THWN for #10 and #12 and THHN/THWN-2 for #8 and larger) insulation in raceway, unless noted otherwise.

B. Wiring in vicinity of heat producing equipment: Use only XHHW insulation in raceway.

C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required to meet the UL listing of the fixture; however, in no case shall the temperature rating be less than 90 degrees Centigrade. Remove incorrect insulation types in new work.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 26 05 53 Identification for Electrical Systems.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

C. Identify neutrals with its associated circuit number(s).

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents and Section 26 08 13 Tests and Performance Verification.

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

3.7 VERTICAL RISERS

A. Provide vertical cable riser supports per NEC 300.19. Cable supports shall be O-Z/Gedney Type "S" or equal. These shall be located in accessible pullboxes of adequate size. Provide for adequate structural connection of cable supports to pullbox, which will transfer cable weight to building.

3.8 PULLING

A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.

B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.

C. Use only powdered soapstone or other pulling lubricant acceptable to the Architect/Engineer. Compound or lubricant shall not cause the conductor or insulation to deteriorate.

D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.

E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.

F. Where communications type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

3.9 CONTROL AND SIGNAL CIRCUITS

A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW or THWN-THHN as permitted by NFPA 70, within voltage drop limits, increased to #12 AWG as necessary for proper operation.

B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volt rated, PVC insulated, except where specifically noted otherwise in the Contract Documents.

C. Conductor insulation for fire alarm systems shall be as accepted by Code Inspection Authority only. Wire acceptance by the Architect/Engineer shall not supersede this final acceptance for conditions of this specific project.

D. Install circuit conductors in conduit.

E. Circuit conductors to be stranded.

3.10 COLOR CODING

A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

B. Unless otherwise accepted or required by Architect/Engineer to match existing, color-code shall be as follows:
Neutrals: 120/208V system white; 277/480V system natural grey
Ground Wire: green, bare
Isolated Ground Wire: green with yellow stripes
120/208V: Phase A black, Phase B red, Phase C blue
277/480V: Phase A brown, Phase B orange, Phase C yellow.

C. All switchlegs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above.

3.11 TAPS/SPLICES/CONNECTORS/TERMINATIONS

A. Clean conductor surfaces before installing lugs and connectors.

B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

C. Power and lighting conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).

D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum. Pull conductors through to equipment, terminal cabinets, and devices.

E. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.

F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.

G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the Contractor to provide sleeve type vertical cable supports in vertical raceway installations, provided in pullboxes at proper vertical spacings.

H. A calibrated torque wrench shall be used for all bolt tightening.

I. Interior Locations:

1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.

J. Exterior Locations:

1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.
2. All taps and splices shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.
3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

END OF SECTION

# SECTION 26 05 29 - HANGERS AND SUPPORTS

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Conduit and equipment supports.
2. Anchors and fasteners.

B. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pullboxes and other equipment furnished under this Division.

### 1.3 REFERENCES

A. NECA National Electrical Contractors Association

B. ANSI/NFPA 70 National Electrical Code

### 1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

## PART 2- PRODUCTS

### 2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

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

B. Provide anchors, fasteners, and supports in accordance with NECA National Electrical Installation Standards.

C. Do not fasten supports to pipes, ducts, mechanical equipment or conduit.

D. Do not use spring steel clips and clamps.

E. Obtain permission from A/E before using powder-actuated anchors.

F. Obtain permission from A/E before drilling or cutting structural members.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1" off wall.

J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

K. All items shall be supported from the structural portion of the building, except standard ceilingmounted lighting fixtures, and small devices may be supported from ceiling system where permitted by Ceiling Contractor, however, no sagging of the ceiling will be permitted. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.

L. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, wall, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching later at his own expense to the satisfaction of the Architect.

M. All conduits shall be securely fastened in place per NEC. Hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by onehole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.

N. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.

O. Hanger assemblies shall be protected after fabrication by galvanizing. Hangers for PVC coated conduit shall be PVC coated galvanized conduit or stainless steel.

P. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self tapping power driven type are acceptable. Plastic anchors are not acceptable.

Q. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.

R. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.

S. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom prestressed beams are not acceptable.

END OF SECTION

SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for electrical conduit.

B. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:

1. Rigid Metal Conduit (RMC) NEC 344
2. Flexible Metal Conduit (FMC) NEC 348
3. Liquid tight Flexible Metal Conduit (LFMC) NEC 350
4. Electrical Metallic Tubing (EMT) NEC 358
5. Rigid Polyvinyl Chloride Conduit (Type PVC) NEC 352
6. Fittings and Conduit Bodies

1.3 REFERENCES

A. ANSI C80.1 Electrical Rigid Steel Conduit, Zinc Coated
B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated
C. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
D. ANSI/NFPA 70 National Electrical Code
E. NECA Standard Practice of Good Workmanship in Electrical Contracting
F. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
G. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
H. NEMA TC 3 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70. (See Drawings and this and other sections of these Specifications for additional requirements).

B. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.

C. A raceway shall be provided for all electrical power and lighting, and electrical systems unless specifically specified otherwise.

1.6 SUBMITTALS

A. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.

B. Submit catalog cut sheet on all types of conduit bodies and fittings.

C. Product data shall be submitted for acceptance on:

1. Conduits.

2. Conduit straps, hangers and fittings.
3. PVC solvent(s) and bending box.
4. Fitting entering and leaving the ground or pavement

D. Submit UL listed fire and smoke stopping assemblies for each applicable application.

E. Product data shall prove compliance with Specifications, National Electrical Code, National Board of Fire Underwriters, manufacturers' specifications and written installation data.

1.7 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual routing of conduits larger than 1.25".

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, properly store and protect products at the site.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from sun, rain, corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.9 PROJECT CONDITIONS

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

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

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

PART 2 - PRODUCTS

2.1 GENERAL

A. All conduits shall bear UL label or seal and shall be manufactured in the United States.
B. Conduit systems and all related fittings, boxes, supports, and hangers must meet all the requirements of national, state, local and other federal codes where applicable.

2.2 MINIMUM TRADE SIZE

A. Rigid Conduit: 3/4".
B. Non-metallic Conduit: 3/4" C.
C. EMT: 3/4".
D. Flexible and Seal-Tite Metallic Conduit: 1/2" C. (maximum 6' long).
E. Homeruns and Branches Underground: 3/4" C.
F. Branches Aboveground: 1/2" C.
G. All Types: 1/2" C.

2.3 RIGID METAL CONDUIT

A. Comply with:

1. ANSI C80.1.
2. UL 6.
3. NEC 344.

B. Conduit material:

1. Zinc coated or hot dipped galvanized steel.

C. Fittings:

1. Threaded.
2. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.
3. Zinc plated or hot dipped galvanized malleable iron or steel.

D. Conduit Bodies:

1. Comply with ANSI/NEMA FB 1.
2. Threaded hubs.
3. Zinc plated or hot-dipped galvanized malleable iron.

2.4 FLEXIBLE METAL CONDUIT

A. Comply With:

1. NEC 348.
2. ANSI/UL 1.

B. Conduit Material:

1. Steel, interlocked.

C. Fittings:

1. ANSI/NEMA FB 1.
2. ANSI/UL 514B.
3. Die Cast
4. Malleable iron, zinc plated.
5. Threaded rigid and IMC conduit to flexible conduit coupling.
6. Direct flexible conduit bearing set screw type not acceptable.

2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Comply with:

1. NEC 350.
2. ANSI/UL 360.

B. Conduit material:

1. Flexible hot-dipped galvanized steel core, interlocked.
2. Continuous copper ground built into core up to 1-1/4" size.
3. Extruded polyvinyl gray jacket.

C. Fittings:

1. Threaded for IMC/rigid conduit connections.
2. Accepted for hazardous locations where so installed.
3. Provide sealing washer in wet/damp locations.
4. Compression type.
5. ANSI/NEMA FB 1.
6. ANSI/UL 514B.
7. Die Cast
8. Zinc plated malleable iron or steel.

2.6 ELECTRICAL METALLIC TUBING

A. Comply with:

1. UL 797.
2. ANSI C80.3.
3. NEC 358.
4. ANSI/UL 797.

B. Conduit material: Galvanized steel tubing.

C. Fittings:
1. ANSI/NEMA FB
2. Set screw.
3. Die Cast
4. Zinc plated malleable iron or steel.
5. Concrete tight.

2.7 RIGID POLYVINYL CHLORIDE CONDUIT

A. Comply with:

1. NEMA TC 2.
2. UL 651.
3. NEC 352.

B. Conduit material:
1. Shall be high impact PVC, tensile strength 55 PSI, flexural strength 11000 PSI.

C. Fittings:

1. Comply with:
   a) NEMA TC 3.
   b) UL 514. D. General:

1. UL listed and identified.
2. Conform to all national, state and local codes.
3. Manufacturer shall have 5 years experience in manufacturing PVC conduits.

2.8 EXPANSION FITTINGS

A. Expansion fittings shall be:
1. UL Listed, hot dipped galvanized inside and outside providing a 4” expansion chamber when used with rigid conduit, intermediate metal conduit and electrical metallic conduit, or:
2. Be polyvinyl chloride and shall meet the requirements of and as specified elsewhere for non-metallic conduit and shall provide a 6”expansion chamber.
3. Hot dipped galvanized expansion fitting shall be provided with an external braided grounding and bonding jumper with accepted clamps, UL listed for the application.
4. Expansion fitting, UL listed for the application and in compliance with the NEC without the necessity of an external bonding jumper may be considered. Submit fitting with manufacturer's data and UL listing for acceptance prior to installation. PART 3 - EXECUTION

3.1 LOCATION REQUIREMENTS

A. Underground Installations:
1. Use rigid non-metallic conduit (PVC) only unless local Authority Having Jurisdiction or applicable codes/utility requirements, etc. require rigid steel conduit.

2. Use galvanized rigid conduit, or PVC encased in steel-reinforced concrete.

3. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.
4. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with NEC 300.5 except the minimum cover for any conduit shall be 2'. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.
5. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.
6. PVC runs over 150' in length shall utilize rigid steel 90 degree elbows at each riser and at each change in direction. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC 250.80 and NEC 300.5.
7. All underground service lateral raceways shall be protected as required by NEC 300.5, including requirements for installation of warning tape.

B. In Slab Above or on Grade:
1. Use coated rigid steel conduit, coated intermediate metal conduit (if accepted) or rigid nonmetallic conduit.
2. Coating of metallic conduit to be black asphaltic or PVC.

C. Penetration of Slab:
1. Exposed Location:
a) Where penetrating a floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
2. Concealed Location:
a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 48" above finished floor.
b) Where penetrating a floor in location other than that above use a black mastic coated or PVC coated galvanized rigid steel conduit.

D. Outdoor Location:
1. Above Grade:
a) Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
b) In general all exterior conduit runs shall be rigid conduit (with PVC coating if within 10 miles of ocean or gulf) and threaded connectors as specified elsewhere.
c) Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.
d) Exterior conduits not on roof and not subject to damage (i.e. 6' above grade/floor or higher) may be rigid non-metallic PVC conduit as specified elsewhere. (Schedule 40 for low voltage Class II wiring, Schedule 80 for power wiring.)
e) Exterior conduits from grade level to 6' above grade may be rigid non-metallic Schedule 40 PVC for low voltage Class II wiring provided rigid metal conduit is used at transition from below grade to 12" above grade (due to weed eater damage, etc.).
2. Metal Canopies:
a) Conduit runs except for canopy lighting raceways are not to be run on (top or bottom) of metal canopies roof systems. All new conduit shown on or at these areas shall be run underground.

3. Roofs:
   a) Conduit is not to be installed on roofs, without written authorization by A/E for specific conditions.
   b) When accepted by written authorization conduit shall comply with the following:
      1. Be PVC coated rigid galvanized metal conduit.
      2. All fittings, etc. are to be PVC coated.
      3. Conduit shall be supported above roof at least 6" using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
      4. Supports to be fastened to roof using roofing adhesive or means as accepted by roofing contractor.

E. Interior Dry Locations:

1. Concealed: Use rigid metal conduit or aluminum conduit, intermediate metal conduit, electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" AFF except where prohibited by the NEC (Places of Assembly, etc.).

2. Exposed: Use rigid metal conduit or aluminum conduit, intermediate metal conduit, electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.

3. Concealed or Exposed Flexible Conduit:

   a) Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not longer than 6' in length with a ground conductor installed in the conduit or an equipment ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Exposed flexible steel conduit or seal tight flexible steel conduit shall not exceed 2' in length, unless written authorization by A/E for specific conditions is granted.

F. Interior Wet and Damp Locations:

1. Use rigid galvanized steel or intermediate metal conduit.

G. Concrete Columns or Poured in-place Concrete Wall Locations:

1. Use rigid non-metallic conduit. Penetration shall be by accepted metal raceway (i.e. metal conduit as required elsewhere in these specifications).

H. Locations Near 400Hz Distribution Systems:

1. Metal ferrous conduit or support equipment is not to be installed within 6" of any 400 Hz distribution system conduit or wire. Increase distance if so required by 400 Hz system manufacturer.

3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.

1. Accepted pipe vise.

2. Roller/bade type cutter or band saw.

3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.

B. Hangers shall be installed 8' apart.

C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.

3.3 ADDITIONAL REQUIREMENTS FOR EMT

A. Electrical metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.

B. All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted reamer.

3.4 ADDITIONAL REQUIREMENTS FOR FLEXIBLE STEEL CONDUIT AND SEAL-TITE FLEXIBLE STEEL CONDUIT

A. Shall be properly grounded.

B. Shall be installed with accepted fittings.

3.5 ADDITIONAL REQUIREMENTS FOR RIGID NON-METALLIC CONDUIT (PVC CONDUIT)

A. Rigid non-metallic PVC conduit is not allowed anywhere inside building(s) except underground in slab, in poured in place concrete, and in block wall up to first outlet box (if not over 40” AFF) if allowed by codes. Rigid non-metallic PVC conduit may be used exterior to building as stated elsewhere in these specifications.

B. Join rigid non-metallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

C. Threads will not be permitted on rigid non-metallic PVC conduit and fittings, except for rigid steel to rigid non-metallic PVC couplings.

D. Installation of rigid non-metallic PVC conduit shall be in accordance with manufacturer's recommendations.

E. Rigid non-metallic PVC conduit shall not be used to support fixture or equipment.

F. Field bends shall be made with accepted hotbox. Heating with flame and hand held dryers are prohibited.

3.6 SUPPORTS

A. Arrange supports to prevent misalignment during wiring installation.

B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24", increase distance as required) provide space on each for 25 percent additional conduits.

D. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29 Hangers and Supports.

E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach conduit to ceiling support wires.

G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.

H. Non-bolted conduit clamps, as manufactured by Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-

mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.7 EXPANSION FITTINGS

A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

B. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than 100' long and interval between expansion fittings in such runs shall not be greater than 100'.

3.8 GROUNDING

A. All raceways shall have a copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC codes.

B. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings.

C. Grounding conductors run with exterior/ underground feeders shall be bare only.

D. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by accepted ground bushings.

E. See other sections of these specifications for additional requirements.

F. Grounding conductors (including lightning protection down conductors) run in metal conduit shall be bonded to metal conduit at both ends.

3.9 FIRE AND SMOKE STOPPING

A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.

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

C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.

D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in compliance with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in compliance with ASTM E119. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

3.10 VERTICAL RACEWAYS

A. Cables in vertical raceways shall be supported per NEC 300.19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless if shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with architect prior to installation. This includes empty raceways for future use.

3.11 GENERAL

A. Install conduit in accordance with NECA Standard Practice of Good Workmanship in Electrical Contracting. Contractor shall layout all work prior to rough-in.

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange conduit to maintain headroom and present neat appearance.

D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.

E. Route conduit in and under slab from point-to-point.

F. Do not cross conduits in slab.

G. Maintain adequate clearance between conduit and piping.

H. Maintain 12” clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

I. Cut conduit square using saw or pipecutter; de-burr cut ends.

J. Bring conduit to shoulder of fittings; fasten securely.

K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

L. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2” size.

M. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

N. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC 300, whether shown on Drawings or not.

O. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the Specifications. Pullcord must be fastened to prevent accidental removal. A phenolic or brass nameplate shall be attached to each end indicating the location of both ends of conduit as follows: THIS END = "LOCATION," OTHER END = "LOCATION."

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

Q. Ground and bond conduit under provisions of Section 26 05 26 Grounding and Bonding.

R. Identify conduit under provisions of Section 26 05 53 Identification for Electrical Systems.

S. Install all conduits concealed from view unless specifically shown otherwise on drawings

T. Rigid steel box connections shall be made with double locknuts and bushings.

U. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

V. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.

W. All raceways shall be run from outlet to outlet as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.

X. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade. Marker shall be 6” round x 6” deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.

Y. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."

Z. All connections to motors or other vibrating equipment including dry type transformers or at other locations where required shall be made with not less than 12” of flexible steel conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.

AA. All connections to motors or other vibrating equipment including transformers or at other locations where required shall be made with not less than 12” of flexible liquid-tight steel conduit, with nylon insulated throat connectors and wire mesh grip fittings (manufactured by Thomas & Betts or accepted equal) at both terminations of conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.

BB. Provide conduit seal-offs wherever conduit crosses obvious temperature changes (i.e. from inside to outside of coolers, freezers, etc.).

CC. Route conduit through roof openings for piping and ductwork or through suitable roof flashing or boot. Coordinate location with roofing installation specified under other Sections of these specifications.

DD. All raceways shall be run in neat and workmanlike manner and shall be properly installed in accordance with latest edition of NEC with accepted conduit clamps, hanger rods and structural fasteners.

EE. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.

FF. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.

END OF SECTION

SECTION 26 05 34 - OUTLET BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes wall and ceiling outlet boxes (and/or small junction/pullboxes).

B. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.

1.3 REFERENCES

A. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

B. ANSI/NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

C. ANSI/NFPA 70 National Electrical Code

D. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Submit catalog cut sheets/product data on:

1. Surface cast boxes.

B. For pullboxes and junction boxes not covered in Section 26 05 35 Pull and Junction Boxes. Submit product data showing dimensions, covers, and construction.

1.6 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of outlets in offices and work areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 GENERAL

A. All boxes and fittings shall be labeled by Underwriters Laboratories.

B. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.

C. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.

D. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting therto.

E. Handy boxes shall not be used.

F. Outlet boxes to be one-piece.

G. 4" x 4" boxes and 4 11/16" x 4 11/16" boxes used as junction boxes shall be one piece.

2.2 SHEET METAL OUTLET BOXES: ANSI/NEMA OS 1, GALVANIZED STEEL

A. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2” male fixture studs where required.

B. Concrete Ceiling Boxes: Concrete type.

C. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices. T&B, Steel City, Raco or accepted substitution.

D. Ceiling outlet boxes shall be 4" octagonal or 4" square X 1 1/2" deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.

E. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be 4" square X 1 1/2" deep. For recessing in exposed masonry, provide one piece 4" square x 1-1/2" deep wall boxes with appropriate 4" square cut tile wall covers Steel City series #52-C-49/52-C52 or accepted substitution. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.

2.3 CAST BOXES NEMA FB 1:

A. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices; Appleton, Crouse Hinds or accepted substitution. Trim rings shall also be of one-piece construction.

B. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast metal suited to each application with threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitably configured, gasket, and corrosion-proof fasteners.

C. Boxes to be Type FD unless otherwise noted on drawings.

D. Freestanding cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6” from ceiling access panel or from removable recessed luminaire.

D. Install boxes to preserve fire resistance rating of partitions and other elements.

E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

F. Use flush mounting outlet boxes in finished areas.

G. Do not install flush mounting boxes back-to-back in walls; provide minimum 6” separation.

Provide minimum 24” separation in acoustic rated walls.

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

I. Use stamped steel bridges to fasten flush mounting outlet box between studs.

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

K. Support all outlet boxes from structure with minimum of one 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two all-thread rod hangers, minimum.

L. Do not fasten boxes to ceiling support wires.

M. Support boxes independently of conduit.

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

O. Use gang box with plaster ring for single device outlets.

P. Use cast outlet box in exterior locations and wet locations.

Q. Comply with applicable portions of the NECA National Electrical Installation Standards.

R. Install outlets in the locations shown on the Drawings; however prior to rough-in, the Owner shall have the right to make slight changes in locations to reflect room furniture layouts.

S. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.

T. The Contractor shall relocate electrical boxes as required so that once installed, electrical devices will be symmetrically located with respect to the room layout.

U. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.

V. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.

W. As a minimum, provide pull boxes in all raceways over 150’ long. The pull box shall be located near the midpoint of the raceway length.

X. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.

Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.

Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.

AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.

BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Adda-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.

CC. Outlet boxes mounted in metal stud walls are to be supported to studs with two screws inside of outlet box to a horizontal stud brace between vertical studs, or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall is finished.

DD. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

EE. Mount Height.

1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural Drawings and Shop Drawings for installing:

| | |
|---|---|
| Switches | 4'-0" AFF to top |
| Receptacles | 1'-4" AFF to bottom |
| Lighting Panels | 6'-6" AFF to centerline of highest breaker/fuse |
| Phone outlets | 1'-4" AFF to bottom |
| Intercom Call-in button/handsets | 4'-0" AFF to top |
| Fire Alarm Pull Stations | 4'-0" AFF to top |
| Fire Alarm Strobe Lights | 80" AFF to bottom |
| Thermostats | 4'-0" AFF to top |
| Space Sensors | 4'-0" AFF to top |

2. Bottoms of outlets above countertops or base cabinets shall be minimum 2" above countertop or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural Drawings, prior to rough-in, regardless of height shown on Division 26 Drawings.

3. Height of wall-mounted fixtures shall be as shown on the Drawings or as required by Architectural Drawings and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

FF. Special Purpose Outlets.

1. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.

GG. Outlets in Fire/Smoke and Smoke Partitions/Walls.

1. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other accepted materials. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under all Sections of these specifications.

B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.

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

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

E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

END OF SECTION

SECTION 26 05 35 - PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide and install pull and junction boxes as shown on drawings or as required by the NEC.

B. Provide and install pull and junction boxes wherever required for a complete and operating distribution system whether shown on drawings or not.

C. Where outlet boxes are used for pull and/or junction boxes, they shall meet the requirements of Section 26 05 34 Outlet Boxes.

1.3 REFERENCES

A. ANSI/NEMA FB 1 Fittings and Supports for Conduit and Cable Assemblies

B. ANSI/NEMA OS 1 Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports

C. ANSI/NEMA OS 2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

D. ANSI/NFPA 70 National Electrical Code

E. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Submit actual shop drawings of all pull boxes showing:

1. Covers.

2. Dimensions - inside and out.

3. Rating of concrete or gauge of metal.

4. Manufacturer.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of pull and junction boxes.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of pull and junction boxes prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose and to maintain required access.

PART 2 - PRODUCTS

2.1 GENERAL

A. Dimensions of pull and junction boxes shall meet dimensions shown on Drawings or dimensions required by NEC, whichever is largest.

B. Pull and junction boxes shall meet all requirements of UL and NEC.

C. Small pull boxes (i.e. 4" x 4") shall meet the requirements of these Specifications for outlet boxes as a minimum.

D. All boxes (above ground) of 100 cubic inches or more shall be constructed of 14 gauge steel with hot dip galvanized coating.

2.2 SHEET METAL BOXES

A. NEMA OS 1, galvanized steel.

B. Box to be fully weatherproof and watertight where installed outside.

2.3 SURFACE-MOUNTED CAST METAL BOX

A. NEMA 250, Type 4; flat-flanged, surface-mounted junction box.

B. Material: Cast aluminum.

C. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. Provide all hubs as required for conduit connections.

PART 3- EXECUTION

3.1 GENERAL

A. Install per NEC.

B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

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

E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6” from ceiling access panel or from removable recessed luminaire.

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

G. Align adjacent wall-mounted boxes with each other.

H. Use flush mounting boxes in finished areas.

I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6” separation. Provide minimum 24” separation in acoustic rated walls.

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

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

L. Pull and junction boxes larger than 25 square inches shall be supported with two 3/8" all-thread rod hangers minimum.

M. Pull and junction boxes used for Systems Divisions 27, 28 larger than 25 square inches shall be hinged cover type.

N. Do not fasten boxes to ceiling support wires.

O. Support boxes independently of conduit.

P. Large Pull Boxes:

1. Boxes larger than 100 cubic inches in volume or 12” in any dimension.:

a) Interior dry locations per NEC with screw covers.

b) Other locations use hinged enclosure under provisions of Section 26 27 16 Cabinets and Enclosures.

Q. Outdoor Locations: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access doors with applicable sections in these Specifications.

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

3.3 ADJUSTING

A. Install knockout closure in unused box opening.

END OF SECTION

# SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Provide and install all equipment, labor and material for a complete identification system including but not limited to:

1. Nameplates and labels.
2. Wire and cable markers.
3. Conduit markers.

B. Identify all new and existing conduit, boxes, equipment, etc. as specified herein.

### 1.3 REFERENCES

A. ANSI/NFPA 70 National Electrical Code

B. Americans with Disabilities Act

### 1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

## PART 2- PRODUCTS

### 2.1 NAMEPLATES

A. Nameplates shall be laminated phenolic plastic, chamfered edges.

1. 120/208 Volt System:
   a) Black front and back, white core, lettering etched through outer covering, white engraved letters on black background.
2. 277/480 Volt System:
   a) Orange with white letters.
3. Emergency System:
   a) Red with white letters.
4. Emergency Power:
   a) Red front and back, white core, lettering etched through outer covering, white engraved letters on red background.

B. Letter Size:

1. 1/8” letters for identifying individual equipment and loads.
2. 1/4” letters for identifying grouped equipment and loads.

C. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the Drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards,

switchboards, motor control centers, disconnects and enclosed breakers shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire." In addition, provide phenolic label in panel to describe where the panel is fed from and location. For example, "Fed From MDP-1:3:5 Electrical Room #E101 Level 1." Nameplates for equipment listed below shall describe particular equipment name and associated panel/circuit, if applicable. The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and pushbutton station nameplates for that machine.

D. The following items shall be equipped with nameplates:

1. All motors, motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches, transformers, panelboards, circuit breakers (i.e., all 2-pole, 3-pole circuit breakers), contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical, and electrical systems (Systems Divisions 27, 28), junction and pull boxes (larger than 4-11/16"), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number, if applicable.

E. All Electrical system panels, transfer switches, motor control centers, disconnect switches, motor controllers, etc. shall be labeled as per branch, i.e.: "Panel ABC Emergency-Life Safety Branch" (similar for emergency legally required standby branch, or emergency optional standby branch).

2.2 WIRE MARKERS

A. Description: Cloth, tape, split sleeve or tubing type wire markers.

1. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

B. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings including neutral conductor.

2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

2.3 CONDUIT/JUNCTION BOX COLOR CODE

A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:

| COLOR CODE FOR JUNCTION BOXES | KRYLON PAINT NUMBER |
|---|---|
| System Emergency 277/480 volt | Cherry Red K02101 |
| System Emergency 120/208 volt | Zinger Pink S01150 |
| Fire Alarm | ~~Safety Orange K02410~~ Cherry Red K02101 |
| Normal Power 277/480 volt | Leather Brown K02501 |
| Normal Power 120/208 volt | Glossy Black K01601 |
| Fiber Optics | Safety Purple K01929 |
| Sound System | Safety Yellow K01813 |
| Clock/Radio | Light Blue S01540 |
| Intercom | True Blue K01910 |
| Computer/Data | Gold K01701 |
| TV | Glossy White K01501 |

| | |
|---|---|
| BAS | Cameo White K04129 |
| FIDS/BIDS | Saddle Tan K03554 |
| Security/CCTV | John Deere Green K01817 |
| Telephone | Safety Green K02012 |
| Grounding | Fluorescent Green K03106 |

B. Conduit (not subject to public view) longer than 20’ shall be painted with above color paint band 20’ on center. Paint band shall be 4" in length applied around entire conduit. Where conduits are parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniform. Paint boxes and raceways prior to installation, or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.

C. Junction boxes and conduits located in public areas (i.e. areas that can be seen by the public) shall be painted to match surface attached to. Provide written request to A/E for interpretation of public areas in question.

2.4 CONDUIT/JUNCTION BOX MARKER

A. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately describe its associated panel and circuit reference number(s) within (i.e. ELRW-2, 4, 6), or systems within (i.e. fire alarm, intercom, etc.). Identification shall be neatly written by means of black permanent marker. Paint one-half of cover plate with appropriate color above, and one-half with associated panel/circuit or system as described above. Junction box cover plates located in public areas shall be identified with small phenolic labels securely attached. Label colors to be determined by A/E. Large pull/junction boxes (8" x 8" or larger) shall be color identified by painting the corners of box cover plate with specified colors at 45 degree angles; phenolic labels as specified herein.

B. Identify conduit not installed in public areas with corresponding panel/circuit numbers or corresponding system type as described above. Spacing 20 ft. on center adjacent to color identification bands.

2.5 UNDERGROUND WARNING TAPE

A. Description: Minimum 6” wide plastic tape, detectable type, with suitable warning legend describing buried lines. Systems conduit shall have orange colored tape. Power/lighting conduit shall have red colored tape.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using stainless steel pop rivets.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Nameplates installed inside on dead front cover shall be self-adhesive tape. Do not drill or install screws in dead front.

E. Identify new and existing conduit, junction boxes, and outlet boxes using field painting.

F. Identify new underground conduit using underground warning tape. Install a minimum of one tape per trench at 6” below finished grade. For trenches exceeding 24” in width, provide one tape per 24” of trench width spaced evenly over trench width.

G. Install wire markers at all new connections and terminations, and at existing connections and terminations modified or altered.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide all labor, materials, and equipment necessary to properly and completely install panelboards as scheduled on the drawings and as required by this Section.

1.3 REFERENCES

A. NECA National Electrical Installation Standards
B. NEMA PB 1 Panelboards
C. NEMA PB 1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
D. NFPA 70 National Electrical Code
E. UL 50 Enclosures for Electrical Equipment
F. UL 67 Panelboards
G. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with NECA National Electrical Installation Standards.

B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

1.6 SUBMITTALS

A. Product data shall be submitted on:

1. Panel.
2. Cabinet.
3. Bus.
4. Dimensions.
5. Construction.

B. Shop drawing shall be submitted for each and every panel for this project, each and every panel drawing shall clearly indicate the following information:

1. UL label.
2. Each circuit breaker amperage rating, circuit number and position/location in panel.
3. Electrical characteristics of panel.
4. Mains rating.
5. Main device rating.
6. Mounting.
7. Dimension, width, depth, height.
8. Bus material.
9. Interrupting capacity of minimum rated breaker.
10. Panel type.

11. Series AIC rating with upstream breakers.

1.7 PROJECT RECORD DOCUMENTS

A. Submit record documents to record actual locations of products, indicate actual branch circuit arrangement.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit Maintenance Data: Include spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by manufacturer.

1.10 MAINTENANCE MATERIALS

A. Provide two of each panelboard key.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle panelboards and enclosures carefully to prevent damage.

B. Store equipment indoors and protect from weather.

C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work. This time shall be established by a CPM provided by the Contractor and accepted by the supervising authorities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Square D.

B. Manufacturers (including accepted substitutions) must provide equipment equal to or superior than the basis of design used on this project.

1. Panels or circuit breakers with an AIC rating less than that shown on the drawings will not be approved.

2. Where basis of design panelboard can accept a certain type, frame, and/or AIC rated breaker, the accepted substitution manufacturer must also be able to accept all equal breaker type, frame, and/or AIC rating.

2.2 GENERAL

A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1, circuit breaker type, dead front UL 67.

B. Panelboard Bus: Copper ratings as indicated. Provide copper ground bus in each panelboard. Provide isolated full size neutral bus where neutral is applicable. Provide nonlinear load panelboards as specified on drawings. Non-linear panelboards shall have 200 percent rated neutral busbar.

C. Short Circuit Rating:

1. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:

a) Individual CB AIC rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.

b) Panel series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.

c) Circuit breaker types are not shown or called for. The Contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given, including providing current limiting breakers where required to achieve all ratings given.

2. Short Circuit Rating Label:

a) Panelboards shall be labeled with a UL short-circuit rating.

b) Series ratings shall not be used to achieve short circuit ratings for equipment on life safety or equipment branch.

c) When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:

1. Size and type of upstream device.

2. Branch devices that can be used.

3. UL series short-circuit rating. D. Enclosure:

1. Enclosures shall be at least 20” wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

2. Enclosures shall be provided with blank ends.

3. Where indicated on the drawings, branch circuit panelboards shall be column width type.

4. Regulatory requirements:

a) NEMA PB 1, Type 1, Type 3R, or Type 4X as indicated on Drawings. Use only Type 3R or Type 4X for units to be installed outdoors. Use only Type 4X in interior wet locations and designated wash-down areas. For the purposes of this specification, a wash-down area is defined as any area that is directly washed or rinsed with any form of water hose.

5. Cabinet Box: Depth 6”, width 20” minimum, constructed of code gauge steel, galvanized or bonderized to prevent rust.

E. Cabinet Front: Flush or surface (as indicated on Drawings) cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard baked enamel finish for interior panels. Exterior panels to be painted with rust inhibit primer painted over on all surfaces with epoxy paint.

F. Panels and breakers shall be rated for voltage and class of service to which applied.

G. Spaces:

1. Space provisions or spaces for future breakers shall be located at the bottom of the panel and be fully bused complete with all necessary mounting hardware less the breaker.

H. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

2.3 MAINS

A. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on Drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.

B. Regardless of what is shown on Drawings, provide the following minimum requirements:

1. Main circuit breaker on each panel serving building main if required by applicable codes.

2. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).

C. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

D. Main circuit breaker is not to be mounted as branch breaker or subfeed breaker.

2.4 CIRCUIT BREAKERS

A. General

1. Molded Case Circuit Breakers: Plug-in type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

2. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

B. Main Breakers:

1. Main breakers shall be individually mounted separate from branch breakers.

2. Covered by a metal plate, except for operating handle.

3. Connection from the load's side to the panel bus shall be bus bar. Insulated wire not permitted.

C. Branch Breakers:

1. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.

2. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.

3. Multi-pole breakers shall have common internal trip. No handle ties between single pole breakers are acceptable for this project.

4. Multi-wire branch circuit breakers shall have multi-pole breakers as required by the NEC. Handle ties between breaker handles are not acceptable.

5. Single pole 15 and 20 ampere circuit breakers shall be rated for switching duty and shall be labeled as "SWD."

6. AIC rating shall be as called for in paragraph 2.2 General.

7. Ground Fault Circuit Interrupters (GFCI):

a) Provide UL Class (5 milliamp sensitivity) ground fault circuit protection on 120 VAC branch circuits for exterior location receptacles and for interior locations where required by NEC. (These may not be indicated on Panel Schedule.) This

protection shall be an integral part of the branch circuit breaker, which also provides overload, and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. Provide separate neutral for circuits on GFCI breakers whether indicated on drawings or otherwise.

8. Breakers feeding heating and air-conditioning equipment shall be rated HACR type breaker.

9. Breakers feeding high intensity discharge lamps systems shall be HID rated.

D. All breakers are to have lugs sized to match conductors called for on drawings.

2.5 SERVICE ENTRANCE EQUIPMENT

A. Panelboards used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA National Electrical Installation Standards, the applicable requirements of the National Electrical Code, and recognized industry practices.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 26 05 29 Hangers and Supports.

C. Height: 6’ to top of panelboard; install panelboards taller than 6’ with bottom no more than 4” above housekeeping curb.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names on inside of door. Room names shall be actual names or numbers used, not necessarily shown on the drawings. Progress drawings shall show same arrangements as the directory. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 26 05 53 Identification for Electrical Systems.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 4 empty 1”. Identify each as “SPARE”.

H. Proper working clearances shall be maintained at every panelboard location. The working space in front of a panelboard shall be as a minimum, 30” wide extending 3’, 3.5’, or 4’ (per NEC 110.26) out perpendicular to the panelboard.

I. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Enclosures shall be installed so that the top is 6’-6” above finished floor. Where the size of the enclosure is such that the top cannot be installed at 6’-6”, the top of the enclosure shall be kept as low as possible.

J. Clean the interior of each panelboard before installing conductors. At all times, keep the interior trim and exterior surfaces of the panelboard free of rust and debris. Repaint finishes if necessary.

K. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be laced and arranged in orderly manner.

L. Collect all keys upon delivery of panelboard. Store keys on one ring to be kept by project superintendent. Forward key ring with keys to Owner upon Substantial Completion.

M. Provide a separate neutral conductor for each GFI breaker. These shall not be combined to serve more than 1 circuit, even where on different phases. Increase plan indications of conductors for neutral wires required, as necessary.

3.2 IDENTIFICATION

A. Refer to Section 26 05 53 Identification for Electrical Systems for products and content.

B. Provide engraved plastic nameplates under the provisions of Section 26 05 53 Identification for Electrical Systems.

C. Nameplate shall state panel name and voltage of this panel, name of panel that feeds this respective panel, and UL short-circuit rating of this panel. D. Provide labels and identification as required by the NEC.

E. All circuit identifications and directories shall be checked to verify accuracy of the description of the load and/or equipment being fed.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

D. Feeder conductors shall be checked by accepted means to establish the absence of shorts to ground, insulation value, etc., and the result recorded and submitted to the Engineer.

E. All circuits shall be operated to establish a good working order and checked for shorts.

F. All panel directory circuit numbers shall be checked to verify accuracy of the number.

G. Where and when requested by Engineer provide:

1. Inspection of equipment by authorized equipment manufacturer’s technician complete with submittal of statement of findings by technician, and providing any adjustments deemed necessary for a complete and operating system.

2. Ground, voltage, and/or load readings complete with submittal on legible form with applicable data.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:

1. Wall switches.
2. Receptacles.
3. Device plates and decorative box covers.

1.3 REFERENCES

A. NEMA WD 1 General Requirements for Wiring Devices

B. NEMA WD 6 Wiring Devices Dimensional Specifications

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Submit product data on all types of wiring devices including plates and engraving.

B. Submit Manufacturer's Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
2. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.7 EXTRA MATERIALS

A. Provide a minimum of two screwdrivers of each type of tamper proof screw used on project.

B. Turn over to Owner and submit Spare Parts/Maintenance Stock Certification. (See Section 26 01 00 Operation and Maintenance Manual).

PART 2 - PRODUCTS

2.1 GENERAL

A. All devices shall be Specification Grade as minimum.

B. General purpose wiring devices shall meet NEMA standard WD-1, Wiring Devices, General

Purpose. Special purpose devices shall conform to the requirements of NEMA standard WD-5, Wiring Devices, Special Purpose.

C. All wiring devices shall bear UL labels.

D. All devices of one type (i.e. all snap switches, all duplex receptacles, etc.) shall be by the same manufacturer. Hazardous Location and Special Purpose Devices may not be available from the same manufacturer; this shall constitute the only exception to this requirement of single-source.

E. Corrosion resistant devices shall be as specified for normal usage, and fabricated of yellow color melamine plastic. Where "Weatherproof" type is indicated for exterior or wet locations, provide matching self-closing cover with gasketed seals at plate/wall junctions and for cover.

F. Provide factory packaged wiring devices having high impact strength molded plastic bodies.

G. Except where specifically required in these Specifications, use of interchangeable type or combination switch-receptacle-pilot devices is not acceptable and shall be removed.

H. Switches and receptacles connected to [life safety branch of the] emergency power system shall be red. Plates shall be as specified for devices connected to normal circuits, but shall be engraved reading "Emergency", see Drawings for other engraving requirements.

2.2 WALL SWITCHES

A. Manufacturers:

1. See Drawings.

B. General:

1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in Specifications and/or on Drawings.

2. Switches shall be toggle or key-operated types, as indicated on the Drawings. All key operated switches shall be keyed alike.

3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "On". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.

4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front relampable.

5. Snap switches installed in hazardous locations shall be UL listed for the type of location (class and division).

6. Switches connected to emergency power shall have red lighted handles which shall illuminate when the switches are Off.

7. Voltage and ampere rating of switches shall be marked on switch, and shall conform to voltage of system to which applied.

C. Description: NEMA WD 1, heavy-duty, ac only general-use snap switch.

D. Voltage Rating: 120-277 volts, ac.

E. Current Rating: 20 amperes minimum.

F. Ratings: Match branch circuit and load characteristics.

2.3 RECEPTACLES

A. General:

1. All receptacles shall be of standard NEMA configuration, as indicated on the Drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.
2. Duplex receptacles shall have integral UL listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of Industrial Fluorescent light fixtures on the same switching circuit. Receptacle face to be impact resistant nylon.
3. Weatherproof duplex receptacles shall be provided in all exterior locations, and shall be ground fault circuit interrupting (GFCI) types, with weatherproof cover plates allowing use of receptacle with cover in closed position.
4. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.
5. Duplex receptacles shall have back and side wired screw pressure terminals.

B. Description: NEMA WD 1; heavy-duty general use receptacle.

C. Configuration: NEMA WD 6; heavy-duty, general use type as specified and indicated.

D. Convenience Receptacle: Type 5-20.

E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

F. F. Manufacturers:

1. See Drawings.

2.4 COVER PLATES

A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.

B. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel having a nominal thickness of .04" and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.

C. Where so directed by the A/E (either by Contract Documents or direction after the bid), substitute nylon plates of quality as specified below without increase in Contract Price. Coordinate prior to securing plates for project. Where nylon cover plates are required in finished interior spaces, these shall be fabricated of either non-combustible mar-proof high impact resistant fiberglass or nylon reinforced thermosetting material or nylon, having a minimum thickness of .10", with smooth finish. Screws securing the plates shall have flush (when installed) heads of color to match plates. Nylon cover plates shall conform to Federal Specification QP-455A and all other NEC, UL, and NEMA requirements. Where required by A/E, nylon plates shall be fitted with nylon screws for totally nonmetallic surface installation.

D. Cover plates for switches located in corrosive atmospheres (where vaporproof is not indicated) shall be equal to Hubbell #17CM81/#17CM82/#17CM83/#17CM84 one-piece neoprene with matching presswitch.

E. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed.

F. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the Drawings. Metallic plates and nylon plates in ivory, beige, gray, and white shall be engraved with black fill. Red, brown, and black nylon plates shall be engraved with white fill.

G. Unless specifically noted otherwise in Specifications or on Drawings, all outlets for telephone and other communications and data systems shall be provided with standard size one-piece cover plates having a minimum 3/4" diameter bushed hole in the center unless specifically noted otherwise in Specifications and/or on Drawings. Where telephone conductors are installed, plates shall contain telephone type, polarized plug-in receptacles.

H. All device plates (including systems device plates and trims) located in secure areas such as cells, dayrooms, holding rooms, recreation areas, etc., shall have security wall plates (minimum 10 gauge) with minimum 12 gauge galvanized steel backplate. Plates shall have TORX counter pin reject type tamperproof screws.

I. All device plates (including systems device plates and trims) and blank plates located in all secure areas shall be mounted with tamper proof screws, unless otherwise noted.

2.5 COLOR

A. Wiring devices connected to normal power and located in unfinished spaces shall be grey color. Devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the following list of standard colors: ivory, beige, gray, white, brown, black.

B. Cover plates for devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the above list of standard colors or #302 stainless steel.

C. All devices and coverplates in paneled walls shall have finish to match paneling.

D. Devices connected to [the life safety or critical branch of the emergency distribution system] emergency power shall be red color, except where established building standards and/or isolated ground devices require otherwise. Coordinate before purchase.

E. Contractor shall modify any given catalog numbers as required to procure devices and plates of the proper color.

PART 3- EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 01 General Requirements and any other applicable supplemental requirements/conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify floor boxes are adjusted properly.

E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

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

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on bottom.

E. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

F. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.

G. Where two or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang box and combination multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.

H. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.

I. In finished areas provide same type of plate for all surface mounted devices as for recessed mounted devices.

J. In any room where new and existing construction is present, all receptacles, switches, and coverplates which are existing to remain shall be changed as required to match new work.

K. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.

L. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.

M. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment. N.

All devices shall be installed so that only one wire is connected to each terminal.

O. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.

P. Receptacles shown to be floor mounted shall be installed in floor boxes (with coverplates) which are approved for this use.

Q. Connect wiring devices by wrapping conductor around screw terminal.

R. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

S. Install protective rings and split nozzle on active flush cover service fittings.

T. Install local room area wall switches at door locations on the lock side of the door approximately 4” from the jamb. Where locations shown on the Drawings are in question, provide written request for information to A/E prior to rough-in.

3.4 NEUTRAL CONDUCTOR CONNECTIONS

A. Each receptacle’s "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under other Sections of these Specifications to obtain mounting heights specified and indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 27 01 00 - OPERATION AND MAINTENANCE MANUALS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for Operation and Maintenance Manuals (O & M Manuals) specifically applicable to Division 27 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

1.2 OPERATION AND MAINTENANCE MANUALS

A. O& M Manuals shall consist of a minimum of one hard cover view type 3-ring binder sized to hold 8 1/2" x 11" sheets for COMMUNICATIONS OPERATION AND MAINTENANCE. Refer to Division 1, general requirements for additional requirements.

1. Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3". Provide additional binders if 3" size is not sufficient to properly hold submittals.

2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for O & M's at the end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e. COMMUNICATIONS OPERATION AND MAINTENANCE.

B. O & M Data:

1. Manufacturer's operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e. surge suppression – intercom).

2. Include troubleshooting instructions, list of special tools required, theory of operation, manufacturer's care and cleaning, preventative maintenance instructions, wiring diagrams, and point-to-point schematics.

C. O & M Manuals to include:

1. Completed forms and information per Division 1, General Requirements and this section of the specifications.
   a) Table of Contents
   b) Project Addresses
   c) Reinforced Separation Sheets tabbed with the appropriate specification reference number and typed index for each Section in the Systems Schedule
   d) Check Out Memo
   e) Ground Test Information
   f) Progress and Record Drawing Certification
   g) Spare Parts Certification Memo

2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted as required in Section Submittals. These shall be inserted in binder in proper order.

3. Product Data: Product data and/or Catalog sheets shall be a copy of the final and accepted submittal submitted as required in Section Submittals. These shall be inserted in binder in proper order.
4. Warranty/Guarantee: Provide copy of warranty/guarantee in respective location in O & M binder, (Power and Lighting) (Systems). Original warranty/guarantee is to be incorporated into separate project warranty book with warranty/guarantees provided for other sections and divisions of the specifications and submitted for Architectural/Owner acceptance.
5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section
6. Wiring diagrams, schematic, etc. inserted in proper order, for:
   a) UPS systems.
   b) Each and every part of the Systems sections of these Specifications
7. For Sections 27
   a) Product data and/or catalog sheets on all equipment applicable to this project.
   b) Equipment supplier list for each section's equipment.
   c) Floor boxes; in addition to above provide:
      1. Installation/removal instructions.
      2. Parts list.
   d) UPS system; in addition to above provide:
      1. Wiring diagrams.
      2. Parts list.
      3. Installation/removal instructions.
      4. Operation and maintenance requirements.
      5. Copy of maintenance contract.
      6. Preventive maintenance instructions.
      7. Check-Out Memo Form
   e) Grounding; in addition to above provide:
      1. Test results on each ground rod.
      2. Ground Test Information Form
8. Sections 27
   a) Installer's name, address, phone, etc. for each system.
   b) Authorized representatives name, address, phone, etc. for each system.
   c) Equipment supplier's name, address, phone, etc. for each system.
   d) Surge Suppression.
      1. Product data and/or catalog sheets on equipment applicable to this project.
      2. Parts list.
      3. Recommended testing and replacement procedures.
   e) Sound/Paging, Television Systems.
      1. Product data and/or catalog sheets on equipment applicable to this project.
      2. Parts list.
      3. Installation/removal instructions.
      4. Wiring diagrams of panels.
      5. Point-to-point wiring diagrams of system.
      6. Operation and maintenance requirements.
      7. Shop drawing as submitted and accepted in submittal process.
      8. Check-Out Memo Form
   f) Premise Distribution Systems.
      1. Product data and/or catalog sheets on equipment applicable to this project.
      2. Parts list.

3. Wiring diagrams of panels.
4. Shop drawing as submitted and accepted in submittal process.

D. Test Data: record of results for all copper, metallic, and fiber optic cables installed and tested, or tested.

a) Tested data to be formatted according to EIA/TIA 606 Administration Standards.

b) Test results to be submitted in hard copy in three (3) ring binder and in electronic form (CD).

c) Include all fiber tests with performance graph from OTDR. Single Mode and Multi Mode is to be OTDR tested. All fiber utilized for the installation of Project Systems required by the project scope is to be tested whether or not the cable was installed by the Contractor.

2. Data sheets showing all field labeling used for termination blocks, and cable (outside plant, backbone, riser and horizontal) runs.

3. Cable Data for all backbone (riser) and horizontal fiber and copper indicating type and use of cable installed by Contractor and to include:

a) Manufacturer's specification sheet

b) Manufacturers performance and warranty sheet

c) Date manufactured

d) Part number.

e) Serial number

f) Reel number.

g) Description

h) Attenuation specifications

i) Bandwidth specifications

4. Complete equipment rack layouts showing locations of all rack mounted patch panels, and equipment items.

E. As Built record drawings

1. Submit under provisions of the General and Supplemental Conditions of the Contract.

2. Record actual locations and sizes of pathways, outlets, terminal boards, etc.

3. Record actual type and size of cables installed.

4. Record "to and from" locations coordinated with cable labeling for all cables at each terminal board or cabinet.

5. Cross-connects "to and from location" terminations for each Telecom and/or Communication Closet.

6. Provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, detailed cable drawings, with all cables and terminations identified, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment (cables, connectors, outlets, equipment). A clear and consistent nomenclature scheme is to be defined and

used on the documentation and the cable labeling which facilitates locating and identifying each cable.

7. Cable Route Diagram: Provide locations and routes of "as-built" cable system and include:

   a) End points.

   b) Fiber routing.

   c) Splice points.

   d) Patch panels.

   e) Terminations (connector type).

   f) Cable lengths (include slack).

   g) Location of surge suppressors.

1.3 PROCESSING SUBMITTALS

A. Submit a minimum of three (3) sets of O & M Manuals, two (2) sets for Owner, one (1) set for Engineer.

B. The Contractor shall review the manuals before submitting to the A/E. No request for payment will be considered until the brochure has been reviewed and submitted for acceptance.

C. Provide additional copies if additional copies are required in other Divisions and/or sections of these specifications.

1.4 DELAYS

A. Contractor is responsible for delays in job project accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

1.5 RESUBMITTALS

A. The A/E shall be reimbursed cost to review re-submittals subsequent to the second submittal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

A. Submit under provisions of the General and Supplemental Conditions of the Contract.

B. Record actual locations and sizes of pathways, outlets, terminal boards, etc.

C. Record actual type and size of cables installed.

D. Record "to and from" locations coordinated with cable labeling for all cables at each terminal board or cabinet.

E. Cross-connects "to and from location" terminations for each Telecom and/or Communication Closet.

F. Provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, detailed cable drawings, with all cables and terminations identified, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment (cables, connectors, outlets, equipment). A clear

and consistent nomenclature scheme is to be defined and used on the documentation and the cable labeling which facilitates locating and identifying each cable.

G. Cable Route Diagram: Provide locations and routes of "as-built" cable system and include:

1. End points.
2. Fiber routing.
3. Splice points.
4. Patch panels.
5. Terminations (connector type).
6. Cable lengths (include slack).
7. Location of surge suppressors.

PROJECT ADDRESSES 9400 Universal Blvd,
Orlando, Fl 32819

OWNER:

ARCHITECT:

CONSULTING ENGINEER: RTM Engineering Consultants
925 S Semoran Blvd., Suite 100
Winter Park, FL 32792
Telephone No.: (407) 678-2055

GENERAL CONTRACTOR:

SUBCONTRACTOR:

CHECK OUT MEMO FORM

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name:

Type of equipment checked: Equipment Number:

Name of manufacturer of equipment:

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.

2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below.*

3. Written operating and maintenance information has been presented to the Contractor, and gone over with him in detail.

4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

Checked By: (Print or Type Name of Manufacturer's Representative)

(Address and Phone No. of Representative)

(Signature and Title of Representative)

(Date Checked)

Witnessed By: Signature and Title of Contractor Rep.)
*Exceptions Noted At Time Of Check-Out (use additional page if necessary)

GROUND TEST INFORMATION

PROJECT NAME:_____

GROUND TYPE:_____

TEST BY:_____

DATE OF TEST:_____

GROUND LOCATION:_____

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM

GROUND: _____(OHMS)

AFTER CONNECTION TO SYSTEM

GROUND: _____(OHMS)

WEATHER CONDITIONS (Wet/Dry):

SOIL CONDITIONS (Wet/Dry):

CONTRACTOR'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT:

DIVISION NUMBER AND NAME:

This is to certify that the attached marked-up design prints were marked as the items were installed at the site during construction, and that these prints represent as accurate "As-Builts" record of the work as actually installed. One copy will be turned over to the Owner at the instruction in Operation Conference. The duplicate copy is for the Engineer's files.

Name Of General Contractor

BY: Authorized Signature And Title

Date

Name Of Subcontractor

BY: Authorized Signature And Title

Date

SPARE PARTS CERTIFICATION MEMO

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name:

Type of Spare Parts:

Specification Reference:

Quantity of Spare Parts:

Signature below by the contractor signifies that the spare parts required by the drawings and/or specifications have been turned over to the Owner.

_____

(Name of General Contractor)

_____

(Signature, Title, Date)

_____

(Name of Subcontractor)

_____

(Signature, Title, Date)

_____

(Name of Owner)

_____

(Signature, Title, Date)

# SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

### 1.2 SUMMARY

A. This section includes Basic Electrical Requirements specifically applicable to the Division 27 Section, in addition to Division 1 - General Requirements - and any supplemental requirements/conditions.

### 1.3 DESCRIPTION OF WORK

A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.

B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.

C. The Division 26 27 28 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.

D. Only trained, and licensed personnel shall be used by the Contractor to perform work. The Contractor shall not perform work, which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.

E. Refer to other Division 26 27 28 Sections for additional work requirements.

F. Coordinate all work with vendors for rework, relocation, and addition of equipment and devices, including any modification to existing system infrastructure.

G. Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment.

### 1.4 WORK SEQUENCE

A. Install work in stages and/or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with Owner and Architect/Engineer.

### 1.5 CODES, FEES, AND STANDARDS

A. Conform to all applicable requirements of Section Reference Standards and Regulatory Requirements.

B. Obtain permits and request inspections from authority having jurisdiction and applicable utility companies.

C. Pay for all required licenses, fees, and inspections.

D. Contact the Utility Companies to determine if fees, charges or costs are required by the Utility Company for modification to existing system, installations, and hook-ups. These fees, charges or costs shall be included in Contractor's bid.

E. Material shall be new and free of defects with UL listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if UL Listing is not available for material.

1.6 PROJECT/SITE CONDITIONS

A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.

B. The Contractor shall install all equipment so that all Code required and Manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.

C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.7 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding.

B. Each Bidder shall visit the site and shall thoroughly familiarize himself with existing field conditions and the proposed work as described or implied by the Contract Documents. During the course of the site visit, the communications systems bidder shall verify every aspect of the proposed work and the existing field conditions in the areas of construction and demolition which will affect his work. The Contractor will receive no compensation or reimbursement for additional expenses he incurs due to failure to make a thorough investigation of the existing facilities. This shall include rerouting around existing obstructions.

C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.

D. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Contractor shall field verify dimensions of all site utilities, conduit routing, boxes, etc., prior to bidding and include any deviations in the contract. Notify A/E if deviations are found.

E. All existing electrical is not shown. The Contractor shall become familiar with all existing conditions prior to bidding, and include in his bid the removal of all electrical equipment, wire, conduit, devices, fixtures, etc. that is not being reused, back to it's originating point.

F. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.

G. Remove existing systems, material and equipment which are made obsolete or which interfere with the construction of the project. Reinstall power, lighting, systems, materials and equipment which are required to remain active for the facility to be fully functional.

H. All items removed and not re-used shall be immediately turned over to Owner as they are made available by renovation. Remove items from job site and deliver to Owner's storage location(s) as directed by project manager. Discard complete items which Owner elects to refuse.

I. Investigate site thoroughly and reroute all conduit and wiring in area of construction in order to maintain continuity of existing circuitry. Existing conduits indicated in Contract Documents indicate approximate locations only. Contractor shall verify and coordinate existing site conduits and pipes prior to any excavation on site. Bids shall include hand digging and all required rerouting in areas of existing conduits or pipes.

J. Work is in connection with existing building areas (out of scope) which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. Notify Owner as indicated in Division 26 in advance of any shut-down of existing systems.

K. Bid shall include all removal and relocation of all items required for completion of alterations and new construction.

L. See Section Minor Electrical Demolition for Remodeling for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.

B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc which is the most expensive and costly to implement.

C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings.
Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.

D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.

E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.

F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.

G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.

H. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division those requirements shall govern.

1.9 MATERIALS AND EQUIPMENT

A. Material shall be new (except where specifically noted, shown or specified as "Reused" and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

B. Where Contract Documents list design selection or manufacturer, type, 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 A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with Section Substitutions and requirements.

C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.

D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.

E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 27 methods and materials unless specifically noted otherwise.

F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.

G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.

H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.

I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.

J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.

K. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

1.10 SUPERVISION OF THE WORK

A. Reference the General Conditions for additional requirements.

B. The Contractor shall provide experienced, qualified, and responsible supervision for work. A competent foreman shall be in charge of the work in progress at all times. If, in the judgement of the A/E, the foreman is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the A/E. Once a satisfactory foreman has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the A/E.

C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have, as a minimum, an active Journeyman's Electrical License in the State of Florida.

1.11 COORDINATION

A. Provide all required coordination and supervision where work connects to or is affected by work of other trades, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:

1. Door Hardware
2. Roll-up doors
3. Fire shutters
4. Roll-up grilles
5. Elevators
6. Escalators
7. Sliding doors

B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Divisions 27 Contract Documents or not.

C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.

D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required

for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.

E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.

G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Mechanical, Electrical and, where provided Interior Design.

H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.

1.12 PROVISION FOR OPENINGS

A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.

B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.

C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.13 SURFACE MOUNTED EQUIPMENT

A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

1.14 CUTTING AND PATCHING

A. New Construction:

1. Reference Division 1 - General Requirements.

2. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.

3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed finished surface.

B. Existing Construction:

1. See Section Minor Electrical Demolition for Remodeling for additional requirements.

1.15 INSTALLATION

A. Erect equipment to minimize interferences and delays in execution of the work.

B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.

C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.

D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.

E. The Contractor shall keep the construction site clean of waste materials and rubbish at all times. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.

F. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and a layout made prior to the setting or embedment thereof, so as to cause no delay to the project schedule.

1.16 PROGRESS AND RECORD DRAWINGS

A. Keep two sets of prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.

B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:

1. All raceways 1-1/2" and above, exactly as installed.

2. Any panel ID changes on plan shall be indicated on as-builts.

C. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

1.17 "OBSERVATION OF WORK" REPORT

A. Reference the General Conditions.

B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item to the A/E. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected, and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.

C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.18 SYSTEMS WARRANTY

A. Reference the General Conditions.

B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of each System. Warranty shall not include lamps in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.

D. Where extended warranty or guarantee are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.

E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

1.19 SUBSTANTIAL COMPLETION

A. The Contractor shall be fully responsible for contacting all applicable parties to schedule required observations of the work by Engineer. A minimum of 72 hours notice shall be given for all required observations of the work by Engineer, and minimum of 120 hours for substantial completion observation. Time and date shall be agreed on by all applicable parties in writing.

B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

# SECTION 27 05 07 - SUBMITTALS FOR COMMUNICATIONS SYSTEMS

## PART 1- GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Requirements for submittals specifically applicable to Division 27 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

### 1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addenda, Contractor represents that he:

1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.

2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.

3. Waives all claims for additional costs related to substitution which may subsequently become apparent.

4. Will provide the same warranties for the substitution as for the product specified.

5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.

6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

### 1.4 SUBMITTALS

A. Submittals shall consist of a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2" x 11" sheets; one (1) for "ELECTRICAL SUBMITTALS" (Power and Lighting); one (1) for "SYSTEMS SUBMITTALS" Where "SYSTEMS SUBMITTALS" is not applicable, only one (1) binder is required.

1. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).

2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for Submittals included at end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting, (and if required) "SYSTEMS SUBMITTALS."

B. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.

2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.

3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.

4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).

5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:

a) Fabrication and erection dimensions.

b) Arrangements and sectional views.

c) Necessary details, including complete information for making connections with other work.

d) Kinds of materials and finishes.

e) Descriptive names of equipment.

f) Modifications and options to standard equipment required by the work.

g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).

h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.

i) Conduit/raceway rough-in drawings.

j) Items requiring shop drawings include (but not limited to):

1. Premise Distribution System

2. UPS systems

3. UL listed fire and smoke stopping assemblies for each applicable penetration

k) See specific sections of Specifications for further requirements.

6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.

a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.

b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.

c) See specific sections of Specifications for further requirements.

C. PDS System Submittals

1. Typical wiring diagrams and risers. The Project Design Team shall include in the project drawings a PDS riser diagram showing originations, destinations, and type of pathways to be installed for all cabling. A copy of the As-built of this riser shall be submitted.

2. Shop Drawings: Submit plan of building(s) and site showing pathways with all installed cables and pathways noted.

a) Detailed floor plan layouts and riser diagrams showing system components and their location, interconnections, wiring/cabling, and interface and connection with other disciplines.

b) Coordination Drawings in accordance with the requirements of Division

c) Detailed data as requested by designer/OAR.

3. Detail drawings of each of the facilities terminal boards/cabinets, and equipment rack elevations for all MDF and IDF locations.

4. Qualifications: Submit qualifications of system installer including but not limited to:

a) Contractor’s license.

b) A list of recently completed PDS projects of similar type and size with contact names and telephone numbers for each. Included in the list shall be a minimum of five (5) business references, with a contact name and telephone number, whom the Contractor has performed work of similar size and scope within the last two (2) years.

c) Documentation of the Contractor’s staff member who is the company RCDD. The documentation shall be a current copy of the RCDD certificate issued by BICSI.

d) A letter certifying the Contractor maintains an office within fifty (50) miles of the project location.

e) Proof of certification by the manufacturer(s): Documentation that the Contractor is an authorized and designated installer for the equipment manufacturers whose products he intends to install.

f) Technical resume of the Contractor’s Project Manager and Field Supervisor documenting a minimum of five (5) years experience installing Premise Distribution Systems.

g) Similar documentation for any sub-contractor who will assist the PDS Contractor in performance of this work.

h) A list of test equipment proposed for use.

1. For testing copper or metallic cabling components.

2. For testing fiber optic cabling components.

3. Include test certificate verifying that all test instruments have been calibrated within one prior year of anticipated testing completion of project.

i) Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

j) Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire/cable to be used in installation of the Premise Distribution System. Where requested by the Designer the contractor shall provide a complete copy of the UL Test report substantiating that the cable meets EIA/TIA requirements.

k) Point to point wiring diagrams and block diagrams of system to be installed.

l) Submit a detailed step by step testing procedure for any active components, component/ system functional checkout and test.

D. Fire Alarm System Submittals

1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)

2. Manufacturer's data on all products, including but not limited to:

a) Catalog cut sheets.

b) Roughing-in diagrams.

c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

d) Operation and maintenance manuals.

e) Typical wiring diagrams and risers.

f) The contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.

3. Submit floor plans to locate all devices. Wiring diagrams shall include wire and raceway sizes, fire alarm control panels, communication panels, Fire Fighter's HVAC override panel, riser wiring and associated raceway sizes, wiring details, connections and terminal identification. All devices shall be identified by the same applied identification symbol as shown on the contract documents.

4. Submit all load calculations and cable/wire sizing for each branch of the individual fire alarm field circuits. Wire sizing calculations to prove maximum three percent (3%) voltage drop at all ac voltages and maximum eight percent (8%) voltage drop at all dc voltages.

5. Battery sizing calculations.

6. Submit a detailed step by step testing procedure for a component by component system functional checkout and test.
7. Point to point wiring diagrams and block diagrams of system to be installed. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with submittals.
8. Riser diagrams and floor plans showing conduit runs and number of wires. All devices shall be identified by the same applied identification symbol as shown on the drawings.
9. Surge Suppression
    a) Surge protective data for 120 volt power source, power circuit, outside signaling circuit, and exterior incoming circuits from other buildings (if any), and outgoing circuits to other buildings (if any).
    b) Submit Product Data for each type of suppressor:
        1. Dimensions
        2. Means of mounting
        3. Compliance with UL Standards referenced
        4. Compliance with IEEE Standards referenced
        5. Design type (Hybrid, MOV)
        6. Size of wire leads
        7. Warranty
        8. Performance data showing compliance with performance as specified herein.
        9. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
        10. Manufacturer's certified test data on each suppressor type.
        11. Test data from an independent test laboratory.
10. Name, qualifications, etc. of company providing and installing system.
11. Qualifications of installer. Submit proof installer meets specified requirements.
12. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire to be used in installation of fire alarm and communications system.
13. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details and specification sheets for all fire alarm system components and rough-in boxes.
14. Submit Florida Registered Firm certificate number.
15. Submit Florida Fire Alarm Contractor's license number.
16. Submit Fire Alarm Technician(s) Manufacturer's certification.
17. Detail of Fire Department override control panel layout.
18. Detailed drawing of the Fire Alarm Control Panels layout indicating the exact arrangement of all zones, including expansion zones.

19. Coordination Drawing: Coordination CAD drawing of building Fire Command room and equipment layout as shown on drawings, with all panel and rack footprints, using actual manufacturer's dimensions, indicating proper clearances.

20. Network:

    a) Complete description data indicating UL listing for all network components.

    b) Complete sequence of operation of all functions of the network.

    c) A list of every network node address.

    d) A list of every address of every device connected to a network node that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.

    e) Complete network wiring diagrams for all components and interfaces to equipment supplied by others.

21. All drawings required herein shall be on AutoCAD 2007 or higher.

22. Where required by Authority Having Jurisdiction submit signed and sealed documents as required by Authority Having Jurisdiction. Where Authority Having Jurisdiction requires shop drawings to be signed and sealed by a Registered Engineer, Contractor is required to submit same and include in his bid all costs associated with having a Registered Engineer other than the design Engineer of Record perform signing and sealing.

E. Grounding Submittals

1. Submit catalog cut sheet showing brand and selection for all conductors, test wells, components, etc., as specified herein showing that all materials are UL listed and labeled as applicable and manufactured in the United States.

2. Product data shall prove compliance with Contract Documents, National Electrical Code, Underwriters Laboratories, manufacturers' specifications, manufacturers' written installation data and compliance with all performance criteria.

3. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

4. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.

5. Show all dimensions, colors, configurations, covers and applicable labeling/stamping.

6. Record actual locations of grounding electrodes on red lined as-built documents.

7. Submit test results of each ground rod. See Section 16090 Tests and Performance Verification.

1.5 PROCESSING SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.

B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:

1. Project Addresses

2. Index
3. Separation Sheets
4. Basic Materials
5. Systems Product Data

C. Remainder of submittals are to be submitted no later then 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.

D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.

E. Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.

F. Shop Drawings: For custom fabricated items and systems shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.

G. Shop Drawing Review Notation.

| | Action | Description |
|---|---|---|
| 1. | No Exception Noted | No exceptions taken. Resubmittal not required. |
| 2. | Rejected | Not in compliance with Contract Documents. Resubmit. |
| 3. | Submit Specific Item | Resubmit item as specified. |
| 4. | Make Corrections Noted | Make corrections noted, resubmittal not required. |
| 5. | Revise and Resubmit | Make corrections noted, resubmittal is required |
| 6. | Review not Required | Not required for review. No action taken. Copy retained for reference. |

H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet, and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.

I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict; unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

1.6 DELAYS

A. Contractor is responsible for delays in job progress accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

1.7 RE-SUBMITTALS

A. The A/E shall be reimbursed for all costs to review resubmittals subsequent to the second submission for the same product. Cost will be billed to Contractor at Engineer's standard hourly rate.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

RTM Engineering Consultants
925 S Semoran Blvd., Suite 100
Winter Park, FL 32792
Telephone No.: (407) 678-2055

GENERAL CONTRACTOR:

SUBCONTRACTOR:

BINDER EXAMPLES FOR SUBMITTALS Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder

ORANGE COUNTY CONVENTION CENTER PHASE V FIRE ALARM REPLACEMENT

MPE NO. 2014-140

COMUNICATIONS SUBMITTALS

(Size To 8-1/2" x 11")

ORANGE COUNTY CONVENTION
CENTER PHASE IV
FIRE ALARM
REPLACEMENT

MPE NO.2014-140

COMMUNICATIONS
SUBMITTALS

(Size To 11")

SECTION 27 05 29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Furnish and install all supports, hangers and inserts required to mount fixtures, raceways, conduit, cables, pullboxes and other equipment furnished under this Division. B. Section Includes:

1. Conduit and equipment supports.
2. Anchors and fasteners.

1.2 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use spring steel clips and clamps.

E. Obtain permission from Architect/Engineer before using powder-actuated anchors.

F. Obtain permission from Architect/Engineer before drilling or cutting structural members.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and wall mounted equipment with minimum of four anchors.

I. Provide min of (4) 3/8" concrete expansion anchors for securing all racks and cabinet to the ground.

J. All items shall be supported from the structural portion of the building, except standard ceiling mounted lighting fixtures, and small devices may be supported from ceiling system where permitted by Ceiling Contractor, however, no sagging of the ceiling will be permitted. Wire

shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.

K. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, wall, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching, later at his own expense, to the satisfaction of the Architect.

L. All conduits shall be securely fastened in place per NEC; and hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.

M. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.

N. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self tapping power driven type are acceptable. Plastic anchors are not acceptable.

O. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.

P. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.

Q. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom of prestressed beams are not acceptable.

R. Where cable tray or ladder rack is shown it shall be supported by means of manufacturer mounting brackets, concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. Provide supports spaced as required per manufacturer recommendations.

END OF SECTION

SECTION 27 05 33 - CONDUIT AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Wall and ceiling outlet boxes and small junction and pull boxes.
2. Conduit raceway
3. Pathways

B. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating conduit raceway system for the following:

1. Rigid Metal Conduit (RMC) – NEC 344
2. Flexible Metal Conduit (FMC) – NEC 348
3. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
4. Electrical Metallic Tubing (EMT) – NEC 358
5. Rigid Nonmetallic Conduit (PVC) (RNC) – NEC 352
6. Fittings and Conduit Bodies
7. Electrical Nonmetallic Tubing (ENT) – NEC 362

C. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.

D. A raceway shall be provided for all electrical systems.

E. Where the Contract Documents refer to the terms "raceway," or "conduit" the materials shall be as listed above in conjunction with NEC 100, definition of "raceway". MC and HCF flexible metal cables shall not be considered a substitute for raceway or conduit.

F. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.

G. Section includes: Wall and ceiling outlet boxes and small junction and pullboxes.

H. A raceway shall be provided for all electrical systems unless specifically specified otherwise.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit - Zinc Coated
B. ANSI C80.3 - Electrical Metallic Tubing - Zinc Coated
C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
D. ANSI/NFPA 70 - National Electrical Code
E. NECA Standard Practices for Good Workmanship in Electrical Contracting
F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
H. NEMA TC 3 -Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70. (See drawings and this and other sections of these specifications for additional requirements).

1.5 SUBMITTALS

A. Submit in accordance with Section 27 05 00 Common Work Results for Electrical and Section 27 05 07 Submittals.

B. For pull boxes and junction boxes not covered in Section 26 05 35 Pull and Junction Boxes, submit product data showing dimensions, covers, and construction.

C. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.

D. Submit catalog cut sheet on all types of conduit bodies, and fittings.

E. Product data shall be submitted for acceptance on:

1. All outlet boxes to be used on project.
2. Surface cast boxes
3. Conduits
4. Conduit straps, hangers and fittings
5. PVC solvent(s) and bending box
6. Fitting entering and leaving the ground or pavement

F. Submit UL listed fire and smoke stopping assemblies for each applicable application.

G. Product data shall prove compliance with Specifications, National Electrical Code, National Board of Fire Underwriters, manufacturer's specifications and written installation data.

1.6 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Section 27 05 00 Common Work Results for Electrical and Section 27 01 00 Operation and Maintenance Manuals.

1.7 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

B. Conform to the following:

1. ANSI/NFPA 70 National Electrical Code
2. ANSI C80.1 Electrical Rigid Steel Conduit, Hot-Dip Galvanized
3. ANSI C80.3 Steel Electrical Metallic Tubing, Hot-Dip Galvanized.
4. ANSI C80.5 Electrical Rigid Aluminum Conduit
5. ANSI C80.6 Electrical Intermediate Metal Conduit
6. ANSI/UL 651 Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
7. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
8. NECA National Electrical Installation Standards
9. ANSI C80.1/NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
10. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit
11. NEMA TC 3 Polyvinyl Chloride (PVC) Fittings for use with Rigid PVC Conduit and Tubing

12. ANSI/Federal Specification A-A-59544 Cable and Wire, Electrical (Power Fixed Installation)

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from sun, rain, corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.9 PROJECT CONDITIONS

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

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

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

PART 2 - PRODUCTS

2.1 GENERAL

A. All conduits shall bear UL label (or other nationally recognized testing agency) and shall be manufactured in the United States.

B. Conduit systems and all related fittings, boxes, supports, and hangers must meet all the requirements of national, state, requirements and all related FAA codes and other federal codes where applicable.

C. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.

D. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.

E. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.

F. Handy boxes shall not be used.

G. Outlet boxes to be one-piece.

H. 4 inch x 4 inch boxes and 4-11/16 inch x 4-11/16 inch boxes used as junction boxes shall be one piece.

2.2 SHEET METAL OUTLET BOXES:

A. ANSI/NEMA OS 1, Galvanized Steel.

B. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box cover plates or wiring devices. T & B, Steel City, Raco or approved substitution.

C. Ceiling outlet boxes shall be 4 inch octagonal or 4 inch square x 1-1/2 inch deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.

D. For Communication/Systems Telephone, Data, TV, CCTV, Video, and Computer device outlet boxes shall be 4 inches square x 2-1/8 inches deep with single gang plaster ring minimum. Increase outlet box to 4-11/16 inches with single gang plaster ring as required for special devices respectfully

2.3 CAST BOXES:

A. NEMA FB 1

B. Interior surface outlet boxes and conduit bodies installed from 0 inch AFF to 90 inch AFF (including fire alarm device backbox) shall be heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices - Appleton, Crouse Hinds or approved substitution. Trim rings shall also be of one piece construction.

C. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast iron suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.

D. Boxes to be Type FD unless otherwise noted on drawings.

E. Free standing cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

2.4 CONDUIT MINIMUM TRADE SIZE

A. Systems Conduit 3/4 inch.

B. Flexible and Seal-tite metallic conduit 1/2 inch C (maximum 6 feet long).

2.5 RIGID METAL CONDUIT (RMC)

A. Comply with:

1. ANSI C80.1
2. UL Spec - No. 6
3. NEC 344

B. Conduit material:
1. Hot dipped galvanized steel. .

C. Fittings:

1. Threaded.

2. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.

3. Hot dipped galvanized malleable iron or steel.

D. Conduit Bodies:

1. Comply with ANSI/NEMA FB 1.
2. Threaded hubs.
3. Hot-dipped galvanized malleable iron.

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Comply with:

1. NEC 348
2. ANSI/UL 1

B. Conduit material: Steel, interlocked.

C. Fittings:
1. ANSI/NEMA FB 1
2. ANSI/UL 514B
3. Die Cast (Use as Option for SCPS)
4. Malleable iron, zinc plated.
5. Threaded rigid and IMC conduit to flexible conduit coupling.
6. Direct flexible conduit bearing set screw type not acceptable.

2.7 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Comply with:

1. NEC 350
2. ANSI/UL 360

B. Conduit material:

1. Flexible hot-dipped galvanized steel core, interlocked.
2. Continuous copper ground built into core up to 1-1/4" size.
3. Extruded polyvinyl gray jacket.

C. Fittings:

1. Threaded for IMC/rigid conduit connections.
2. Accepted for hazardous locations where so installed.
3. Provide sealing washer in wet/damp locations.
4. Compression type.
5. ANSI/NEMA FB 1.
6. ANSI/UL 5148.
7. Die Cast (Option for SCPS) 8. Zinc plated malleable iron or steel.

2.8 ELECTRICAL METALLIC TUBING (EMT)

A. Comply with:

1. UL 797
2. ANSI C80.3
3. NEC 358
4. ANSI/UL797

B. Conduit material: Galvanized steel tubing.

C. Fittings:
1. ANSI/NEMA FB 1
2. Set screw
3. Die Cast (Option for SCPS)
4. Zinc plated malleable iron or steel.
5. Concrete tight.
6. T&B Series 5031/5030.

2.9 RIGID NONMETALLIC CONDUIT (PVC) (RNC)

A. Comply with:

1. NEMA TC-2
2. UL 651
3. NEC 352

B. Conduit material:
1. Shall be high impact PVC - tensile strength 55 PSI, flexural strength 11000 PSI.

C. Fittings:

1. Comply with: NEMA TC-3 and UL 514.

D. General:

1. Shall be UL listed and identified.
2. Shall conform to all national, state and local codes.
3. Manufacturer shall have five years experience in manufacturing PVC conduits.

2.10 EXPANSION FITTINGS

A. Expansion fittings shall be:
1. UL Listed, hot dipped galvanized inside and outside providing a 4" expansion chamber - when used with rigid conduit, intermediate metal conduit and electrical metallic conduit, or:
2. Be polyvinyl chloride and shall meet the requirements of and as specified elsewhere for non-metallic conduit and shall provide a 6" expansion chamber.
3. Hot dipped galvanized expansion fitting shall be provided with an external braided grounding and bonding jumper with accepted clamps, UL Listed for the application.
4. Expansion fitting, UL Listed for the application and in compliance with the National Electrical Code without the necessity of an external bonding jumper may be considered. Submit fitting with manufacturer's data and UL Listing for acceptance prior to installation.

PART 3 - EXECUTION

3.1 GENERAL (CONDUIT)

A. Install conduit in accordance with NECA "Standard of Installation." Contractor shall layout all work prior to rough-in.

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange conduit to maintain headroom and present neat appearance.

D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.

E. Route conduit in and under slab from point-to-point.

F. Do not cross conduits in slab.

G. Maintain adequate clearance between conduit and piping.

H. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

I. Cut conduit square using saw or pipecutter; de-burr cut ends.

J. Bring conduit to shoulder of fittings; fasten securely.

K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

L. Install no more than equivalent of two 90-degree bends between boxes. Conduit bodies shall not be used for changes in direction. Use factory long radius elbows for bends in metal conduit equal to or larger than 1-1/2 inch size.

M. All 90-degree bends are to be long radius. Provide terminal adapter and plastic bushing at all communications conduit terminations in terminal cabinets, at cable tray, and in Comm. rooms.

N. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

O. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC Article 300, whether shown on drawings or not.

P. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the specifications. Pullcord must be fastened to prevent accidental removal. A phenolic or brass nameplate shall be attached to each end indicating the location of both ends of conduit as follows: THIS END = "LOCATION," OTHER END = "LOCATION."

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

R. Ground and bond conduit under provisions of Section Grouding and Bonding.

S. Identify conduit under provisions of Section Electrical Identification.

T. Install all conduits concealed from view unless specifically shown otherwise on drawings

U. Rigid steel box connections shall be made with double locknuts and bushings.

V. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

W. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.

X. All raceways shall be run from outlet to outlet as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.

Y. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."

Z. Provide conduit seal-offs wherever conduit crosses obvious temperature changes (i.e. from inside to outside of coolers, freezers, etc.).

AA. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified under other Sections of these specifications.

BB. All raceways shall be run in neat and workmanlike manner and shall be properly in accordance with latest edition of NEC with accepted conduit clamps, hanger rods and structural fasteners.

CC. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.

DD. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.

EE. Provide and install raceway for all surface mount secondary clock installations to non-exposed location, penetrations of fire rating assemblies/walls/etc., where exposed to damage, exterior locations, underground locations, interconnection of CC's, CP's, and CER's, or any combination thereof, for all backbone cables, and all areas required by applicable codes and standards or as otherwise noted/required in these specifications.

FF. All raceways shall terminate at point within 12 inches of termination point terminal block with appropriate grounding bushing.

GG. Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage Master Clock Systems. Master Clock System wiring may be installed in underground pull boxes with other low-voltage systems provided:

HH. Installation meets/complies with all applicable codes and standards.

II. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.

JJ. Label all raceway at both ends to indicate destination and Master Clock System source room. Also indicate length of raceway and this labeling/identification shall be fully documented in asbuilt (record) drawings.

KK. Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.

LL. Properly support cables/wire not installed in raceways.

MM. Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.

3.2 GENERAL (BOXES)

A. Install per applicable sections of these specifications and all applicable codes/standards.

B. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.

C. A pull or splice box shall be placed in a conduit run where:

1. the length is over 100 feet,
2. there are more than two $90^{o}$ bends, or
3. if there is a reverse bend in the run.

D. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.

E. Outlet boxes shall be installed at speakers requiring outlet box per applicable codes/standards.

F. Every pullbox and/or splicebox shall have a hinged cover. Install appropriate access panel to allow cover to open.

1. Size

a) Where a pullbox is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pullbox.

b) Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:

c) for straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway;

d) for angle and U pulls:

1. have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest

raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and

2. have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:

(a) ·six times the trade size diameter of the raceway; or

(b) ·six times the trade size diameter of the larger raceway if they are of different sizes.

e) for a raceway entering the wall of a pullbox opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.

f) Where a splicebox is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."

g) No box shall be smaller than that required by NEC 314.28 (A) (1) and (2).

G. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

H. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

I. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

J. Above ceiling outlet and junction boxes shall be install to permit readily accessible access from ladder or staging from corresponding floor without the need to extend ladder up through ceiling system to facilitate ease of maintenance.

K. Install boxes to preserve fire resistance rating of partitions and other elements.

L. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

M. Use flush mounting outlet boxes in finished areas.

N. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches (one stud space) separation in acoustic and rated walls.

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

P. Use stamped steel bridges to fasten flush mounting outlet box between studs.

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

R. Support all outlet boxes from structure with minimum of one 3/8 inch all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two all-thread rod hangers, minimum.

S. Do not fasten boxes to ceiling support wires.

T. Support boxes independently of conduit.

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

V. Use gang box with plaster ring for single device outlets.

W. Comply with applicable portions of the National Electrical Contractors Association (NECA) Standard of Installation.

X. Install outlets in the locations shown on the drawings; however, the OAR shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.

Y. Coordinate each electrical box so that the type is suitable for the wall or ceiling construction anticipated and suitable fireproofing is built into fire rated assemblies.

Z. Relocate electrical boxes as required so that electrical devices, once installed, will be symmetrically located with respect to the room layout.

AA. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete. No surface mounted boxes will be allowed without OAR approval.

BB. For damp and wet locations provide weatherproof boxes and accessories.

CC. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.

DD. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.

EE. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.

FF. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.

GG. Avoid using round boxes where conduit must enter box through side of box which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.

HH. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or approved for the purpose. Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8 inch of finish wall surface.

II. Outlet boxes mounted in metal stud walls, are to be supported to studs with minimum of two self-tapping screws inside, at the back of outlet box, to a horizontal stud brace between vertical studs or pre-manufactured heavy duty box bracket equal to Caddy Corporation # SGB/TSGB series, to prevent movement of outlet box after wall is finished.

JJ. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

KK. Mount Height.

1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural plans and shop drawings.

   a) Phone Outlets: 1'-4" AFF to bottom

   b) ADA Wall Phones: (See part 3.1, Item HH.(4.) below)

   c) Fire Alarm Pull Stations: 4'-0" AFF to top

   d) Fire Alarm Strobe Lights: 80" AFF to bottom of globe or 6" below ceiling to top, whichever is lower

2. Bottoms of outlets and switches above counter tops or base cabinets shall be minimum 2 inches above counter top or backsplash, whichever is highest. Outlets and switches may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at the same height. Coordinate outlet locations in relation to all casework shown on Architectural plans, prior to rough-in, regardless of height shown on Electrical drawings.
3. Height of wall-mounted fixtures shall be as shown on the drawings. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.
4. Coordinate locations and mounting heights of outlet boxes for all phones with architect, phone system installer and approved shop drawings prior to rough-in. Install as directed, including requirements of ADA. In general, ADA wall phones shall be at a maximum of 54 inches to highest operable part essential to basic operation of telephone with side reach and maximum of 48 inches forward reach as defined by 3.1 HH.1.

LL. Outlets in Rated Assemblies and Smoke Barriers.

1. Metallic and approved non-metallic electrical outlet boxes may be installed in vertical fire resistive assemblies or smoke barriers without affecting the classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 sq. inches.
2. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other approved materials.
3. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

3.3 CONDUIT LOCATION REQUIREMENTS

A. In Slab, Above or On Grade:

1. Use coated rigid steel conduit, coated intermediate metal conduit (if approved) or thickwall nonmetallic conduit.
2. In slab conduit is permitted only where written consent is granted by Architect and Structural Engineer, regardless of that shown or noted by drawings. Install as directed by Architect/Structural Engineer.

B. Penetration of Slab:

1. Exposed Location:

a) Where penetrating a floor in an exposed location from underground or in slab, a black coated galvanized rigid steel conduit shall be used.

2. Concealed Location:

a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 40 inches above finished floor.

b) Where penetrating a floor from underground or in slab, a coated galvanized rigid steel conduit shall be used.

C. Outdoor Location:

1. Above Grade:

a) Where penetrating the finished grade, a coated galvanized rigid steel conduit shall be used.

b) All exterior conduit runs shall be rigid conduit and threaded connectors as specified elsewhere.

c) All areas subject to exterior conditions such as overhangs, galvanized rigid steel conduit shall be used.

2. Roofs:

a) Conduit is not to be installed on roofs, without written authorization by OAR for specific conditions.

b) When approved by written authorization conduit shall comply with the following:

1. Be PVC coated rigid galvanized metal conduit.

2. All fittings, etc. are to be PVC coated.

3. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Refer to applicable roofing specifications.

4. Fasten supports to roof per roofing manufacturer's recommendations.

D. Interior Dry Locations:

1. Concealed:

a) Electrical metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.

b) All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted reamer.

2. Exposed:

a) Use rigid galvanized steel and electrical metallic tubing. EMT may only be used where not subject to damage which is interpreted by this specification to be above 96 inch AFF and exiting the top of terminal cabinets and control panels.

3. Concealed or Exposed Flexible Conduit:

a) Concealed: Flexible steel conduit or seal tight flexible steel conduit shall be in lengths not longer than 6 feet in length with a ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Direct change over from conduit to flexible conduit is not acceptable unless written permission is granted by OAR or specifically noted on drawings.

b) Exposed: Liquid tight flexible steel conduit shall be used for connections to motors, movable equipment, or vibration equipment (transformers, pumps, AHU's, loading bridges, etc.) as specified herein. Lengths shall not exceed two 4 feet in length unless written authorization by OAR for specific conduits is granted. Connections to vibration equipment, motors, etc shall be made with wire mesh grip fittings as specified herein. Flexible steel conduit is not acceptable in exposed locations. All exposed flexible metal conduit shall be liquid tight.

3.4 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.

1. Accepted pipe vise.

2. Roller/bade type cutter or band saw.

3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.

B. Hangers shall be installed 8 ft. apart.

C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.

3.5 ADDITIONAL REQUIREMENTS FOR EMT

A. Cut conduit square using approved hacksaw with 32 tooth per inch blade; de-burr cut ends. Roller/blade type pipe cutter is not acceptable.

B. One hole pipe straps, where specified herein, shall be heavy duty type.

3.6 ADDITIONAL REQUIREMENTS FOR FLEXIBLE STEEL CONDUIT AND SEAL-TITE FLEXIBLE STEEL CONDUIT

A. Shall be properly grounded.

B. Shall be installed with accepted fittings.

3.7 SUPPORTS

A. Arrange supports to prevent misalignment during wiring installation.

B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24", increase distance as required) provide space on each for 25 percent additional conduits.

D. Fasten conduit supports to building structure and surfaces under provisions of Section Supporting Devices.

E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports.

F. Do not attach conduit to ceiling support wires.

G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.

H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.8 EXPANSION FITTINGS

A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

B. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than one hundred feet long and interval between expansion fittings in such runs shall not be greater than 100 feet.

3.9 GROUNDING

A. All raceways shall have a copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC codes.

B. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings.

C. Grounding conductors run with exterior/ underground feeders shall be bare only.

D. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by accepted ground bushings.

E. See other sections of these specifications for additional requirements.

F. Grounding conductors (including lightning protection down conductors) run in metal conduit shall be bonded to metal conduit at both ends.

3.10 FIRE AND SMOKE STOPPING

A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.

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

C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.

D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in accord with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in accord with ASTM E119. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

3.11 VERTICAL RACEWAYS

A. Cables in vertical raceways shall be supported as per NEC Article 300-19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless if shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with architect prior to installation. This includes empty raceways for future use.

3.12 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under all sections of these specifications.

B. Coordinate outlet box locations and sizes of required access doors with applicable sections in these specifications.

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

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

3.13 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

END OF SECTION

SECTION 27 05 53 – IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the requirements for provision and installation of identification for electrical equipment.

1.3 DESCRIPTION

A. Provide and install all equipment, labor and material for a complete identification system, including but not limited to:

1. Nameplates and labels.
2. Wire and cable markers.
3. Conduit markers.
4. Identify all new and existing conduits, boxes, equipment, etc. as specified herein.

1.4 REFERENCES AND REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

B. Conform to the requirements of the following:

1. ANSI/NFPA 70 - National Electrical Code
2. Americans with Disabilities Act 1990

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Nameplates for Life Safety Branch Power shall be laminated red phenolic plastic with chamfered edges and white engraved lettering. Orange phenolic plastic border to be added around nameplate to denote branch.

B. Nameplates for Critical Branch Power shall be laminated red phenolic plastic with chamfered edges and white engraved lettering. Green phenolic plastic border to be added around nameplate to denote branch.

C. Nameplates for Security Branch Power shall be laminated red phenolic plastic with chamfered edges and white engraved lettering. Purple phenolic plastic border to be added around nameplate to denote branch.

D. Nameplates for Equipment Branch Power shall be laminated red phenolic plastic with chamfered edges and white engraved lettering. Blue phenolic plastic border to be added around nameplate to denote branch.

E. Nameplates for Normal Branch Power shall be laminated black phenolic plastic with chamfered edges and white engraved lettering.

F. Letter Size:

1. 1/8 inch for identifying individual equipment and loads.
2. 1/4 inch for identifying grouped equipment and loads.

G. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for approval. Nameplates for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire". In addition, provide phenolic label in panel to describe from where the panel is fed. For example, "Fed From MDP-1:3:5". The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine.

H. The following items shall be equipped with nameplates: All motors, motor starters, motor control centers, push-button stations, control panels, time switches, disconnect switches, transformers, panelboards, circuit breakers (i.e., all 2 pole, 3 pole C.B.), contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical, and electrical systems (Systems Sections 16700 through 16799) junction and pull boxes (larger than 411/16 inch), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number (if applicable).

I. All Electrical System panels, transfer switches, etc. shall be labeled per branch, i.e.: "Panel ABC-Life Safety Branch" (similar for critical or equipment branch).

J. All receptacles shall be clearly labeled with panel/circuit designation.

K. All junction/pull boxes shall receive phenolic labels clearly labeling circuitry/cabling/etc., within.

2.2 WIRE MARKERS

A. Description: Cloth, tape, split sleeve, or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings including neutral conductor.

2. Low voltage circuits (circuits under 120V).

D. Control wire number indicated on schematic and interconnection diagrams on shop drawings.

2.3 CONDUIT/JUNCTION BOX COLOR CODE

A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:

| Color Code for Junction Boxes | Krylon Paint Number |
|---|---|
| System Emergency 277/480 volt | Cherry Red K02101 |
| System Emergency 120/208 volt | Zinger Pink S01150 |
| Fire Alarm | Safety Orange K02410 |
| Normal Power 277/480 Volt | Leather Brown K02501 |
| Normal Power 120/208 Volt | Glossy Black K01601 |
| Fiber Optics | Safety Purple K01929 |
| Sound System | Safety Yellow K01813 |
| Clock | Light Blue S01540 |
| Intercom | True Blue K01910 |
| Computer Data | Gold K01701 |
| TV | Glossy White K01501 |

| | |
|---|---|
| BAS | Cameo White K04129 FIDS/BIDS |
| | Saddle Tan K03554 |
| Security/CCTV | John Deer Green K01817 |
| Telephone | Safety Green K02012 |
| Grounding | Fluorescent Green K03106 |
| Access Control System | John Deer Green K01817 |
| Dictaphone | Dusty Pink K02117 |
| Lightning Detection & Notification | Global Blue K03546 |
| Elevator Status | Georgia Clay K03531 |
| 800 Mhz Radio | Copper Metallic K02203 |
| FCIC | Safety Green K02012 |
| Positron | Safety Green K02012 |
| DC Controls | Safety Green K02012 |
| Duress | Fresh Salmon K03536 |
| Fire Pump Status | Popsicle Orange K02410 |
| Emergency Generator Status | Zinger Pink S01150 |

B. Conduits (not subject to public view) longer than 20 feet shall be painted with above color paint band 20 feet on center. Paint band shall be 4 inches in length. Where conduit are parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniformed. Paint boxes and raceways prior to installation or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.

C. Emergency (Backed by Generator). Conduit shall be painted red 20 feet on center. Paint band shall be 4 inches in length. A smaller band, 1 inch in length, centered over the 4 inch red band shall be applied to denote Emergency Branch as follows:

| Emergency Branch | Color Band |
|---|---|
| Life Safety | Orange |
| Critical | Green |
| Security | Purple |
| Equipment | Blue |

D. Junction boxes and conduit located in public areas (i.e. areas that can be seen by the public) shall be painted to match surface attached to. Provide written request to Designer for interpretation of those public areas which may be in question.

E. Where two colors apply to the same raceway, paint on opposite corners leaving room for panel/ckt./system/etc., labeling in center.

F. The Contractor may utilize conduit banding tape instead of paint, on interior conduits only, where specified colors are available. Surface of conduits shall be thoroughly cleaned prior to tape application, and tape shall be applied in a neat and workmanlike manner. Tape to be manufactured by Seton Identification Products only.

2.4 CONDUIT/JUNCTION BOX MARKER

A. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately identify its associated systems panel and circuit number. Identification shall be by means of black permanent marker. (Paint one-half cover plate with appropriate color above, and one-half with associated panel/circuit or system as described above.)

2.5 DEVICE COVER PLATE IDENTIFICATION

A. Description: Self-adhesive clear printed labels with Black typed letters (pre-printed, dot matrix, or laser).

B. Locations:

1. Each new receptacle cover plate.
2. Each existing receptacle cover plate in areas of remodel/renovation.
3. Each new communications cover plate (Systems Sections 16700 thru 16799).
4. Each existing communications cover plate (Systems Sections 16700 thru 16799) in areas of remodel/renovation.

C. Legend:

1. Receptacle plates shall adequately describe its associated panelboard and circuit reference.
2. System plates shall adequately describe its terminal board, or terminal cabinet, termination cable identifier and assigned user code number.

2.6 UNDERGROUND WARNING TAPE

A. Description: 6 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines, one strip per 24 inches of duct.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using stainless steel pop rivets.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Nameplates installed inside on dead front cover shall be self adhesive tape. (Do not drill or install screws in dead front.)

E. Identify new and existing conduit, junction boxes, and outlet boxes using field painting.

F. Identify new underground conduits using underground warning tape. Install one tape per 24 inches of trench at 3 inches below finished grade.

G. Install wire markers at all new and existing connections and terminations.

END OF SECTION

SECTION 27 10 01 - PREMISE DISTRIBUTION WIRING SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. Furnish and install, complete with all accessories an EIA/TIA 568-B.2-1 Category 6 Premise Distribution System (PDS) with a minimum 25-year, LINK AND CHANNEL WARRANTY for the entire system. Enhanced PDS system shall serve as a vehicle for transport of data, and voice telephone signals throughout the building and from building to building from designated demarcation points to outlets located at various desk, workstation and other locations as indicated on the contract drawings and described herein.

B. Support analog and digital voice applications, data, local area networks (LAN), video and low voltage devices for building controls and management on a common cabling platform. The applications that shall be supported include, but are not limited to:

1. Data Processing - EIA-232-D, EIA-422A, EIA-43-A, RS-485, StarLAN, Fiber Distributed Data Interface (FDDI), Ethernet 10BASE-T (IEEE 802.3i), 10BASE-F (IEEE 802.3j), and TP-PMD. In addition, these links/channels shall be capable of supporting high-end applications such as 100 Base-T (IEEE 802.3u), 1000Base-T (IEEE 802.3z,ab), and 1000 base TX.

2. Voice Applications - Avaya, Northern Telecom, NEC, SIEMENS.

3. Video – Broadband and base band Analog Video, Digital Video, Video Conferencing.

4. Other Applications: ISDN, ATM, ADSL, VoIP.

C. General: The system shall utilize a network of unshielded twisted pair cables (UTP) and fiber optic cables (FO) for horizontal cabling, Backbone cabling, Riser cabling, tie cabling, and patch cords. Cables and terminations shall be provided and located as shown and in the quantities indicated on the drawings. FO Cables shall terminate on rack-mounted Fiber Distribution Units (FDU's), UTP cables shall terminate on rack-mounted modular patch panels and work area outlets located as shown on the drawings. All cables and terminations shall be identified at all locations according to the EIA/TIA 606 standard. All cables shall be terminated in an alphanumeric sequence at all termination locations.

D. Warranty: Cabling systems shall be required to be covered under a manufacturer’s warranty program for LINK and Channel configurations. Including cable, jacks, patch panels, patch cords and include cabling specifically approved for the LINK and Channel configuration as specified in the connectivity manufacturer’s warranty. The patch cords and workstation cords shall me manufactured by the same manufacturer as the jacks and patch panels. The patch cords shall be 100% factory tested for compliance to the Category 6 standard.

E. All terminations shall comply with, and be tested to the EIA/TIA 568B.2-1 Category 6 requirements at a minimum, and providing at least a 25-year warranty.

1. It should be anticipated by all installers that all horizontal cable supporting data applications must meet at a minimum the Category 6 performance requirements as listed by EIA/TIA standards for the link and channel. (Field testing for LINK only, 100% factory patch cord testing required)

F. Data Services: Wiring utilized for data communications shall originate at Owner provided hubs and concentrators in vertical free standing equipment racks located at individual IDF’S.

G. Work Included: Wiring, terminations and patch bays between these designated demarcation points and outlet locations designated on the plans shall be considered part of the contact. Outlets (jacks) shall be furnished, wired and installed by the contractor.

H. The Contractor is advised that circuit routing for this system is not shown on the project drawings. The Contractor shall provide and install all conduit, wiring and cabling required for a complete and fully functional system as intended by these specifications. Individually homerun each device to respective MDF/IDF equipment rack. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install fire stopping where penetrations are made through rated walls and floors.

1.2 SYSTEM DESCRIPTION

A. The Premise Distribution Wiring System (PDS) is to include all equipment, materials and labor as required to provide, install and test a complete system as described herein.

B. System to include but not be limited to:

1. Backbone Pathway: Conform to EIA/TIA 569 using conduit, cable tray, backboards, etc. as indicated.
2. Horizontal Pathway: Conform to EIA/TIA 569, using conduit, sleeves, backboards, and cabinets as indicated.
3. Premises Wiring: Complete from Premise Distribution System Equipment to each outlet, and between each building using wire and cable as specified.
4. Outlets: Complete as specified.
5. Conduits, outlet boxes, cabinets, identification, etc.: Conform to applicable sections in these specifications. Provide/install complete with all required basic materials.
6. Terminal backboards and/or cabinets.
7. Equipment racks.
8. Frames and termination hardware.
9. Horizontal cables.
10. Backbone copper and fiber optic cables (interbuilding and intrabuilding.)
11. Terminal blocks
12. Patch boards.
13. Cross connect cables.
14. Terminations.
15. Surge suppression/Grounding
16. Fireproofing.

C. PDS equipment is to be installed in its own equipment rack.

D. All backbone cable shall be installed in conduit or cable tray.

1.3 RELATED SECTIONS

A. All applicable sections of Division 0, Division 1, and Division 27.

1.4 RELATED DOCUMENTS

A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Standards - Conform to the requirements of the following:

1. TIA/EIA-568-B.1 “Commercial Building Telecommunications Cabling Standard”, CSA T529.

2. TIA/EIA-568-B.2-1 "Transmission Performance Specifications for 4-pair 100Ohm Category 6 Cabling".
3. TIA/EIA-569 “Commercial Building Standard for Telecommunications Pathways and Spaces”, CSA T530.
4. TIA/EIA-606 “Administration Standard for Telecommunications Infrastructure of Commercial Buildings”, CSA T528.
5. TIA/EIA-607 “Commercial Building Grounding/Bonding Requirements”.
6. TSB-67 “Transmission Performance Specification for Field Testing of Unshielded Twisted Pair Cabling Systems”.
7. TIA/EIA TSB-72 “Centralized Optical Fiber Cabling Guidelines”.
8. *TIA/EIA PN-3398 TSB-75 “Additional Horizontal Cabling Practices for Open Offices”.
9. ANSI/NFPA 70 National Electrical Code, CSA C22.1.
10. BICSI Telecommunications Distribution Methods Manuals.
11. BICSI Telecommunications Installation Manuals.
12. County Codes and Regulations.
13. Underwriters Laboratories (UL).
14. FCC -Federal Communications Commission.
15. ADA Requirements.
16. Occupational Safety and Health Regulations (OSHA).
17. National Fire Protection Association (NFPA).
18. Florida Statutes and Administrative Rules.
19. Cabling System Certified Cabling Catalog.
20. American Society for Testing and Materials (ASTM).
21. EIA/TIA-492AAAA - Detail Specification for 50 Micrometer Core Diameter/125 Micrometer Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers.
22. EIA/TIA TSB-36 - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Cables.
23. EIA/TIA TSB-40-A - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Connecting Hardware.
24. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems
25. LPC - Lightning Protection Code (NFPA-780).
26. UL Certified - UL's LAN Cable Certification Program.
27. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
28. UL 1666 - Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts.
29. UL 1449, 3rd Edition – Standard for Safety for Surge Protective Devices.
30. UL 497, UL 497A, UL 497B.
31. ANSI - American National Standards Institute.

32. NEMA - National Electrical Manufacturer's Association.

33. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.5 QUALITY ASSURANCE

A. Perform work governed by local telephone utility (service only) in accordance with telephone utility's rules and regulations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.

B. Supplier: Authorized distributor of specified manufacturer with minimum 5 years documented experience.

C. Installer/Contractor:

1. General: The contractor selected for the Project must show current certification as an installer of the manufacturers of the products approved for the project, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturers components and distribution channels in provisioning the Project.

2. General: The Contractor directly responsible for this work shall be a "Premise Distribution Wiring Contractor" who is, and who has been, regularly engaged in the providing and installation of commercial and industrial telecommunications wiring systems of this type and size for at least the immediate past five years. Any sub-Contractor, who will assist the PDW contractor in performance of this work, shall have the same training and certification as the PDW contractor.

3. Certification: The contractor's Project Manager shall possess a current BICSI Registered Communications Distribution Designer (RCDD) certificate. All shop drawings submitted by the contractor shall bear the RCDD's seal.

4. Experience: The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical fiber and Category 6 copper premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.

1.7 SUBMITTALS

A. Submit in accordance with Section 27 05 00 Common Work Results for Electrical and Section 27 05 07 Submittals.

1.8 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Section 27 05 00 Common Work Results for Electrical and Section 27 01 00 Operation and Maintenance Manuals.

1.9 O & M MANUALS

A. Submit in accordance with Section 27 05 00 Common Work Results for Electrical and Section 27 01 00 Operation and Maintenance Manuals.

1.10 SPECIAL REQUIREMENTS FOR CABLE ROUTING AND INSTALLATION

A. General: Cable routing and Installation practices shall be in accordance with BICSI’s Telecommunications Distribution Methods Manual (TDMM) and Telecommunications Installation Manual.

B. Plenum Spaces and cable routing: The majority of PDW wiring in this building will be installed above ceilings. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electrical Code (NEC) article 800. All cabling shall bare the CMR, MPR OR OFNR (RISER) and or appropriate markings for ducted "air return" applications, and for cable run in conduit. Cable shall bare CMP, MPP or OFNP (plenum) markings for all non-ducted return air applications or as required by local and/or State code requirements. It shall be the responsibility of the contractor to verify with local and State code enforcement officers where plenum and non-plenum cables are required. All cable shall bare the appropriate markings for the environment in which they are installed.

C. Cable Pathway: In suspended ceiling and raised floor areas where duct, cable trays, or conduits are not available, the Contractor shall bundle, in bundles of 40 or less, horizontal wiring with cable ties snug, but not deforming the cable geometry. Cable ties in plenum areas shall be plenum rated. The cable bundling shall be supported via "CLIC" fasteners in Telecommunications closets and non-plenum areas and Category 6 compliant J-hooks or basket tray in ceiling spaces. Provide a minimum of two hangers at any corners or 90 degree turns. Attachment shall be to the building structure and framework at a maximum of five (5) foot intervals. Ceiling suspension wire or independent tie wire shall not be allowed in any space for cable support. Where cable is run above the ceiling in areas without walls, all thread rod shall be used (minimum 1/4", however sized to support the intended weight) with the appropriate CAT 6 hanger for cross-room support. Support rods shall be level and plumb after cable installation. The contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.

D. Protection: Sealing of openings through rated fire and smoke walls, existing or created by this contractor for cable pass through shall be the responsibility of the contractor. Sealing material and application of this material shall be accomplished in such a manner, which is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of this contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work. Penetration rating shall equal structure rating.

E. Damage: The contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces including painting and ceiling tile replacement shall be included as part of this contract.

F. Avoiding EMI: To avoid EMI, all pathways shall provide clearances of at least 4 feet (1.2 meters) from motors or transformers; 1 foot (12 inches) from conduit and cables used for electrical-power distribution; and 1 foot (12 inches) from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables and conduits.

1.11 DEFINITIONS

A. Communications Equipment Room (CER). The "communications equipment room" (CER) is a dedicated room for termination of cable and to house the primary voice and data equipment. NOTE: The CER normally houses the MDF

B. Communications Closet (CC). A "communications closet" (CC) is a dedicated room for termination of cable and to house secondary voice and data equipment. NOTE: The CC normally houses an IDF

C. Communications Panel (CP). A wall mounted cabinet for termination of cable and to house secondary and data equipment. NOTE: The CP may serve as an IDF.

D. Intermediate Distribution Frame (IDF). The "intermediate distribution frame" (IDF) is an equipment rack(s) and/or cabinet(s) housing secondary (intermediate) voice and data equipment.

E. Main Distribution Frame (MDF). The "main distribution frame" (MDF) is an equipment rack(s) and/or cabinet(s) housing the primary voice and data equipment.

F. Horizontal Pathways. Horizontal pathways are facilities for the installation of communication cable from the communications closet to the work area communications outlet. Horizontal pathways encompass underfloor, accessfloor, conduit, tray and wireway, ceiling, sleeves, perimeter facilities and applicable fireproofing.

G. Backbone Pathways. Backbone pathways consist of intrabuilding and interbuilding pathways. The term backbone replaces rise, house and building-tie cable terminology.

Backbone pathways may be either vertical or horizontal. Interbuilding backbone pathways extend between buildings. Intrabuilding backbone pathways are contained within a building.

1. Intrabuilding pathways consist of conduit, sleeves or slots, and trays, within a building, and provide the means for placing backbone cables from:

a) CER to CC

b) CC or CP to CC or CP

2. Interbuilding pathways interconnect separate buildings such as in campus environments. These consist of underground pathways.

1.12 EXTRA MATERIALS

A. Provide 10% spare modular jack inserts (fiber and copper).

B. Provide 10% spare termination blocks of each kind.

1.13 MAINTENANCE SERVICE AND WARRANTY

A. Furnish service and maintenance of premises wiring for one year from Date of Substantial Completion.

B. Surge Suppression:

1. All surge suppression devices shall be warranted to be free from defects in material and workmanship for a period of five (5) years.

2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be replaced by the manufacturer and installer at no cost to the Owner.

3. Equipment that is damaged by surges during the warranty period shall be replaced at no expense to the Owner. PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.

B. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for PDS configurations specified in this section.

2.2 PATHWAYS

A. General:

1. All pathways (conduit, raceways, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 27 of these specifications.

2. All pathways (conduit, raceways, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of EIA/TIA-569.

B. Conduit. (Comply with Section 27 05 33 except as noted below).

1. Metal flexible conduit shall not be used for PDS system.
2. Bushings: Provide insulated bushings on ends of all raceway. All backbone conduits shall have bonding bushings and be bonded to the Systems Ground Bus Bar with an insulated #6 AWG wire.
3. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
4. Size:
   a) See Part 3 for size requirements.
   b) Minimum size shall be 1".

C. Conduit Inner-Duct

1. Inner-duct shall be installed where indicated on drawings.
2. Basis of Design:
   a) MaxCell

D. Boxes:

1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
2. Boxes shall be sized as required by EIA/TIA and NEC for cables, conduit and/or device installed.
3. Junction/pull boxes shall not be mounted more than ten (10) feet above the floor and must be mounted in such a way as to make them readily accessible.
4. Junction/pull boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably fire rated, marked, hinged panel.

E. Cable Trays

1. Match existing type and size.

2.3 TERMINATION BACKBOARDS (TTB)

A. Material: 3/4" A/C Class A fire retardant plywood

B. Size: 8 ft. high with width as shown on drawings unless otherwise noted or required in these specifications.

C. Finish: Paint terminal board with gray paint having a flame spread rating of Class A as a minimum.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.5 LABELS

A. All telecommunication components, areas, and cables shall be labeled; including but not limited to Telephone Terminal boards (TTBs, Telecom Closets (TCs) comm. spaces, fiber cables, metallic cable, ground points, cross-connect fields, exterior enclosures, conduit ends (pathways), pull-boxes, relay racks, patch panels, LIUs, cabinets, manholes, and cables in manholes/pull boxes and patch cords/jumpers shall be labeled following Owner established labeling format. As-builts to contain matching label information.

B. Pathways are defined but not limited to; any conduit, inner-duct, underground duct-bank, wiring troughs, pull boxes, and any wiring systems used to enclose cabling of any type

1. Contractor shall install all pathway and cable labels so they are visible and able to be read by a person standing on floor without moving cables, and if conduit/pathway, labels shall not be obscured by other conduit, or components. Any additional types of labeling materials necessary to keep labels visible shall be provided by the Contractor and installed by the Contractor.

C. Cables to be labeled include but are not limited to backbone, horizontal, patch cords, line cords, and jumpers.

D. Labeling guidelines are ANSI/TIA 606 Administration Standards for Telecommunication Infrastructure of Commercial Buildings with Owner specific asset nomenclature.

E. All label material shall be suitable for intended usage and environment, meeting the legibility, defacement and general exposure requirements listed in UL 969 for indoor and outdoor use. Where insert labels are used the insert label shall be covered with clear cover and securely held in place.

F. For interior labeling; printer shall be of the thermal transfer type capable of printing self-laminating labels of various size up to and including 1.5”by 1.5” printable area with a 4.5” self-laminating tail. Label Printer Basis of Design: Brady TLS2200 or approved substitution. No non-self-laminating labels shall be approved.

G. Backbone/riser label format – see Attachment Two in this document.

H. Place a riser or OSP fiber label on the door of LIUs used, in front of the fiber cables landing positions.

I. Label printer shall be of the thermal transfer type capable of printing self-laminating labels of various size up to and including 1.5 inch by 1.5 inch printable area with a 4.5 inch self-laminating tail.

J. Label Printer Basis of Design: Brady TLS2200 or approved equal.

K. Pathways, riser fiber optic cables, and riser metallic cable labels shall have a 1.5 inch by 1.5 inch printable area white in color with a 4.5 inch self-laminating clear tail.

1. Font shall be Arial Alt Mono 7 font size (11 point size).

2. Label shall have the ability to have 15 characters per line and 8 lines for a total of 120 characters.

3. Label Basis of Design: Brady P/N PTL-34-427 or approved equal, for inside use. For exterior use label shall follow the same character format, and meet the legibility, defacement, and general exposure requirements listed in UL 969.

4. For all conduit or other pathways that have a diameter too large for the self-laminating label to over-wrap itself and fully laminate the printable area the label shall be changed to an insert type (tie-on is acceptable) and meet the exposure requirements in UL 969 for indoor and outdoor use. The insert label shall be covered with clear cover and shall be securely held in place under the normal operating conditions and usage to which the labeled infrastructure element is applied.

L. All metallic/fiber horizontal cable and metallic/fiber patch cord labels shall have a 1 inch by .5 inch printable area white in color with a 1 inch self laminating clear tail, labeled at each end.

1. Font shall be Arial Alt Mono, 7 font size (11 point size).

2. Label shall have the ability to have 15 characters per line and 2 lines for a total of 30 characters.

3. Label Basis of Design is Brady P/N PTL-31-427 or approved equal, for inside use. For exterior use label shall follow the same character format, and meet the legibility, defacement, and general exposure requirements listed in UL 969.

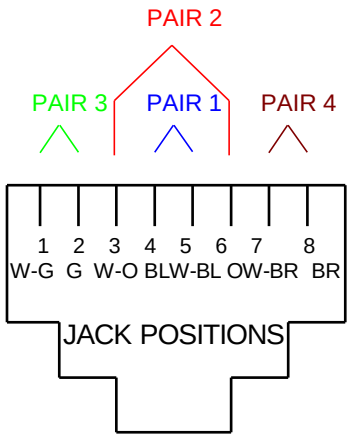
2.6 OUTLETS

A. General: Communications outlets that contain copper services shall be equipped with ANSI/TIA/EIA-568-B.2-1 Category 6, 8-position modular jacks (RJ45 type) matching existing wiring. All outlet cabling shall terminate on appropriate termination blocks at their associated IDF. Outlet jack module arrangement and quantities are shown on the drawings. Outlets shall be certified to operate at 1000 Mbps date speed with twisted pair terminal wiring as verified by ETL or UL. Faceplates shall be able to accommodate up to 6, 8-position modular jacks each.

B. 8-POSITION MODULAR JACKS: CAT 6 jacks shall meet or exceed the following electrical and mechanical specifications:

1. Jacks shall be standard 8-position, RJ-45 style, un-keyed, FCC compliant.
2. Jacks shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.
3. Each jack shall be single unit construction, with snap – fit to industry standard keystone opening (.760” x .580”).
4. Jack housings shall be high impact UL 94 V-0 rated thermoplastic.
5. Jacks shall have a temperature rating of -10 °C (14°F) to 70°C (158 °F).
6. Jacks shall utilize a 2-layer printed circuit board to control NEXT.
7. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
8. Housing shall be ultrasonically welded for tamper resistance.
9. Modular jack contacts shall accept a minimum of 2000 mating cycles without degradation of electrical or mechanical performance.
10. Jack contacts shall maintain a minimum deflection force of 100 grams while mated with an FCC-standard RJ-45 plug.
11. Jack contacts shall be formed flat for increased surface contact with mated plugs.
12. Jack contacts shall be arranged on the PC board in 2 staggered arrays, one array having 6 contacts and the other array having 2 contacts.
13. Jack contacts shall be constructed of Beryllium copper for maximum spring force and durability.
14. Contact plating shall be a minimum of 50 micro-inches of hard gold in the contact area over 50 micro-inch of nickel.
15. Jack termination method shall follow the industry standard 110 IDC punch-down.
16. IDC contact termination towers shall have tapered pair-splitting features to aid wire insertion and minimize pair un-twist.
17. IDC contacts shall be arranged in staggered arrays of 4 sets of 2 contacts.
18. Jacks shall have the Category 6 designation, visible from the front when installed.
19. Bottom of jack shall have date code and an abbreviated catalog number.
20. Jacks shall utilize a paired punch-down sequence to maximize electrical performance.
21. IDC contacts shall be Phosphor Bronze with 100 micro-inch tin lead 60/40 plating over nickel.
22. Jacks shall terminate 26-22 AWG solid or stranded conductors.
23. Jacks shall terminate insulated conductors with outside diameters up to .050”.

24. Jacks shall not require special cords, specialty tools or special installation requirements.
25. Jacks shall be compatible with single conductor standard 110 impact termination tools.
26. Jacks shall be compatible with a 4-pair single punch impact tool designed specifically for the purpose.
27. Jacks shall include a translucent stuffer cap for wire retention and to permit visual inspection.
28. Stuffer cap shall have retention snaps to assure conductor strain relief.
29. Jacks shall accept FCC compliant 6 position plugs.
30. Jacks shall accept optional hinged dust covers.
31. Jacks shall be compatible with ANSI/TIA/EIA-606-A color code labeling.
32. Jacks shall accept snap-on icons for specific identification.
33. Jacks shall be available in various colors to meet specific customer applications.
34. Jacks shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
35. Category 6 jacks shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.
36. JACKS SHALL BE MANUFACTURED IN THE USA.




Optional Eight-Position Jack Pin/Pair Assignments
(designation T568A)

C. Channel Performance: All Enhanced CAT 6 jacks shall be utilized in a channel configuration meeting or exceeding the following specifications at 350 Mhz:

1. Performance Requirements

a) All transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.

b) Category 6 jacks shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-B.2-1, Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling.

c) The manufacturer shall provide Category 6 component compliance certificates from third party testing organization upon request.

d) Jacks shall be UL LISTED 1863 and CSA certified.

e) Jacks shall exceed IEEE 802.3af DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.

f) Jacks shall be third party verified, error free Gigabit Ethernet performance to IEEE 802.3ab.

g) Jacks shall exceed 4 Gb/s data transmission capacity within the bandwidth of 1 – 250 MHz when configured in a 4-connector channel.

h) Category 6 jacks shall meet or exceed the 4-connector channel performance requirements of Category 6, per the ANSI/TIA/EIA-568-B.2-1 standard.

i) The 4-connector channel test configuration shall utilize Category 6 patch panels and Category 6 patch cords, from the same manufacturer, with qualified Category 6 cable.

j) The 4-connector channel performance margins in the table below shall be guaranteed, provided the configuration satisfies requirement No. 9 above.

| Electrical Parameter (1 - 250MHz) | GUARANTEED MARGINS TO CATEGORY 6 / CLASS E CHANNEL SPECIFICATIONS |
|---|---|
| Insertion Loss | 3 % |
| NEXT | 4 dB |
| PSNEXT | 5 dB |
| ELFEXT | 4 dB |
| PSELFEXT | 5 dB |
| Return Loss | 2 dB |

D. Design Selection: Panduit, as follows. See drawing details for exact outlet configurations.

1. Voice jack (office white): #CJ688TGIW
2. DATA jack (Blue): #CJ688TGBU
3. Provide blank module inserts for all unused module locations.

E. Approved Equals: Panduit, Wiremold, Siemon, meeting the listed requirements, if submitted with a 25-year or greater total PDW warranty and if meeting the physical characteristics described. Warranty shall include all components including cabling.

F. Outlet Labeling: Each jack on all outlets shall be identified with permanent machine generated labels, meeting the EIA/TIA 606 requirements, matching the numbering plan indicated on the drawings with the addition of a letter suffix indicating the jack position on the faceplate. All labeling must be permanent. All labeling shall be a minimum 12 pt. in size. All labeling systems shall be submitted to the engineer for acceptance prior to fabrication.

2.7 CATEGORY 6 DATA AND VOICE HORIZONTAL CABLE

A. General: Data pairs shall be extended between the outlet location and its associated IDF. The cable shall consist of 4 pair 24 gauge, solid copper conductors, Certified to the Category 6 standards. ETL or UL Verified for EIA/TIA electrical performance Comply with FCC Part 68. Cables shall be terminated on each of the 8-position modular jacks provided at each outlet. Voice jacks shall also utilize this cable type. Only virgin materials shall be used.

B. Cable selection shall be based upon meeting an end-to-end channel performance and shall be shown to have been tested with the proposed component manufacturers products and warranted as a complete permanent link and channel solution.

C. Cable Insulation and Jacket: Cable jacket shall comply with Article 800 NEC for the environment in which the cable will be installed. All cables shall bear the U.L. And NEC, CMR or MPR markings. (All cable shall be RISER rated unless otherwise specified or required by code.) All PLENUM cables shall bear the UL and National Electrical Code, CMP or MPP markings. Cables utilizing 2x2, 3x1, or other combinations of construction shall not be acceptable

D. Horizontal Cables drops from IDF to specified outlets locations are to be without splices.

E. Horizontal Cable Specified:

1. Basis of Design:

a) Panduit #PUR6C04BU-U (Cat.6)

2. Approved Equals:

a) If submitted with a 25 year or greater total PDW warranty and if meeting the physical characteristics described and certified as part of the channel solution. The cable selected must be an approved cable for use in a warranted system from the connectivity manufacturer.

b) Uniprise – Media 6

c) Birktek – Landmark 1000

d) General Cable – Genspeed 6000

2.8 CABLE SUPPORT SYSTEM

A. All Horizontal cables shall be in one (1) inch conduit. Extending from outlet location to Systems Room /MDF

B. Extension of existing cable tray system shall match existing system type and size.

2.9 FIBER OPTIC CABLING

A. General: Single-Mode fiber optic cabling shall be provided between IDF'S and MDF, and between FOB and IDF's as designated on the contract drawings.

B. Single Mode Fiber Optic Cabling (12-Strand):

1. Number of fibers: 12, or as shown on the drawings.

2. Core/Cladding: 8.2 micron/125 micron.

3. Tight Buffer

4. Sheath construction: Non-metallic

5. Design Selection:

a) General Purpose Horizontal, Vertical Riser: Corning MIC #012E81-33131-24.

6. Approved Equals:
    a) Commscope, Belden, Berk-tek, or OCC.

C. Single Mode Fiber Optic Cabling (24-Strand):
1. Number of fibers: 24, or as shown on the drawings.
2. Core/Cladding: 8.2 micron/125 micron.
3. Tight Buffer
4. Sheath construction: Non-metallic
5. Design Selection:
    a) General Purpose Horizontal, Vertical Riser: Corning MIC #024E81-33131-24.
6. Approved Equals:
    a) Commscope, Belden, Berk-tek, or OCC.

D. Composite cables are approved with compliance of above specifications where applicable.

E. All terminations shall utilize a Fan-out Kit: All kits shall be installed per manufacturers guidelines to provide fiber protection at each termination point. Kits shall be equal to Corning SFK-P.

F. Labels: Labeling for fiber cabling shall be by IDF number, plus the color suffix designating which fiber is terminated. Die cut acetate labels or Kroy labels shall be considered acceptable the purpose. Labels shall also be provided at any exposed cable location 20' on center and at all IDF'S locations. Identification shall include to and from information.

2.10 EQUIPMENT RACKS – Wall Mounted Enclosure (IDF)

A. General: TTB's shall be equipped with wall mounted enclosures for local horizontal cabling, to house owner-provided equipment and contractor provided termination bays for the multiple cable types. Wall mounted enclosures shall be mounted and utilize non-conductive washers to secure the rack to the wall. Equipment Mounting Selections:

B. Wall Mount Enclosures
1. CPI Heavy duty wall mount equipment rack (black)
    a) Accessories:
        1. Power Strip: CPI #12820-705
    b) Basis of Design: CPI #15321-724
2. Approved Substitutions:
    a) Panduit (black)
    b) Hubbell (black)
    c) Ortronics (black)

C. Rack Accessories: Each equipment rack will be provided with the following accessories:
1. Horizontal cable organizer:
    a) 19" rack mount, 1U high horizontal cable manager.
        1. Design selection: Panduit #NM1
    b) 19" rack mount, 2U high horizontal cable manager.
        1. Design selection: Panduit #NM2

c) Approved Substitutions

1. Hubbell (black)
2. Ortronics (black)

2. Vertical cable organizer:

a) 19” rack mount, Vertical cable manager.

1. Design selection: Panduit #WMPV45E

b) Approved Substitutions

1. Hubbell (black)
2. Ortronics (black)

D. Cable Routing: Station cables will be routed into the rear station Cable manager, neatly organized and terminated onto the patch panel following TIA/EIA-568-B, 569 termination guidelines. It is required that a horizontal cable manager be installed above and below any patch panel installed onto a rack. Patch panels and front/rear cable managers will then be installed in alternating order on the rack. It is further required that on 48 port patch panels, the cable terminated to the top 24 ports shall be neatly routed through the cable manager mounted above the patch panel. The lower set of 24 ports shall be routed through the wire manager mounted below the patch panel. This routing method is required to allow easier moves, adds and changes at a later date.

E. Plywood backboards: shall be installed in each IDF rooms on walls to a height of 8' AFF. Rooms shall have walls covered as shown on the drawings. Plywood shall be minimum ¾” AC with the best side out. All imperfections shall be sealed and sanded prior to painting with 2 coats fire retardant paint. (Color to be Gray ) Coordinate color selection with the owner/Architect.

2.11 CATEGORY 6 PATCH PANELS

A. General: Equipment racks: shall be equipped with 19" rack mounted, 8-position modular jacks (RJ-45 type), non-keyed, factory configured, patch panels for termination of all copper horizontal cables.

B. Patch Panels:

1. 24 Port Cat-6 Patch Panel.

a) Provide CAT-6 modules as required to terminate all cabling.

b) Basis of Design: Panduit #CPPL24WBLY 2. 48 Port Cat-6

2. Patch Panel.

a) Provide CAT-6 modules as required to terminate all cabling.

b) Basis of Design: Panduit #CPPL48WBLY 3. Approved

3. Substitutions:

a) Ortronics, Category 6

b) Uniprise Category 6

C. Provide distribution of the voice pairs from existing TTB 110 block to modular patch panels in IDF rack. These patch panels shall be configured with four voice pairs per port via the 110connector side of the panel. The panels shall be configured as 8-position modular jack-to-110 termination panels in quantities as indicated on the drawings. These panels shall be patched to another set of FOB voice patch panels, which shall be connected to the voice jack of the FOB outlets in the field.

D. Identification: Designation strips for each port shall be provided on the patch panel. All cables shall be terminated in numerical sequence and each position labeled as to outlet number and jack position as is noted for the outlets.

E. Category 6 Modular Patch Cords and FOB Cords: The contractor must supply the same brand of patch cables as the Jack/patch panel manufacturer in order to maintain the requirement for a channel warranty.

1. Provide one Category 6 Modular Patch Cords for each outlet containing DATA jacks, for the rack patching. Patch cords shall be provided in length as follows with RJ-45 modular connectors on both ends: 50% 4', and 50% 6'. Color desired is blue for DATA.

2. Provide one Category 6 Modular Patch Cords for each outlet containing VOICE jacks, for the rack patching. Patch cords shall be provided in length as follows with RJ-45 modular connectors on both ends: 50% 4', and 50% 6'. Color desired is yellow for Voice.

3. All cords shall be round, and consist of stranded conductors insulated with high-density polyethylene and jacketed with flame retardant PVC. Cords shall be a component part of the proposed CAT 6 channel solution and have been tested as such.

a) Basis of Design:

1. Data: Panduit, blue

2. Voice: Panduit, yellow

b) Approved Substitutions:

1. Ortronics

2. Uniprise

2.12 FIBER OPTIC PATCH PANELS

A. Rack Mounted Panels: Fiber optic cabling shall be terminated in fiber distribution Units (FDU) where indicated on the contract drawings and described herein. Provide blanking modules in all unused connection ports. FDU's shall be provided in quantities and configurations as shown on the drawings complete with loaded with SC Style coupler plates. All FDU's shall be provided with rack mounting hardware allowing the unit to be placed in a standard EIA 19" rack.

1. Fiber Distribution Unit (2U):

a) Basis of Design: Corning #CCH-02U (or approved equal)

2. Fiber Distribution Unit (4U):

a) Basis of Design: Corning #CCH-04U (or approved equal)

3. Blank Panels for all unused opening in FDU

a) Basis of Design: Corning (or approved equal)

4. Coupling Panels for "FDU", (Single-Mode, 8.2/125)

a) SC Style Connectors

b) Basis of Design: Corning #CCHCP12-59 (or approved equal)

B. Wall Mounted Panels (WM): Fiber optic cabling shall be terminated in fiber distribution Units (FDU) where indicated on the contract drawings and described herein. Provide blanking modules in all unused connection ports. FDU's shall be provided in quantities and configurations as shown on the drawings complete with loaded with SC Style coupler plates.

1. Fiber Distribution Unit (4-Panel):

a) Basis of Design: Corning #WCH-04P (or approved equal)

2. Fiber Distribution Unit (6-Panel):
   a) Basis of Design: Corning #WCH-06P (or approved equal)
3. Blank Panels for all unused opening in FDU
   a) Basis of Design: Corning (or approved equal)
4. Coupling Panels for "FDU", (Single-Mode, 8.2/125)
   a) SC Style Connectors
   b) Basis of Design: Corning #CCH-CP06-59 (or approved equal)

C. Fiber-Optic Patch cables:
1. All Patch cables shall be the same manufacturer as the Fiber Distribution Units, (FDU).
2. Provide (6) 6' duplex patch cables at each FDU Location
3. Basis of Design (SC, duplex fiber optic patch cords),

D. Provide label indicating each strand ID and location of other end termination. (LIU/NODE/TRSP/ROOM#)

2.13 FIBER OPTIC CONNECTOR

A. Single Mode SC type connector field installable. Connectors shall meet or exceed the following transmission and mechanical specifications:
1. 900um terminations only
2. Mated pair insertion loss per shall be field-installed SC connector pair shall not exceed 0.75 dB per ANSI/TIA/EIA-455-34 method.
3. Special tooling is required for the termination of SC connectors.
4. Factory pre-polished fiber stub connectors with alignment pins.
5. Basis of Design:
   a) Basis of Design: Corning Anaerobic Connector #95-201-41-SP (or approved equal)

2.14 UNSPECIFIED EQUIPMENT AND MATERIAL

A. Any item of equipment or material not specifically addressed on the contract drawings or in this document and required to provide a complete and functional installation shall be provided in a level of quality consistent with other specified items.

2.15 GROUNDING SYSTEM AND CONDUCTORS

A. Communications bonding and grounding shall be in accordance with the NEC and NFPA as well as EIA/TIA grounding and bonding standards. Backbone and entrance cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices.

B. A #6 AWG stranded copper wire cable shall be extended between new ground bars located at each IDF and the building main electrical service ground point or secondary transformer ground point. The building steel, the equipment rack, and all surge suppressors, protectors and metallic cabinets shall be bonded to the ground bar via a #6 AWG stranded copper cable and U.L. accepted connecting hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Install equipment in accordance with manufacturer's instructions.
2. Install equipment, cables, raceways and outlets as required to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.
3. Install all electrical basic materials per applicable sections of these specifications.
4. Install all rack mountable equipment in equipment rack.
5. Install system racks in locations shown; arrange to provide adequate ventilation and access.
6. Coordinate location of equipment with drawings and all equipment provided by Telephone System, Television System, Fire Alarm System.
7. Properly ground system per applicable sections of these specifications.
8. Support raceways, backboards, and cabinets as required by manufacturer's instructions.
9. Install raceways to conform to applicable sections of these specifications.
10. Install PDS system wiring and/or conduits away from any surface that may become hot, including and not limited to, hot water piping and heating ducts.
11. Install PDS system conduit with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power and Class 1 circuits, separation may be reduced to six inches. Increase separation if so required to comply with EIA/TIA referenced standards or manufacturer's recommendations.
12. Each PDS outlet shall have cables homerun in 1" conduits to the respective voice or data patch panels in the associated Main/Intermediate Distribution Frame (MDF/IDF) at the communication equipment room (CER), communication closet (CC), or communication panel (CP) as indicated on the drawings.
13. Components of the premise distribution system shall be installed in a neat, workmanlike manner consistent with the best telephone and data practices.
14. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the building.
15. Identification markings and systems shall be uniform.
16. T568A wiring codes as shown on the drawings shall standardize all twisted pair wiring.

B. Patch Panels:

1. All horizontal cables shall be terminated in order, group all ports from same FOB adjacent to each other. Refer to detail on drawings.

C. Outlets:

1. General: Install outlets for PDS where indicated on the drawings. Install devices/inserts in outlets so that same orientation is used throughout project.
2. Outlets: Install per applicable section of these specifications

D. Pathway

1. General

a) All conduit shall meet the applicable requirements of all Sections 26,27,28

b) All conduit at terminal boards shall terminate at point within 6 inches of termination board with appropriate bushing, (ground if metal).

c) Conduit shall not be shared by power or any other electrical wiring that is not part of the low voltage PDS systems. PDS system wiring may be installed in underground pull boxes with other low-voltage systems provided:

1. Installation meets/complies with all applicable codes and standards.

2. PDS system cables are separated by at least 12 inches from any nonshielded wire/cable.

d) Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.

e) Install conduit so no more than two 90o bends are in any raceway section without a pullbox. Install additional pullboxes as required to maintain maximum of two 90o bends between pullboxes and/or termination points.

f) Install conduit so no more than one hundred (100) feet of raceway are in any raceway section without a pullbox. Install additional pullboxes as required to maintain maximum of one hundred (100) feet between pullboxes and/or termination points.

g) Label all conduit at both ends to indicate destination and PDS source room. Also

indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.

h) Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.

i) Properly support cables/wire not installed in conduit.

j) Conduit at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.

2. Equipment Racks/Cabinets shall be installed where shown on the drawings and in accordance with the manufacturer's instructions.

a) Specialty cabinets shall meet Project Design while complying with rack/cabinet/enclosure equipment specifications within this document.

b) Each equipment rack shall have one full-length vertical wire manager installed on each side of the equipment rack.

c) Multiple contiguously installed equipment racks shall have a double width vertical wire manager installed between each adjoining equipment racks.

d) All terminating frames and cable racks shall be grounded with a minimum #6 stranded THHN copper cable with a continuous green jacket.

e) Each rack to be grounded with it’s own grounding cable connected back to the communications room Master Ground Bar. Remove paint from grounding lug attachment points on each rack. Each grounding lug to be attached to rack via nut and bolt method.

1. Ground cables within Communications Room to be installed separate route from all horizontal and backbone cabling, back to Master Ground Bar.
2. This separate pathway shall hang from ladder rack.

f) When mounting any equipment in enclosure, provide width, height, hardware, etc. as required for complete and coordinated installation.

g) Horizontal wire managers are to be installed qty (1) for each 24 ports of modular copper cable patch panels.

h) For the maximum size allowed patch panel (48 ports) one horizontal wire manager to be installed above and one horizontal wire manager to be installed below. above and one (1) horizontal wire manager (2 RU) below.

i) One additional Horizontal wire managers to have both front and rear channels with covers,

3. Fire Stop

a) Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.

b) Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.

c) Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.

4. Fire and Smoke Partition Penetrations

a) Openings in sleeves and conduits used for the PDW system cables and those that remain (empty) spare shall be sealed with a U.L. approved fireproof, removable safing material.

1. Additional penetrations through rated assemblies necessary for passage of PDW wiring shall be made using an approved method and permanently sealed after installation of cables.

5. Horizontal Cable Pathway

a) Cable Support

1. Install 1”conduit for all PDS stations. Routing from MDF/IDF to station location.

b) Communication Outlet (CO) Pathway:

1. Each CO outlet shall have conduit homerun to MDF/IDF.
2. Minimum size to be 1" conduit.

6. Backbone Pathways (Intrabuilding or Interbuilding)

a) Install raceways as required above under "General."

b) Minimum size: 4" C.

1. Increase size of conduit/raceway/pathway called for above if larger size is called for on drawings or larger size is required per paragraph "2)" below.
2. Conduit/raceway/pathway size shall not be smaller than that required by EIA/TIA-569, Table 5.2-1, "Conduit Fill for Backbone Cable." Conduit size shall be based on type of cable and quantity of cables.

7. Pullboxes, Splice (Junction) Boxes, Outlet Boxes

   a) Install per applicable sections of these specifications and all applicable codes/standards.

   b) Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.

   c) A pull or splice box shall be placed in a conduit run where:

      1. The length is over 100 feet
      2. There are more than two 90 degree bends
      3. If there is a reverse bend in the run

   d) Boxes shall be placed in a straight section of conduit and not used in lieu of a bend unless specifically noted otherwise or accepted by the Engineer. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.

   e) Outlet boxes shall be installed at locations shown on drawings per applicable codes/standards.

   f) Every pullbox and/or splicebox shall have a hinged cover. Install appropriate access panel to allow cover to open.

   g) No pullbox shall be installed such that from finished floor to the top of the box exceeds ten (10) feet unless accepted by the Engineer.

   h) Size

      1. Where a pullbox is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pullbox.
      2. Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
         (a) For straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway;
         (b) For angle and U pulls:
            (1) Have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and
            (2) Have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
            (3) Six (6) times the trade size diameter of the raceway
         (c) six times the trade size diameter of the larger raceway if they are of different sizes.
      3. For a raceway entering the wall of a pullbox opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.

4. Where a splicebox is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."

8. No box shall be smaller than that required by NEC 314.28(A) (1) and (2).

9. Cable Trays:

   a) Install in all CO's and CER's as shown on drawings.

   b) Support no more than four (4) feet on center. Reduce support spacing if so recommended/required by manufacturer.

   c) Install at approximately 8 ft. A.F.F.

   d) Support/brace to wall.

E. Termination Backboards

1. Plywood backboards shall be installed in each IDF and MDF room on walls to a height of 8' AFF. Rooms shall have walls covered as shown on the drawings. Plywood shall be minimum ¾" AC with the best side out. All imperfections shall be sealed and sanded prior to painting with 2 coats fire retardant paint. (Color to be Black, Grey or white) Coordinate color selection with the owner/Architect.

2. Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.

3. Install termination backboards plumb, and attach securely to building wall at each corner.

4. Finish paint termination backboards with durable gray paint having flame spread rating of Class A prior to installation of any equipment on termination boards.

F. Grounding

1. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.

2. Connect Central Equipment rack to "systems" ground bus with #6 green insulated copper ground wire.

3. Connect metal conduit (via grounding bushing) to "systems" ground bus.

4. Connect cable shields to "systems" ground busbar.

5. Connect surge suppression equipment to "systems" ground busbar.

6. Ground each terminal board by extending 1 AWG #2 green insulated copper conductor in ¾" non-metallic conduit from a junction box at terminal board to the nearest accessible acceptable building grounding electrode system as defined in NEC Article 800.100(B). Where "SYSTEMS" grounding bus/bar is provided in same room as terminal board, the bus/bar may be used for grounding point if acceptable to telephone system installer and all applicable codes.

G. Surge Suppression

1. General

   a) Provide and install surge suppression devices for 120 volt source to all equipment. Install on line side of UPS (or power strip) at equipment rack.

   b) Extreme care shall be taken by the contractor to assure a properly surge protected system.

   c) Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.

d) Installation of surge protection equipment and it's grounding must be per manufacturer's recommendations to assure short and proper ground paths.

2. Equipment Selection

a) Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

3. Equipment Installation

a) Install surge suppression equipment per manufacturers recommendation.

b) Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.

c) Locate surge suppression equipment in terminal cabinet nearest equipment cabinet being served (MDF, IDF, Telephone Company Service Entrance, etc.).

d) Contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.

4. Ground Installation

a) Ground Bus Connections.

1. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).

2. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.

3. Connect terminal cabinet "local" ground bus to "systems" ground bus installed with minimum #6 copper insulated wire (unless otherwise noted) in conduit.

4. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.

b) Surge suppression equipment grounding.

1. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.

2. Contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section for same system (i.e. Premise Distribution, Telephone Company Service Entrance, etc.).

c) Conductors.

1. Conductors minimum size to be #12 THWN.

2. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.

3. Do not bundle unprotected conductors with protected conductors.

4. Conductors shall be kept as short as possible.

5. Conductors shall be secured at 12" intervals with an accepted copper clamp.

6. Grounding conductors shall be properly connected to the building service ground by accepted clamps.

d) Grounding Connectors

1. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or U.L. for the purpose.

2. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.

3. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

e) Telephone Circuits

1. Systems utilizing telephone company pairs as a transmission medium shall be provided with a suppressor conforming to respective device in Part 2 of this specification.

2. Suppressors shall be installed at each point where interface is made to telephone company pairs.

3. In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:

(a) Where the modem or coupling device is furnished by the telephone company the suppressors shall be installed on the system side of the modem or coupling device.

(b) Where the modem or coupling device is furnished by the system contractor, the suppressor shall be installed on the telephone line side of the modem or coupling device.

H. Cables/Wires

1. Install cables/wires in accordance with manufacturer's instructions and EIA/TIA 568.

2. All cables shall be installed as illustrated on the drawings except where necessary to avoid EMI sources or other obstacles. Major deviations from the illustrated path must be accepted in advance by the Engineer.

3. PDS system cables will be in 1" conduit.

4. Splice cable only at terminal block units.

5. Provide adequate cable size and length for each backbone/riser run.

6. Tie cables of adequate sizes and quantities in 25, 50, and 100 pair increments shall be used to splice smaller cable into large sizes.

7. Provide adequate size and quantities of cross-connect/patch cables to perform necessary cross-connections.

8. Provide riser/backbone cable which meets performance requirements specified, and links all Closet locations indicated on Electrical Drawings.

9. Spare Cable: The following spare cable lengths are to be left at termination ends of conduits:

a) Communications Equipment Room (CER): Fiber and copper cables terminating in the CER shall have enough spare cable length left in the CER to be routed to the equipment rack or backboard, then down to the floor plus three (3) feet.

b) Communications Closets (CC): Fiber cables and copper backbone cables terminating in the CC shall have the same amount of spare cable length left in the CC as specified for the CER above. The four 4-pair UTP cables shall be terminated with enough spare cable length to be routed to the equipment rack or backboard, and down to the floor plus three (3) feet.

c) Communications Outlets: At the CO's, the four 4-pair UTP cables shall terminate with approximately one (1) foot of spare cable length. This spare cable shall be pulled out at CO's that are wall or floor mounted during cable installation. Following installation, spare cable length shall be pushed back into the wall or floor for future use in terminating cables.

d) All cable runs shall contain service slack prior to the termination point. Provide 12inch service slack in the ceiling above each outlet. Service slack at IDF shall consist of a 10 foot slack section all station cables located and placed neatly in the cable ladder above the equipment rack.

10. Install Premise Distribution Cables no closer than 12" from any wire/cable installed for power system cable/raceway, or fluorescent/ballasted light fixtures.
11. Provide protection for exposed cables where subject to damage.
12. Use suitable cable fittings and connectors.
13. All cables in CC's and CER's shall be routed in overhead cable trays in IDF/MDF, provided by the PDS Contractor and dropped into the appropriate racks. All cables shall be neatly routed and properly secured to the cable tray, racks, or cabinets.
14. Cables shall be terminated to preserve wiring order consistently across all terminations (jacks, patch panels, connector blocks and patch cords). It is the Contractor's responsibility to ensure this consistency. Corrections will be made at the Contractor's expense.
15. Cables shall be terminated in order, lowest room number first, station A first, and ports 14 in order.
16. Install appropriate cable to match application, i.e., plenum, riser, etc. All cables shall bear CMP and/or appropriate marking for the application in which they are installed.
17. Cables routed through rated walls, floors and assemblies shall be routed via appropriate fireproofing system as accepted by UL.
18. Label cable at both ends indicating the originating and terminating location of each end. This labeling/identification shall be fully documented in as-built (record) drawings.
19. Cat 6 Cable Installation

    a) Installation of Category 6 UTP cable shall be in accordance with EIA/TIA guidelines for Category 6. The contractor shall replace Cable installation and terminations that do not comply.

        1. The maximum pulling tension shall not exceed 25 pounds to avoid stretching the conductors.
        2. The minimum bending radius of the cable shall not be less than 4x the diameter of the Category 6 cabling.
        3. The cable shall be installed without kinks or twists and the application of cable ties shall not deform the cable bundle.
        4. Strip back only as much cable jacket as is required to terminate the cable and the amount of untwisting in a pair as a result of the termination shall not exceed 0.5 in.

20. Service Slack

    a) All cable runs shall contain service slack prior to the termination point. Provide 12inch service slack in the ceiling above each outlet. Service slack at IDF shall consist of a 10 foot slack section all station cables located and placed neatly in the cable ladder above the equipment rack.

21. Support and Routing of Cables

    a) Horizontal cables used in this system are to be installed within conduit. Cables shall be routed through these spaces at right angles to electrical power circuits and supported only from the structure. Tie cables shall be extended between MDF to IDF'S utilizing conduit runs as shown on the drawing

    b) The PDW system contractor shall install supporting hardware for this system as part of the PDW contract. All supporting hardware shall be submitted to the engineer for acceptance prior to installation. Hardware shall also be utilized by other systems work. Comply with basic layout indicated on drawing details for cable placement.

22. Horizontal Cables

    a) Horizontal cables shall be color Blue.

    b) Provide and install adequate number cables and cable lengths for each horizontal run. A 4-pair Category 6 cable is required for each modular jack in an outlet to voice or data patch panel in respective CP, CC (IDF), or CER (MDF).

    c) Horizontal cables shall be installed in a neat and orderly manner. All cables entering a room shall enter through a single point. Where possible, all cables shall be routed along a single path and bundled together.

    d) Install cables via acceptable conduit as specified herein.

    e) Install cable type rated for environment.

    f) Install cables in cable tray in CC's and CER's.

    g) Terminate all horizontal station cable pairs according to EIA/TIA 568A wiring schedule.

    h) Terminate all four pair cables to RJ-45 modular jacks at each outlet.

    i) Terminate all cables at IDF/MDF in voice or data patch panel as required for system configuration. No cables shall be left unterminated.

    j) Contractor shall ensure individual pair twists of horizontal station cable shall be maintained at both the CO and Patch Panel. Category 6 cable pair untwisting shall not exceed 1/2".

    k) Fiber Optic Cable

        1. Install a minimum of one (1) 24- strand multimode 50mn fiber optic cable from the Immediate Needs IDF to existing MDF.

        2. Terminate all fibers in respective fiber optic patch panel.

        3. Provide 30 feet of slack (service loop) on both ends of each fiber optic cable. Slack cable to be stored in MDF/IDF fiber optic patch panel splice tray. If fiber optic patch panel splice tray cannot accommodate 30 feet of slack Contractor shall provide a separate storage tray mounted in equipment rack adjacent to the fiber optic patch panel.

4. Observe all manufacturer's specifications relative to cable bend radius and pulling tension. There shall be no intermediate splices between fiber terminating equipment.
5. All fiber strands shall be field terminated to SC-style connectors. Any termination with a greater than 0.5 dB loss shall be replaced by Contractor at no expense to Owner.
6. Loose tube, gel-filled fiber optic cables shall be spliced to pig tail assemblies in splice tray. Use mechanical, re-enterable splices.
7. Install adequate fiber terminating equipment to properly terminate all fiber optic cable strands. No single chassis shall support more than 144 fiber optic cable strands. No spare connector panels are required.
8. All fiber terminating equipment installed in the CER and CC's shall be 19 - inch rack or cabinet mounted. All fiber terminating equipment installed in the systems equipment rooms shall be rack mountable and capable of holding 144 individual strands.
9. Each six strand shall be terminated on a separate 6-port SC connection panel.

I. All conduits and/or innerducts containing fiber optic cables shall have a pull string to accommodate the future installation of additional fiber optic cables.

J. Labels

1. All PDS components must be easily identifiable for any person that may need to locate telecommunications equipment, facilities, or circuit information. Cable and equipment management shall be performed using PDS administration database programs that track all telecommunications circuit components.
2. The labeling scheme is to enable tracing data/circuit information flow between devices without physically tracing each cable, and will be used to identify the following communications paths:
   a) Each active device and its rack location.
   b) Each patch panel, row and the associated active device.
   c) Each active device cable and the device it is attached to at the other end.
   d) Each Closet cable and the Closet/Equipment Room located at the other end.
3. All labels must be printed (not hand written) and applied on all specified PDS components. The label shall be of a type which can be easily applied to PDS components. Label sheets with adhesive backing, a durable surface side is recommended for cables. Other components can follow this format, but the contractor must provide for acceptance, details on how labeling will be accomplished.
4. All Fiber Optic strands shall be labeled at all termination points, and all fiber distribution units (FDU) shall be labeled. Coordinate exact labeling scheme with county MIS.

K. Copper Cables

1. Each jack on the Communications Outlet shall be labeled at the faceplate using the following scheme:
   a) Station ID(2) - Bldg#(2)CC#(3) – Port ID (3) where:
      1. Station ID (2) = single capital letter and single digit representing which jack in room

2. Bldg#(2) = two digit building number as per labeled in drawing
3. CC#(3) = three digit room number of CC or CER as per drawing
4. Port ID (3) = single capital letter representing the patch panel order and then two digits representing the patch panel port number. Patch Panels are labeled alphabetically from top to bottom, left to right.
5. Sample: A1-01100-A24

2. All wires shall be labeled at all termination points, and the patch panels shall be labeled, using the following scheme:

a) Station ID(2) - Bldg#(2) Rm (3) where:

1. Station ID(2) = single capital letter and single digit representing which jack in room. Communications outlets are labeled alphabetically clockwise from main entrance to the room.
2. Bldg#(2) = two digit building number as per labeled in drawing.
3. Rm(3) = three digit number as per labeled in drawing.
4. Sample: A1-01004

3.2 FIELD QUALITY CONTROL

A. General

1. Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.
2. Test all cables/outlets.
3. The Contractor shall submit to the Engineer a testing schedule fifteen (15) days prior to commencement of testing. Testing schedule shall be accepted by the Owner. If unacceptable to the Owner, resubmit testing schedule that will allow Owner to have personnel at the site during testing.
4. Contractor shall make a minimum of two (2) personnel available for the Owner's testing of active components after their installation. Active physical layer components shall be fully tested by dynamic node emulation, simulating IEEE 802.3 data communications environment. Communications simulators and analyzers will test all component ports for packet passing integrity throughout the logical network.

B. Fiber Optic Cable Testing:

1. Each strand if fiber optic cables shall be tested for correctness of termination, overall transmission loss, and defects using an accepted Optical Time Domain Reflectometer (OTDR) and a power meter. The Engineer shall be present during all tests. Notify the engineer one week prior to testing to assure attendance.
2. Testing Equipment: Tester shall be as manufactured by Agilent Technologies, Fluke, Microtest, Noyes or Wavetek.
3. Multimode fiber testing shall be I.A.W. TIA/EIA-526-14 method B. System loss measurements (both calculated and measured) shall be provided at 850 and 1300 nanometers in both directions for multimode cables (1310 and 1550 nanometers for singlemode) for each strand. Per IEEE 802.3z, maximum fiber strand attenuation shall not exceed 2.38 dB @ 850 nm with a modal bandwidth of 160 Mhz-km and 2.35 dB @ 1310 nm with a modal bandwidth of 500 Mhz-km. Test as follows:

a) Measure and record normalized fiber loss at operating wavelength in dB/km.

b) Detect and record point faults or discontinuities.

c) Measure and record overall length of cable.

4. Certification report shall be provided listing both the calculated and measure loss for each fiber optic circuit and submitted with the test results as called for above. Provide test results in IBM text format on 3-1/2" diskettes as well as (2) hardbound copies in 3ring binders. Documentation of testing shall include:

   a) Wavelength, fiber type, fiber manufacturer and cable model number, cable manufacturers' attenuation specifications, cable manufacturers' bandwidth specifications, measurement direction, test equipment and serial numbers (with date of last calibration), date of each test, reference setup, name of technician(s) performing testing.

   b) OTDR trace(s) shall be submitted with request for substantial completion.

C. Copper UTP Cable Testing:

1. General: Premises Distribution Cabling Contractor shall test wiring setting tester for a channel configuration which includes the patch cord, patch panel, UTP Cable, work-area jack and work-area cord.

2. Testing Equipment: Tester shall be as manufactured by Agilent technologies, Fluke, Microtest or Wavetek. Tester shall be 100% Level IIE compliant with TSB-95/ADDENDUM 5 to ANSI/EIA/TIA 568A-5 specifications for testing of CAT 6 cabling. No tester will be accepted with out meeting these requirements.

3. Each jack in each outlet shall be tested at a minimum to the Category 6 compliance in a channel configuration to verify the integrity of all conductors and the correctness of the termination sequence. Testing shall be performed between work-area cord at the outlets and the patch cord at the equipment rack. Prior to Testing UTP runs, the tester shall be calibrated per manufacturer guidelines. The correct cable NVP shall be entered into tester to assure proper length and attenuation readings. During Channel testing the patch cords and the work-area cords shall be the same as those provided by the contractor per this specification. Each Channel test shall include one patch cord and one work-area cord, with no cord used twice.

4. Documentation of cable testing shall be required. The contractor shall provide the results of all Category 6 cable tests in electronic format as well as two (2) hardbound copies in 3-ring binders. Provide IBM format text files on disk. Provide a separate text file for each building in the project. Each test page shall be separated by standard page break (one test per page). The test results shall include:

   a) 100 MHz sweep tests, continuity, polarity checks, wire map, Attenuation, NEXT, PSNEXT, FEXT, PSFEXT, ELFEXT, PSELFEXT, ACR, PSACR, Return Loss, Delay Skew, and the installed length for Category 6 cables.

   b) Cables not complying with EIA/TIA 568A Category 6 tests for 250 Mb rating shall be identified to the engineer for corrective action which may include replacement at no additional expense to the Owner.

D. Acceptance:

1. Contractor shall provide the Engineer with written notification of testing schedule ten (10) days prior to commencement.

2. System verification and acceptance documentation signed and dated by the installer (Contractor) shall be provided. This documentation shall include test measurements and system calibrations performed for the entire system. Sample system operations shall also be performed with actual hardware or using Contractor provided test

equipment and documented to verify that the system is operational and ready for acceptance. This shall also establish the baseline performance of the system.

E. System Commissioning:

1. Upon completion of the aforementioned tests and before system commissioning, actual telephone, data and video testing shall be performed. The tests may be performed with existing equipment, if in place, or using contractor provided equipment or test equipment.

3.3 DEMONSTRATION

A. Provide one (1) active phone line to first or second floor for substantial.

B. Demonstrate system to designated Owner personnel as required by applicable sections of these specifications.

C. Conduct walking tour of project. Briefly describe function, operation, and maintenance of each component.

D. Provide detailed operation and maintenance instruction and training.

E. Use submitted operation and maintenance manual as reference during demonstration and training.

3.4 TRAINING

A. The contractor shall provide one 2-hour training session to familiarize the owner with the locations of all IDF's, cable and jack labeling and numbering systems, data and voice connections.

3.5 DOCUMENTATION

A. Close Out Documents

1. As well as documents indicated elsewhere, the project close out documents shall include those listed below.

2. Detailed as-built drawings shall be adapted from the original prints provided. Each CER and CC shall contain a copy of that building's as-built drawing affixed to an adjacent wall or located in an interior pouch for quick reference. Revised rack and equipment cabinet elevations shall be provided including serial numbers of all installed equipment.

3. Building drawings shall be left in each closet and three (3) copies supplied for use by the Owner's MIS Department.

B. As-Built and CAD Drawings

1. As-built drawings are required.

2. Computer Assisted Design (CAD) drawings on disk are required.

3. As-built CAD drawings shall show all cable runs, communications closets, and cable runs with distances marked between buildings in DFX format.

4. The cable route drawings shall contain end points, fiber routing, conduit routing, patch panels terminations (connector type) and cable length (including slack).

5. The as-built drawing for each building shall show communications closets, placement of A/C power, point of entry, communication outlets and types of jacks. The communication outlets may be summarized by indicating the type used in all locations throughout the installation as a representation of the installation.

6. A completed closet schematic and each diagram must be submitted to MIS/Telecommunications prior to completion of wiring.

3.6 AS-BUILT DOCUMENTATION

A. As-built documentation shall be provided as part of the contract. As-built drawings shall be a complete set of AutoCAD Release 14/2000 floor plans with all outlets shown and numbered as installed. The original project floor plan disks shall be obtained from the Owner. All cable routings (trunk lines) and elevations of each IDF or MDF indicating outlet, tie, and riser cable terminations shall be required. All addendum information or project revisions resulting in drawing changes that occur during the construction period shall be documented and included in the as-built material. All required as-built documentation is mandatory and shall be required prior to project closeout. A set of prints with all changes shall be submitted to the Engineer for review. Upon completion of the Engineer's review, the Contractor shall provide updated disks and a reproducible set of drawings, which include final As-built conditions and the Engineer's review comments, if any.

B. Contractor shall provide Excel software spreadsheet that defines the telecommunications outlet number, location, and number of voice, data and special jacks. This database shall also provide the outlet patch panel connection to the riser/inter-floor cable, equipment, and telephone company demarcation circuit pairs as part of the as-built documentation.

3.7 TESTING OF WIRING ACCURACY

A. General: Premises Distribution Cabling Contractor shall test wiring setting tester for a channel configuration which includes the patch cord, patch panel, UTP Cable, work-area jack and work-area cord.

B. Testing Equipment: Tester shall be as manufactured by Agilent Technologies, Fluke, Microtest or Wavetek. Tester shall be 100% Level lll compliant with TIA/EIA 568B.2-1 specifications for testing of CAT 6 cabling. No tester will be approved without meeting these requirements.

C. Testing guidelines: Each jack in each outlet shall be tested at a minimum to Category 6 compliance. The test shall be done in a LINK configuration to verify the integrity of all conductors and the correctness of the termination sequence. The Contractor and Manufacturer shall provide a minimum 25 year application assurance Warranty for the LINK and CHANNEL. The manufacturer shall provide 100% factory testing of the patch cords. It is not an acceptable practice for patch cords to be unpackaged for use in certification testing. The cords shall remain boxed, and stored for installation by the owner or as otherwise indicated by the scope of work.

D. Testing shall be performed between the outlets and the patch panel at the equipment rack, prior to testing UTP runs the tester shall be calibrated per manufacturers guidelines. The correct cable NVP shall be entered into the tester to assure proper length and attenuation readings.

E. The contractor must verify that this testing method is acceptable to the manufacturer that will be providing the LINK AND CHANNEL warranty for this project.

1. 350 MHz sweep tests, Wire map, Attenuation, NEXT, PSNEXT, ELFEXT, PSELFEXT, ACR, PSACR, Return Loss, Delay, Delay Skew, and the installed length for Category 6 Cables.

2. Cables not complying with ANSI/TIA/EIA-568-B.1 and B.2-1 Category 6 tests shall be identified to the engineer for corrective action which may include replacement at no additional expense to the Owner.

3. Documentation of cable testing shall be required. The contractor shall provide the results of all Category 6 cable tests in electronic format as well as two (2) hardbound copies in 3-ring binders. Provide IBM format text files on 3 1/2" diskette. Provide a

separate text file for each building in the project. Each test page shall be separated by standard page break (one test per page).

END OF SECTION

SECTION 28 01 05 - INVESTIGATION OF EXISTING ELECTRONIC AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. Test the essential features of the following existing electrical systems:

1. Fire detection devices, smoke detection devices
2. Controls and alarms

B. Each system shall be tested once only, and after completion of testing, results given to the Owner, Engineer and/or Owner's representative. Point out any non-operational function noticed during testing.

C. Document the existing conditions and operation of the existing electrical systems prior to any work.

D. Contractor is responsible for all non-working systems and their components unless non-working status is verified prior to work on system.

1.3 TIME

A. The testing shall be held at a date to be agreed upon in writing by the Owner or his representative.

1.4 ATTENDING PARTIES

A. The testing shall be held in the presence of the Owner, or his representative and contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PERFORMANCE VERIFICATION

A. Perform a one-time test upon completion of construction: Test the operation of each of the following existing devices and associated systems in or adjacent to project scope:

1. Fire Alarm System

a) Test each pull station and record location of each tested device, and note either operational or non-operational.

b) Test each heat detector and record location of each tested device and note either operational or non-operational.

c) Test each smoke detector with canned smoke and record location of each tested device and note either operational or non-operational.

d) Test tamper switches by closing the valve until signal is activated and verify trouble signal indication at the fire alarm control panel and annunciators. Record location of each tested device and note either operational or non-operational.

e) Upon alarm activation, verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.

f) Test Fire Alarm System sufficiently to determine existing operating condition of system. Pull the pull stations, check automatic detectors. Test minimum of one manual device per zone, and one automatic device per zone.

g) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.

B. The electrical contractor shall investigate all existing systems as called out in this performance verification prior to the beginning of any work which could affect these systems.

C. Each system shall be retested after completion of remodel and/or renovation to ensure proper operation is maintained. Demonstrate operation per Section Demonstration of Completed Electrical Systems.

3.2 MEMO OF INVESTIGATION (TESTING)

A. Submit Existing Facilities Investigation Memo and advise Owner/Engineer of all deficiencies in system(s) prior to work. All systems will be assumed to be fully operational if memo is not received by Engineer prior to work on system.

B. Submit five (5) copies of memo of tested devices and equipment, memo signed by the Contractor, Subcontractor and Owner and submit each test result to the owner's representative.

END OF SECTION

EXISTING FACILITIES INVESTIGATION MEMO

NAME OF PROJECT:

The existing systems on the above project have been investigated and checked to determine the existing condition of all existing electrical systems within the area(s) affected by the scope of work of this project. The investigation consisted of testing all electrical systems/devices as required by Section Investigation of Existing Electrical Systems of these Specifications.

All equipment was found to be operational except as noted herein (list below):

NAME OF PRIME CONTRACTOR:

AUTHORIZED SIGNATURE AND TITLE:

DATE:

NAME OF OWNER'S AUTHORIZED REPRESENTATIVE:

AUTHORIZED SIGNATURE AND TITLE:

DATE:

Note To Contractor: Upon completion of investigation and one week prior to the commencement of work, submit five copies of the completed EXISTING FACILITIES INVESTIGATION MEMO to the Owner's Authorized Representative, signed and dated by the Contractor. Have the Owner's Authorized Representative sign and date receipt of MEMO. Retain copy(ies) and submit copy of MEMO in each Operation and Maintenance Manual. Contractor shall submit quantities of MEMOS as required to present required information.

GROUND TEST INFORMATION

PROJECT NAME:_____

GROUND TYPE:_____

TEST BY:_____

DATE OF TEST:_____

GROUND LOCATION:_____

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM

GROUND: _____(OHMS)

AFTER CONNECTION TO SYSTEM

GROUND: _____(OHMS)

WEATHER CONDITIONS (Wet/Dry):

SOIL CONDITIONS (Wet/Dry):

CONTRACTOR'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

SECTION 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

A. This section includes Basic Electrical Requirements specifically applicable to the Division 28 Section, in addition to Division 1 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.

B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.

C. The Division 26 27 28 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.

D. Only trained, and licensed personnel shall be used by the Contractor to perform work. The Contractor shall not perform work, which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.

E. Coordinate telephone company equipment service, rework and relocation requirements prior to bid. Bid to include all work required for complete and properly operating systems.

F. Coordinate all work with vendors for rework, relocation, and addition of equipment and devices, including any modification to existing system infrastructure.

G. Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment.

1.4 WORK SEQUENCE

A. Install work in stages and/or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with Owner and Architect/Engineer.

B. Refer to architectural phasing plan.

1.5 CODES, FEES, AND STANDARDS

A. Conform to all applicable requirements of Section Reference Standards and Regulatory Requirements.

B. Obtain permits and request inspections from authority having jurisdiction and applicable utility companies.

C. Pay for all required licenses, fees, and inspections.

D. Contact the Utility Companies to determine if fees, charges or costs are required by the Utility Company for modification to existing system, installations, and hook-ups. These fees, charges or costs shall be included in Contractor's bid.

E. Material shall be new and free of defects with UL listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if UL Listing is not available for material.

1.6 PROJECT/SITE CONDITIONS

A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.

B. The Contractor shall install all equipment so that all Code required and Manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.

C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.7 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding.

B. Each Bidder shall visit the site and shall thoroughly familiarize himself with existing field conditions and the proposed work as described or implied by the Contract Documents. During the course of the site visit, the electronic safety and security systems bidders shall verify every aspect of the proposed work and the existing field conditions in the areas of construction and demolition which will affect his work. The Contractor will receive no compensation or reimbursement for additional expenses he incurs due to failure to make a thorough investigation of the existing facilities. This shall include rerouting around existing obstructions.

C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.

D. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Contractor shall field verify dimensions of all site utilities, conduit routing, boxes, etc., prior to bidding and include any deviations in the contract. Notify A/E if deviations are found.

E. All existing electrical is not shown. The Contractor shall become familiar with all existing conditions prior to bidding, and include in his bid the removal of all electrical equipment, wire, conduit, devices, fixtures, etc. that is not being reused, back to it's originating point.

F. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.

G. Remove existing systems, material and equipment which are made obsolete or which interfere with the construction of the project. Reinstall power, lighting, systems, materials and equipment which are required to remain active for the facility to be fully functional.

H. All items removed and not re-used shall be immediately turned over to Owner as they are made available by renovation. Remove items from job site and deliver to Owner's storage location(s) as directed by project manager. Discard complete items which Owner elects to refuse.

I. Investigate site thoroughly and reroute all conduit and wiring in area of construction in order to maintain continuity of existing circuitry. Existing conduits indicated in Contract Documents indicate approximate locations only. Contractor shall verify and coordinate existing site conduits and pipes prior to any excavation on site. Bids shall include hand digging and all required rerouting in areas of existing conduits or pipes.

J. Work is in connection with existing building areas (out of scope) which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. Notify Owner as indicated in Division 26 in advance of any shut-down of existing systems.

K. Bid shall include all removal and relocation of all items required for completion of alterations and new construction.

L. See Section Minor Electrical Demolition for Remodeling for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.

B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc which is the most expensive and costly to implement.

C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.

D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.

E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.

F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.

G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.

H. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division those requirements shall govern.

1.9 MATERIALS AND EQUIPMENT

A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

B. Where Contract Documents list design selection or manufacturer, type, 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 A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with Section Substitutions and requirements.

C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.

D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.

E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 28 methods and materials unless specifically noted otherwise.

F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.

G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.

H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.

I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.

J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.

K. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

1.10 SUPERVISION OF THE WORK

A. Reference the General Conditions for additional requirements.

B. The Contractor shall provide experienced, qualified, and responsible supervision for work. A competent foreman shall be in charge of the work in progress at all times. If, in the judgement of the A/E, the foreman is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the A/E. Once a satisfactory foreman has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the A/E.

C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have, as a minimum, an active Journeyman's Electrical License in the State of Florida.

1.11 COORDINATION

A. Provide all required coordination and supervision where work connects to or is affected by work of other trades, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:

1. Door Hardware
2. Roll-up doors
3. Fire shutters
4. Roll-up grilles
5. Elevators
6. Escalators
7. Sliding doors

B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Divisions 28 Contract Documents or not.

C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.

D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space,

prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.

E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.

G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Mechanical, Electrical and, where provided Interior Design.

H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.

1.12 PROVISION FOR OPENINGS

A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.

B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.

C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.13 SURFACE MOUNTED EQUIPMENT

A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

1.14 CUTTING AND PATCHING

A. New Construction:

1. Reference Division 1 - General Requirements.

2. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.

3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed finished surface.

B. Existing Construction:

1. See Section Minor Electrical Demolition for Remodeling for additional requirements.

1.15 INSTALLATION

A. Erect equipment to minimize interferences and delays in execution of the work.

B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.

C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.

D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.

E. The Contractor shall keep the construction site clean of waste materials and rubbish at all times. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.

F. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and a layout made prior to the setting or embedment thereof, so as to cause no delay to the project schedule.

1.16 PROGRESS AND RECORD DRAWINGS

A. Keep two sets of prints on the job, and neatly markup design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.

B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:

1. All raceways 1-1/2" and above, exactly as installed.
2. Any panel ID changes on plan shall be indicated on as-builts.

C. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

1.17 "OBSERVATION OF WORK" REPORT

A. Reference the General Conditions.

B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item to the A/E. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected, and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.

C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.18 SYSTEMS WARRANTY

A. Reference the General Conditions.

B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of each System. Warranty shall not include lamps in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.

D. Where extended warranty or guarantee are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.

E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

1.19 SUBSTANTIAL COMPLETION

A. The Contractor shall be fully responsible for contacting all applicable parties to schedule required observations of the work by Engineer. A minimum of 72 hours notice shall be given for all required observations of the work by Engineer, and minimum of 120 hours for substantial completion observation. Time and date shall be agreed on by all applicable parties in writing.

B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

## PART 1 - GENERAL

### 1.1 DESCRIPTION OF WORK

A. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable Codes as accepted by the Authorities having jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.

B. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of Article 250 of the N.E.C. and State codes. Bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.

C. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed with-in conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors that run with feeders in PVC conduit outside of building(s) shall be bare only.

D. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to Article 250 of the NEC.

E. Section Includes

1. Equipment grounding conductors.
2. Bonding.

### 1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

### 1.3 SUBMITTALS

A. Submit in accordance with Section 28 05 00 Common Work Results for Electrical and Section 28 05 07 Submittals.

### 1.4 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Section 28 05 00 Common Work Results for Electrical and Section 28 01 00 Operation and Maintenance Manuals.

### 1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

## PART 2 - PRODUCTS

### 2.1 MECHANICAL CONNECTORS

A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.

B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. Specified items of designated manufacturers indicate required criteria and equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:

1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.

2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.

3. Piping Clamps: Burndy GAR-TC Series with two-hole compression terminal or T&B equal.

4. Grounding Screw and Pigtail: Raco No. 983 or equal.

5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.

C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

### 2.2 WIRE

A. Material: Stranded copper.

B. Size: Size to meet NFPA 70 requirements as a minimum; increase size if called for on drawings, in these specifications, or as required for voltage drop.

C. Insulated THWN (or bare as noted elsewhere).

### 2.3 GROUNDING BARS/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BARS AND GROUND BUS BARS)

A. Ground bars shall be copper of the size and description as shown on the drawings. If not sized on drawings, bus bar shall be minimum 1/4" x 2" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.

B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2 inches on center spacing. Lugs to be manufactured by Burndy or T&B.

C. Standoff supports to be 2" polyester as manufactured by Glastic #2015-4C.

## PART 3 - EXECUTION

### 3.1 GENERAL

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

B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.

C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the N.E.C., the NFPA, and applicable standards of IEEE.

D. Where there is a conflict between these specifications and the above applicable codes/standards, or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the code/standard requirements shall be complied with.

E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

### 3.2 EQUIPMENT GROUNDING CONDUCTOR

A. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.

B. All cable tray, rack, cabinets, equipment requiring ground connection, and metallic surface raceway shall contain a green insulation ground conductor from local system ground bus. Conductor shall be continuous.

### 3.3 MISCELLANEOUS GROUNDING CONNECTIONS

A. Provide bonding to meet regulatory requirements.

B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded to steel or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/I beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.

C. Grounding conductors shall: be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.

D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.

E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and

which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.

F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

H. Grounding provisions shall include double locknuts on all heavywall conduits.

3.4 GROUNDING BAR/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION

A. Where indicated on the drawings, provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.

B. Mount bolt tapping lugs with hex head bolts to bus bar at 2" o.c. spacing, one for each ground conductor.

C. Mount bus bar to wall using 2" polyester molded insulator stand-off.

D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by N.E.C. for service ground, etc.) in conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.

E. Extend #6 insulated copper ground wire from respective bus/bar to each 'local' ground bus/bar in each cabinet for Systems Sections.

F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800-40(b).

3.5 COMMUNICATIONS SYSTEMS

A. Provide and install all grounding as required by NEC Article 800 and where available on project: Articles 810 (Radio and Television Equipment); 820 (Community Antenna Television and Radio Distribution Systems); and 830 (Network-Powered Broadband Communications Systems.

B. Provide and install grounding electrode at point of entry of communication cables and bond to service entrance grounding electrodes per NEC 800. Install ground bus bar at point of entry of communications cable and connect electrode to ground bus. Connect communications cable metal sheath and surge protection devices to ground bar.

3.6 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.

B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.

C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Architect/Engineer as called for in Section Tests and Performance Verification.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Interface with site grounding system.

B. Interface with communications system installed under Systems Sections series specification sections.

3.8 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

SECTION 28 05 29 - HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Furnish and install all supports, hangers and inserts required to mount fixtures, raceways, conduit, cables, pull boxes and other equipment furnished under this Division.

B. Section Includes:

1. Conduit and equipment supports.
2. Anchors and fasteners.

1.2 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide corrosion resistance.

1. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use spring steel clips and clamps.

E. Obtain permission from Architect/Engineer before using powder-actuated anchors.

F. Obtain permission from Architect/Engineer before drilling or cutting structural members.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and wall mounted equipment with minimum of four anchors.

I. Provide min of (4) 3/8" concrete expansion anchors for securing all racks and cabinet to the ground.

J. All items shall be supported from the structural portion of the building, except standard ceiling mounted lighting fixtures, and small devices may be supported from ceiling system where permitted by Ceiling Contractor, however, no sagging of the ceiling will be permitted. Wire

shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.

K. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, wall, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching, later at his own expense, to the satisfaction of the Architect.

L. All conduits shall be securely fastened in place per NEC; and hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.

M. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.

N. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self-tapping power driven type are acceptable. Plastic anchors are not acceptable.

O. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.

P. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.

Q. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom of prestressed beams are not acceptable.

R. Where cable tray or ladder rack is shown it shall be supported by means of manufacturer mounting brackets, concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. Provide supports spaced as required per manufacturer recommendations.

END OF SECTION

# SECTION 28 05 33 - CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section includes:

1. Wall and ceiling outlet boxes and small junction and pull boxes.
2. Conduit raceway
3. Pathways

B. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating conduit raceway system for the following:

1. Rigid Metal Conduit (RMC) – NEC 344
2. Flexible Metal Conduit (FMC) – NEC 348
3. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
4. Electrical Metallic Tubing (EMT) – NEC 358
5. Rigid Nonmetallic Conduit (PVC) (RNC) – NEC 352
6. Fittings and Conduit Bodies
7. Electrical Nonmetallic Tubing (ENT) – NEC 362

C. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.

D. A raceway shall be provided for all electrical systems.

E. Where the Contract Documents refer to the terms "raceway," or "conduit" the materials shall be as listed above in conjunction with NEC 100, definition of "raceway". MC and HCF flexible metal cables shall not be considered a substitute for raceway or conduit.

F. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.

G. Section includes: Wall and ceiling outlet boxes and small junction and pullboxes.

H. A raceway shall be provided for all electrical systems unless specifically specified otherwise.

### 1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit - Zinc Coated
B. ANSI C80.3 - Electrical Metallic Tubing - Zinc Coated
C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
D. ANSI/NFPA 70 - National Electrical Code
E. NECA Standard Practices for Good Workmanship in Electrical Contracting
F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
H. NEMA TC 3 -Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

### 1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70. (See drawings and this and other sections of these specifications for additional requirements).

1.5 SUBMITTALS

A. Submit in accordance with Section 26 05 00 Common Work Results for Electrical and Section 27 05 07 Submittals.

B. For pull boxes and junction boxes not covered in Section 26 05 35 Pull and Junction Boxes, submit product data showing dimensions, covers, and construction.

C. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.

D. Submit catalog cut sheet on all types of conduit bodies, and fittings.

E. Product data shall be submitted for acceptance on:

1. All outlet boxes to be used on project.
2. Surface cast boxes
3. Conduits
4. Conduit straps, hangers and fittings
5. PVC solvent(s) and bending box
6. Fitting entering and leaving the ground or pavement

F. Submit UL listed fire and smoke stopping assemblies for each applicable application.

G. Product data shall prove compliance with Specifications, National Electrical Code, National Board of Fire Underwriters, manufacturer's specifications and written installation data.

1.6 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Section 26 05 00 Common Work Results for Electrical and Section 27 01 00 Operation and Maintenance Manuals.

1.7 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

B. Conform to the following:

1. ANSI/NFPA 70 National Electrical Code
2. ANSI C80.1 Electrical Rigid Steel Conduit, Hot-Dip Galvanized
3. ANSI C80.3 Steel Electrical Metallic Tubing, Hot-Dip Galvanized.
4. ANSI C80.5 Electrical Rigid Aluminum Conduit
5. ANSI C80.6 Electrical Intermediate Metal Conduit
6. ANSI/UL 651 Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
7. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
8. NECA National Electrical Installation Standards
9. ANSI C80.1/NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
10. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit
11. NEMA TC 3 Polyvinyl Chloride (PVC) Fittings for use with Rigid PVC Conduit and Tubing

12. ANSI/Federal Specification A-A-59544 Cable and Wire, Electrical (Power Fixed Installation)

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from sun, rain, corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.9 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.
B. Verify routing and termination locations of conduit prior to rough-in.
C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 GENERAL

A. All conduits provided for fire alarm system shall be continuously **RED** in color. Color must be factory provided as part of conduit coating. No paint shall be allowed.

B. All conduit exposed in exhibit halls shall be continuously **BLACK** in color. Color must be factory provided as part of conduit coating. No paint shall be allowed.

C. All conduits shall bear UL label (or other nationally recognized testing agency) and shall be manufactured in the United States.

D. Conduit systems and all related fittings, boxes, supports, and hangers must meet all the requirements of national, state, requirements and all related FAA codes and other federal codes where applicable.

E. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.

F. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.

G. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.

H. Handy boxes shall not be used.

I. Outlet boxes to be one-piece.

J. 4 inch x 4 inch boxes and 4-11/16 inch x 4-11/16 inch boxes used as junction boxes shall be one piece.

2.2 SHEET METAL OUTLET BOXES:

A. ANSI/NEMA OS 1, Galvanized Steel.

B. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices. T & B, Steel City, Raco or approved substitution.

C. Ceiling outlet boxes shall be 4 inch octagonal or 4 inch square x 1-1/2 inch deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.

D. For Communication/Systems Telephone, Data, TV, CCTV, Video, and Computer device outlet boxes shall be 4 inches square x 2-1/8 inches deep with single gang plaster ring minimum. Increase outlet box to 4-11/16 inches with single gang plaster ring as required for special devices respectfully.

2.3 CAST BOXES:

A. NEMA FB 1

B. Interior surface outlet boxes and conduit bodies installed from 0 inch AFF to 90 inch AFF (including fire alarm device backbox) shall be heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices - Appleton, Crouse Hinds or approved substitution. Trim rings shall also be of one piece construction.

C. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast iron suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.

D. Boxes to be Type FD unless otherwise noted on drawings.

E. Free standing cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

2.4 CONDUIT MINIMUM TRADE SIZE

A. Systems Conduit 3/4 inch.

B. Flexible and Seal-tite metallic conduit 1/2 inch C (maximum 6 feet long).

2.5 RIGID METAL CONDUIT (RMC)

A. Comply with:

1. ANSI C80.1
2. UL Spec - No. 6
3. NEC 344

B. Conduit material:

1. Hot dipped galvanized steel.

C. Fittings:

1. Threaded.

2. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.

3. Hot dipped galvanized malleable iron or steel.

D. Conduit Bodies:

1. Comply with ANSI/NEMA FB 1.
2. Threaded hubs.
3. Hot-dipped galvanized malleable iron.

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Comply with:

1. NEC 348
2. ANSI/UL 1

B. Conduit material: Steel, interlocked.

C. Fittings:
1. ANSI/NEMA FB 1
2. ANSI/UL 514B
3. Die Cast (Use as Option for SCPS)
4. Malleable iron, zinc plated.
5. Threaded rigid and IMC conduit to flexible conduit coupling.
6. Direct flexible conduit bearing set screw type not acceptable.

2.7 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Comply with:

1. NEC 350
2. ANSI/UL 360

B. Conduit material:

1. Flexible hot-dipped galvanized steel core, interlocked.
2. Continuous copper ground built into core up to 1-1/4" size.
3. Extruded polyvinyl gray jacket.

C. Fittings:

1. Threaded for IMC/rigid conduit connections.
2. Accepted for hazardous locations where so installed.
3. Provide sealing washer in wet/damp locations.
4. Compression type.
5. ANSI/NEMA FB 1.
6. ANSI/UL 5148.
7. Die Cast (Option for SCPS) 8. Zinc plated malleable iron or steel.

2.8 ELECTRICAL METALLIC TUBING (EMT)

A. Comply with:

1. UL 797
2. ANSI C80.3
3. NEC 358
4. ANSI/UL797

B. Conduit material: Galvanized steel tubing.

C. Fittings:
1. ANSI/NEMA FB 1
2. Set screw
3. Die Cast (Option for SCPS)
4. Zinc plated malleable iron or steel.
5. Concrete tight.
6. T&B Series 5031/5030.

2.9 RIGID NONMETALLIC CONDUIT (PVC) (RNC)

A. Comply with:

1. NEMA TC-2
2. UL 651
3. NEC 352

B. Conduit material:
1. Shall be high impact PVC - tensile strength 55 PSI, flexural strength 11000 PSI.

C. Fittings:

1. Comply with: NEMA TC-3 and UL 514.

D. General:

1. Shall be UL listed and identified.
2. Shall conform to all national, state and local codes.
3. Manufacturer shall have five years' experience in manufacturing PVC conduits.

2.10 EXPANSION FITTINGS

A. Expansion fittings shall be:
1. UL Listed, hot dipped galvanized inside and outside providing a 4" expansion chamber - when used with rigid conduit, intermediate metal conduit and electrical metallic conduit, or:
2. Be polyvinyl chloride and shall meet the requirements of and as specified elsewhere for non-metallic conduit and shall provide a 6" expansion chamber.
3. Hot dipped galvanized expansion fitting shall be provided with an external braided grounding and bonding jumper with accepted clamps, UL Listed for the application.
4. Expansion fitting, UL Listed for the application and in compliance with the National Electrical Code without the necessity of an external bonding jumper may be considered. Submit fitting with manufacturer's data and UL Listing for acceptance prior to installation.

PART 3 - EXECUTION

3.1 GENERAL (CONDUIT)

A. Install conduit in accordance with NECA "Standard of Installation." Contractor shall layout all work prior to rough-in.

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange conduit to maintain headroom and present neat appearance.

D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.

E. Route conduit in and under slab from point-to-point.

F. Do not cross conduits in slab.

G. Maintain adequate clearance between conduit and piping.

H. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

I. Cut conduit square using saw or pipecutter; de-burr cut ends.

J. Bring conduit to shoulder of fittings; fasten securely.

K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

L. Install no more than equivalent of two 90-degree bends between boxes. Conduit bodies shall not be used for changes in direction. Use factory long radius elbows for bends in metal conduit equal to or larger than 1-1/2 inch size.

M. All 90-degree bends are to be long radius. Provide terminal adapter and plastic bushing at all communications conduit terminations in terminal cabinets, at cable tray, and in Comm. rooms.

N. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

N. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC Article 300, whether shown on drawings or not.

O. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the specifications. Pullcord must be fastened to prevent accidental removal. A phenolic or brass nameplate shall be attached to each end indicating the location of both ends of conduit as follows: THIS END = "LOCATION," OTHER END = "LOCATION."

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

Q. Ground and bond conduit under provisions of Section Grouding and Bonding.

R. Identify conduit under provisions of Section Electrical Identification.

S. Install all conduits concealed from view unless specifically shown otherwise on drawings

T. Rigid steel box connections shall be made with double locknuts and bushings.

U. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

V. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.

W. All raceways shall be run from outlet to outlet as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.

X. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."

Y. Provide conduit seal-offs wherever conduit crosses obvious temperature changes (i.e. from inside to outside of coolers, freezers, etc.).

Z. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified under other Sections of these specifications.

AA. All raceways shall be run in neat and workmanlike manner and shall be properly in accordance with latest edition of NEC with accepted conduit clamps, hanger rods and structural fasteners.

BB. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.

CC. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.

DD. Provide and install raceway for all surface mount secondary clock installations to non-exposed location, penetrations of fire rating assemblies/walls/etc., where exposed to damage, exterior locations, underground locations, interconnection of CC's, CP's, and CER's, or any combination thereof, for all backbone cables, and all areas required by applicable codes and standards or as otherwise noted/required in these specifications.

EE. All raceways shall terminate at point within 12 inches of termination point terminal block with appropriate grounding bushing.

FF. Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage Master Clock Systems. Master Clock System wiring may be installed in underground pull boxes with other low-voltage systems provided:

GG. Installation meets/complies with all applicable codes and standards.

HH. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.

II. Label all raceway at both ends to indicate destination and Master Clock System source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as built (record) drawings.

JJ. Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.

KK. Properly support cables/wire not installed in raceways.

LL. Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.

3.2 GENERAL (BOXES)

A. Install per applicable sections of these specifications and all applicable codes/standards.

B. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.

C. A pull or splice box shall be placed in a conduit run where:

1. the length is over 100 feet,
2. there are more than two $90^{o}$ bends, or
3. there is a reverse bend in the run.

D. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.

E. Outlet boxes shall be installed at speakers requiring outlet box per applicable codes/standards.

F. Every pull box and/or splice box shall have a hinged cover. Install appropriate access panel to allow cover to open.

1. Size
   a) Where a pull box is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pull box.

b) Where a pull box is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:

c) for straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway;

d) for angle and U pulls:

1. have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and

2. have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:

(a) ·six times the trade size diameter of the raceway; or

(b) ·six times the trade size diameter of the larger raceway if they are of different sizes.

e) For a raceway entering the wall of a pull box opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.

f) Where a splice box is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."

g) No box shall be smaller than that required by NEC 314.28 (A) (1) and (2).

G. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

H. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

I. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

J. Above ceiling outlet and junction boxes shall be install to permit readily accessible access from ladder or staging from corresponding floor without the need to extend ladder up through ceiling system to facilitate ease of maintenance.

K. Install boxes to preserve fire resistance rating of partitions and other elements.

L. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

M. Use flush mounting outlet boxes in finished areas.

N. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches (one stud space) separation in acoustic and rated walls.

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

P. Use stamped steel bridges to fasten flush mounting outlet box between studs.

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

R. Support all outlet boxes from structure with minimum of one 3/8 inch all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two all-thread rod hangers, minimum.

S. Do not fasten boxes to ceiling support wires.

T. Support boxes independently of conduit.

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

V. Use gang box with plaster ring for single device outlets.

W. Comply with applicable portions of the National Electrical Contractors Association (NECA) Standard of Installation.

X. Install outlets in the locations shown on the drawings; however, the OAR shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.

Y. Coordinate each electrical box so that the type is suitable for the wall or ceiling construction anticipated and suitable fireproofing is built into fire rated assemblies.

Z. Relocate electrical boxes as required so that electrical devices, once installed, will be symmetrically located with respect to the room layout.

AA. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete. No surface mounted boxes will be allowed without OAR approval.

BB. For damp and wet locations provide weatherproof boxes and accessories.

CC. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.

DD. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.

EE. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.

FF. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.

GG. Avoid using round boxes where conduit must enter box through side of box which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.

HH. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or approved for the purpose. Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8 inch of finish wall surface.

II. Outlet boxes mounted in metal stud walls, are to be supported to studs with minimum of two self-tapping screws inside, at the back of outlet box, to a horizontal stud brace between vertical studs or pre-manufactured heavy duty box bracket equal to Caddy Corporation # SGB/TSGB series, to prevent movement of outlet box after wall is finished.

JJ. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

KK. Mount Height.

1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural plans and shop drawings.

a) Phone Outlets: 1'-4" AFF to bottom

b) ADA Wall Phones: (See part 3.1, Item HH.(4.) below)

c) Fire Alarm Pull Stations: 4'-0" AFF to top

d) Fire Alarm Strobe Lights: 80" AFF to bottom of globe or 6" below ceiling to top, whichever is lower

2. Bottoms of outlets and switches above counter tops or base cabinets shall be minimum 2 inches above counter top or backsplash, whichever is highest. Outlets and switches may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at the same height. Coordinate outlet locations in relation to all casework shown on Architectural plans, prior to rough-in, regardless of height shown on Electrical drawings.

3. Height of wall-mounted fixtures shall be as shown on the drawings. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

4. Coordinate locations and mounting heights of outlet boxes for all phones with architect, phone system installer and approved shop drawings prior to rough-in. Install as directed, including requirements of ADA. In general, ADA wall phones shall be at a maximum of 54 inches to highest operable part essential to basic operation of telephone with side reach and maximum of 48 inches forward reach as defined by 3.1 HH.1.

LL. Outlets in Rated Assemblies and Smoke Barriers.

1. Metallic and approved non-metallic electrical outlet boxes may be installed in vertical fire resistive assemblies or smoke barriers without affecting the classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 sq. inches.

2. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other approved materials.

3. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

3.3 CONDUIT LOCATION REQUIREMENTS

A. In Slab, Above or On Grade:

1. Use coated rigid steel conduit, coated intermediate metal conduit (if approved) or thickwall nonmetallic conduit.

2. In slab conduit is permitted only where written consent is granted by Architect and Structural Engineer, regardless of that shown or noted by drawings. Install as directed by Architect/Structural Engineer.

B. Penetration of Slab:

1. Exposed Location:

a) Where penetrating a floor in an exposed location from underground or in slab, a black coated galvanized rigid steel conduit shall be used.

2. Concealed Location:

a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 40 inches above finished floor.

b) Where penetrating a floor from underground or in slab, a coated galvanized rigid steel conduit shall be used.

C. Outdoor Location:

1. Above Grade:

a) Where penetrating the finished grade, a coated galvanized rigid steel conduit shall be used.

b) All exterior conduit runs shall be rigid conduit and threaded connectors as specified elsewhere.

c) All areas subject to exterior conditions such as overhangs, galvanized rigid steel conduit shall be used.

2. Roofs:

a) Conduit is not to be installed on roofs, without written authorization by OAR for specific conditions.

b) When approved by written authorization conduit shall comply with the following:

1. Be PVC coated rigid galvanized metal conduit.

2. All fittings, etc. are to be PVC coated.

3. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Refer to applicable roofing specifications.

4. Fasten supports to roof per roofing manufacturer's recommendations.

D. Interior Dry Locations:

1. Concealed:

a) Electrical metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.

b) All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted reamer.

2. Exposed:

a) Use rigid galvanized steel and electrical metallic tubing. EMT may only be used where not subject to damage which is interpreted by this specification to be above 96 inch AFF and exiting the top of terminal cabinets and control panels.

3. Concealed or Exposed Flexible Conduit:

a) Concealed: Flexible steel conduit or seal tight flexible steel conduit shall be in lengths not longer than 6 feet in length with a ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Direct change over from conduit to flexible conduit is not acceptable unless written permission is granted by OAR or specifically noted on drawings.

b) Exposed: Liquid tight flexible steel conduit shall be used for connections to motors, movable equipment, or vibration equipment (transformers, pumps, AHU's, loading bridges, etc.) as specified herein. Lengths shall not exceed two 4 feet in length unless written authorization by OAR for specific conduits is granted. Connections to vibration equipment, motors, etc shall be made with wire mesh grip fittings as specified herein. Flexible steel conduit is not acceptable in exposed locations. All exposed flexible metal conduit shall be liquid tight.

3.4 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.

1. Accepted pipe vise.
2. Roller/bade type cutter or band saw.
3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.

B. Hangers shall be installed 8 ft. apart.

C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.

3.5 ADDITIONAL REQUIREMENTS FOR EMT

A. Cut conduit square using approved hacksaw with 32 tooth per inch blade; de-burr cut ends. Roller/blade type pipe cutter is not acceptable.

B. One hole pipe straps, where specified herein, shall be heavy duty type.

3.6 ADDITIONAL REQUIREMENTS FOR FLEXIBLE STEEL CONDUIT AND SEAL-TITE FLEXIBLE STEEL CONDUIT

A. Shall be properly grounded.

B. Shall be installed with accepted fittings.

3.7 SUPPORTS

A. Arrange supports to prevent misalignment during wiring installation.

B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24", increase distance as required) provide space on each for 25 percent additional conduits.

D. Fasten conduit supports to building structure and surfaces under provisions of Section Supporting Devices.

E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach conduit to ceiling support wires.

G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.

H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.8 EXPANSION FITTINGS

A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

B. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three

times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than one hundred feet long and interval between expansion fittings in such runs shall not be greater than 100 feet.

3.9 GROUNDING

A. All raceways shall have a copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC codes.

B. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings.

C. Grounding conductors run with exterior/ underground feeders shall be bare only.

D. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by accepted ground bushings.

E. See other sections of these specifications for additional requirements.

F. Grounding conductors (including lightning protection down conductors) run in metal conduit shall be bonded to metal conduit at both ends.

3.10 FIRE AND SMOKE STOPPING

A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.

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

C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.

D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in accord with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in accord with ASTM E119. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

3.11 VERTICAL RACEWAYS

A. Cables in vertical raceways shall be supported as per NEC Article 300-19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless if shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with architect prior to installation. This includes empty raceways for future use.

3.12 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under all sections of these specifications.

B. Coordinate outlet box locations and sizes of required access doors with applicable sections in these specifications.

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

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

3.13 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

END OF SECTION

SECTION 28 31 00 - ADDRESSABLE FIRE ALARM-DETECTION SYSTEM (EXTENSION OF EXISTING)

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test an extension of the existing automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.

B. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least seven days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the authority having jurisdiction.

C. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer’s recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.

D. The Contractor shall provide and install the fire alarm system (including all equipment, wiring, etc.) in accordance with the manufacturer’s recommendations.

1. Installation of devices shall be in accordance with the manufacturer’s requirements as well as the requirements of the Contract Documents. Recommendations by the manufacturer for the proper installation of the fire alarm system and its equipment shall not preclude the requirement for the Contractor to comply with the requirements of the Contract Documents.

2. Termination of fire alarm circuits shall be in accordance with the manufacturer’s recommendations, applicable requirements of the National Electrical Code (NFPA 70), ADA, other applicable Codes and the Contract Documents.

3. Voice evacuation audio circuits (25V or 70V) shall be run in separate raceways from fire alarm data loops and other system circuits where the potential exists for interference or adverse effect upon the proper operation of the any fire alarm equipment, circuit or the system as a whole.

4. The fire alarm installer shall be responsible for ensuring that prior to bidding the project the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the fire alarm system manufacturer’s recommendations for proper installation of the

system and its associated equipment, or for compliance with the requirements of the Contract Documents shall not be allowed.

5. The Contractor shall be responsible for providing personnel necessary to accomplish either a fire watch and/or a security watch in unprotected areas during times when the fire alarm system is off-line.

   a) Where the fire alarm system is inactive in any area due to the work of this project, the contractor shall, as a minimum, provide personnel necessary to observe the status of each fire alarm control panel in the affected area.

   b) When security functions provided by the fire alarm system are off-line in any area or partial area, the Contractor shall, as a minimum, provide one person at each AOA door until the system is operational. During those times where the off-line time is accidental, the contractor shall station personnel within five minutes of the system going off-line.

E. This specification describes a fully addressable, common fire alarm system with remote power supplies.

1. All components shall be connected via the Signaling Line Circuit (SLC) to the local NODE.

2. The installation includes the phasing in of new equipment, and/or conduits and temporary wiring, if required, for the existing system in areas of demolition, and then removal of the existing system.

3. Any existing conduit that is in place, in good condition and meets this specification may be reused.

4. All new components must be electrically compatible with the existing FACP and must be interconnected by means of suitable wiring circuits to form a complete functional system when the project is completed.

5. Existing system must remain active at all times. Provide Fire Watch if system is taken off line at any location as required by applicable codes and the local Authority Having Jurisdiction.

F. The Owner shall be responsible for any retrofits, installation and design required by the local AHJ to comply with the requirements of the 2010 Florida Fire Prevention Code Section 11.10. This code requirement can only be determined after the construction of the building and may or may not be required by the local AHJ in the area of this project.

1.3 DESCRIPTION

A. The Contractor shall furnish and install an addressable fire alarm system extension to match the existing system. The existing system is a Simplex system. All devices shall be addressable. Control shall be microprocessor based and field-programmable. All electronics shall be solid state.

B. Provide all materials, work, labor, etc. as required to modify (including any programming, battery capacity, etc.) the existing to comply with the operation, etc. noted in these Contract Documents.

C. Contractor to provide all equipment and programming to the existing fire alarm head end for additional sensors and logic used at each WON door location to prevent damage to door due to pressure differential. (ensure door is completely closed before starting atrium exhaust fans)

D. The system extension shall include but not be limited to:

1. Manual Pull Stations

2. Smoke Detectors
3. Duct Detectors
4. Heat Detectors
5. Combination Audible/Visual devices (indoor and outdoor weatherproof as indicated on the drawings)
6. Visual Devices (indoor and outdoor weatherproof as indicated on the drawings)
7. Remote Fire Alarm Control Panels (Network Nodes)
8. NODE expansion modules
9. NAC Power supplies
10. Releasing Appliance Relays
11. Monitor Modules
12. Remote Power Supplies (Remote power supplies shall be in a UL Listed assembly and be provided by the same manufacturer as the Fire Alarm Control Panel (FACP)).
13. “Do not use elevator" warning lights
14. Surge Suppression
15. Programming
16. Fire Fighter Smoke Control Panel
17. Grounding
18. Firestopping
19. Wire and Cable Labeling
20. Electrical power required to comply with all functions and operations called for in this section of the specifications.
21. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system.

E. The Contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:

1. Elevator recall, control, and/or shutdown
2. Monitoring of sprinkler system and/or fire protection system flow and tamper switches
3. Monitoring of sprinkler system and/or fire protection system valve supervisory switches
4. Monitoring of post indicator valve (PIV) switches
5. HVAC system control and/or shutdown
6. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown
7. Control of fire, smoke, and/or combination fire/smoke dampers
8. Fire suppression and or extinguishing systems
9. Monitoring of kitchen hood fire suppression systems
10. Dimming / Relay lighting system override.
11. Audio / Paging System override.

12. Control of fire and/or smoke doors, dampers, shutters, etc.

F. The system shall operate as a non-coded, continuous ringing system which will sound all audible devices and activate all visual devices until it is manually silenced. When system is silenced by silence switch in control panel, audible alarm is to silence, but visual alarm devices are to continue to operate.

G. The system shall be wired as a Class B system for all circuits.

H. The system is to be a complete analog addressable system.

I. All portions of fire alarm system shall be installed in conduit. Conduit and boxes to be installed by electrical contractor.

J. The fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.

K. Provide and install wiring, equipment, etc. for connection to devices furnished under other divisions of the work.

L. Provide and install wiring, equipment, etc. as required to deactivate power in the elevator rooms by heat detectors via shunt trip breakers and arm sprinkler pre-action system.

M. Provide and install wiring, equipment, etc. as required to provide complete control of existing precaution sprinkler systems via protected area heat detectors and arm sprinkler pre-action system via releasing appliance relay.

N. Although they may not be indicated on the fire alarm system diagram and/or drawings, all required control and interlock wiring between the fire alarm system and building equipment shall be provided hereunder, Controls are required to/for/from:

1. Override of Lighting Control / Dimming System
2. Override of Sound System
3. Fire/smoke air and duct detectors
4. Fire, smoke and/or combination fire/smoke dampers
5. Supply/return fans, exhaust fans, and/or fan terminal boxes (FTB)
6. Automatic fire extinguishing systems
7. Sprinkler and/or fire protection system components

O. Provide wiring for post indicator valve alarms, in each instance in which these are provided under work of other trades, connected to fire alarm system.

P. Provide and install all relays (electric-electric, electric-pneumatic, and/or pneumatic-electric) as required for a complete and operational fire alarm system, complying with all applicable codes and all requirements, and coordinated with all divisions of these specifications.

Q. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.

R. Surge Suppression

1. The Contractor shall have equipment installed on the ac voltage supply and other lines taking care to arrest damaging electrical transient and spikes, which can cause damage to the microprocessor components of the system. Central office telephone lines shall have equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.
2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the

effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.

3. Provide surge suppression equipment at the following locations:

   a) On each conductor pair and cable sheath entering or leaving a building.

   b) On each conductor associated with fire protection (sprinkler) system fire alarm connections.

   c) In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge protection equipment herein specified is required to be installed in addition to internal equipment protection.

1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

A. The equipment and installation shall comply with the current or applicable provisions of the following standards:

1. ANSI S3.41 American National Standard Audible Emergency Evacuation Signal

2. National Fire Protection Association Standards:

   a) NFPA 70 National Electrical Code (including but not limited to Article 760, Fire Alarm Systems)

   b) NFPA 72 National Fire Alarm Code

   c) NFPA 101 Life Safety Code

   d) NFPA 90A Installation of Air Conditioning and Ventilating Systems

   e) NFPA 96 Ventilation Control and Fire Protection of Commercial Cooking Operations

3. Underwriters Laboratories Inc. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:

   a) UL 864 (Category UOJZ) APOU Control Units and Accessories for Fire Alarm Systems. All Control Equipment shall be listed under UL category UOJZ.

   b) UL 268 Smoke Detectors for Fire Alarm Systems

   c) UL 268A Smoke Detectors for Duct Application

   d) UL 217 Smoke Detectors Single and Multiple Station Smoke Alarms

   e) UL 521 Heat Detectors for Fire Protective Signaling Systems

   f) UL 228 Door Closers With or Without Integral Smoke Detectors

   g) UL 464 Audible Signal Appliances

   h) UL 1638 Visual Signaling Appliances

   i) UL 1481 Power Supplies for Fire-Protective Signaling Systems

   j) UL 1480 Speakers

   k) UL 1424 Cables for Power-Limited Fire-Alarm Circuits

   l) UL 1971 Signaling Devices for the Hearing Impaired

   m) UL 1449 3rd Edition - Standard for Safety Surge Protective Devices

   n) UL 497, UL 497A, UL 497B

4. All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed by the Underwriters' Laboratories product directory called Fire Protection Equipment and/or the Electrical Construction Materials List.
5. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
6. The system controls shall be UL listed for Power Limited Applications per NEC. All circuits must be marked in accordance with NEC.
7. All equipment supplied as part of the Fire Alarm System shall be provided by a single manufacturer and shall comprise a complete UL Listed Fire Alarm System.
8. IEEE: The fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in Table 1, Location Category A High Exposure of ANSI/IEEE Standard C62.41-1991.

C. The equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
1. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Accessibility Guidelines (ADAAG).
2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
3. ASME/ANSI A17.1 – Safety Code for Elevators and Escalators (2004)
4. Local and State Building Codes.
   a) Florida Administrative Code. All applicable chapters including but not limited to:
      1. Chapter 69A Rules, including but not limited to:
         (a) Ch 69A-3 Fire Prevention - General Provisions
         (b) Ch 69A-43 (Florida Handicap Code - Lodging)
         (c) Ch 69A-46 Fire Protection System Contractors and Systems
         (d) Ch 69A-47 Uniform Fire Safety Standards for Elevators
         (e) Ch 69A-48 Fire Safety Standards for the Fire Alarm Systems
      2. Florida Administrative Codes 33-8 (Jails)
   b) Florida Department of Insurance:
      1. Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.
      2. Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal.
   c) Authority Having Jurisdiction:
      1. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.

D. Surge Suppression

1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters Laboratories, shall bear the UL seal and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.
2. Comply with all standards and guides as listed under "References" above.

E. Systems not capable of complete network interface operations as described in this specification shall supply a complete local area or wide area network with CRT/terminals at each location and shall obtain UL site certification and acceptance prior to the completion date. Certification shall not delay final system acceptance.

1.5 RELATED SECTIONS

A. All applicable sections of Division 0, Division 1, and Division 26.

B. Applicable sections of these specifications with regard to, but not limited to:

1. Doors
2. Exhaust hoods
3. Elevators
4. Standpipe and fire hose systems
5. Sprinkler systems
6. Extinguishing systems
7. Ductwork accessories: smoke dampers
8. Building control systems
9. Area lighting control / Dimmer system

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 10 years' experience and with service facilities within 50 miles of Project.

B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 10 years' experience and with service facilities capable of providing a maximum response time of 2 hours.

C. Installer:

1. Company specializing in installing the products specified in this section with minimum 10 years' experience.
2. The Installer shall be currently licensed as a Florida Certified Alarm System Contractor I (EF).
3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
5. The Installing Contractor shall maintain an office within fifty 50 miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least ten 10 consecutive years going back from date of bid.

6. The Installing Contractor shall maintain an office with capability to provide emergency service 7 days a week, 24 hour days, with a maximum response time of 2 hours. The Installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least 10 consecutive years going back from date of bid.

D. Surge Suppression

1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
3. Verify proper clearances, space, etc. is available for surge suppressor.

E. Coordination/Project Conditions

1. Verify proper grounding is in place.
2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide a coupling conductor within the fire alarm underground raceway system to run alongside fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.

F. The work specified herein is an extension of the existing system and as such all equipment shall match existing. In the event that the existing equipment is no longer available other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the Engineer (See Division 1 requirements):

1. Certified letter from the manufacturer specifically stating the following:
   a) Part numbers and descriptions of each item that is no longer manufactured.
   b) Manufacturer name (if not the same as the original manufacturer), part numbers and descriptions of items that are certified by the manufacturer to be compatible with the existing system.
   c) A detailed listing of specific differences, including both advantages and disadvantages, between the original item and the proposed substitution.
2. Contractor qualifications (as listed above).
3. Complete lists, descriptions and drawings of materials to be used.
4. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
5. A complete riser diagram of Fire Alarm System.

1.7 SUBMITTALS

A. Submit in accordance with Section 26 05 00 Common Work Results for Electrical and Section 27 05 07 Submittals.

1.8 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Section 26 05 00 Common Work Results for Electrical and Section 27 01 00 Operation and Maintenance Manuals.

1.9 O & M MANUALS

A. Submit in accordance with Section 26 05 00 Common Work Results for Electrical and Section 27 01 00 Operation and Maintenance Manuals.

1.10 WARRANTY

A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.

1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.

2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

B. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

C. Surge Suppression

1. All surge suppression devices shall be warranted free from defects in materials and workmanship for a period of five (5) years.

2. Any suppressor, which shows evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced by the manufacturer and installer at no cost to the owner.

3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.11 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

A. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes, and in particular the ADA requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant system. Said additional devices shall be shown on shop drawings submitted by Contractor.

B. In addition to the above-mentioned devices, Contractor shall include in his bid price the cost of installing twenty additional audible/visual notification devices (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior to substantial completion date. At least two weeks prior to substantial completion system shall be fully operational. After system is operational, Owner's safety representative and the system installer shall review the placement of and coverage provided by visual and audible signals throughout the facility for compliance with all codes, and in particular the ADA requirements and NFPA 72. System installer shall provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion.

C. After the project has had its first annual safety inspection, the system installer shall install within one week's notice any additional audible/visual signals that have been determined to be required during said inspection from the balance of the twenty additional devices noted above. There shall be no cost for these added devices provided the total does not exceed the balance remaining of the twenty devices noted above. The final balance of the twenty additional devices included in bid price shall be turned over to the Owner as spare material after any fire alarm issues identified during the first annual safety inspection are resolved.

1.12 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm system for one (1) year from date of Substantial Completion.

1. No charge shall be made by the installer and/or contractor for any labor, equipment, or transportation during this period to maintain functions.
2. Respond to trouble call within twenty-four (24) hours after receipt of such call.

1.13 SYSTEM OPERATION

A. Network communication:

1. Network node communication shall be through a token ring configuration.
2. A single open, ground or short on the network communication loop shall not degrade network communications. Token shall be passed in opposite direction to maintain communications throughout all network nodes. At the same time the status of the communication link shall be reported.
3. If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.
4. Fiber optics communication shall be provided as an option via a fiber optics modem. Modem shall multiplex audio signals and digital communication via full duplex transmission over a single fiber optic cable, either single mode or multi-mode.
5. The communication method shall be NFPA 72 style 7.

B. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
3. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.
4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location and type of device.
5. Selective Alarm: A system alarm shall include:
    a) Indication of alarm condition at the FACP and the annunciator(s).
    b) Identification of the device /zone that is the source of the alarm at the FACP and the annunciator(s).
    c) Operation of audible and visible notification devices on the fire floor, floor above and floor below until silenced at FACP.
    d) Selectively closing doors normally held open by magnetic door holders on the fire floor, floor above and floor below.
    e) Unlocking designated doors.
    f) Shutting down supply and return fans serving zone where alarm is initiated.

g) Closing smoke dampers on system serving zone where alarm is initiated.

h) Initiation of smoke control sequence through the building temperature control system.

i) Notifying the local fire department.

j) Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated.

6. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:

a) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.

b) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.

c) Record the event in the FACP historical log.

d) Transmission of supervisory signal to remote central station.

e) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.

8. System Reset

a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."

b) Should an alarm condition continue, the system will remain in an alarmed state

9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.

10. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:

a) The city circuit connection and any suppression release circuits shall be bypassed for the testing group.

b) Control relay functions associated to one of the 8 testing groups shall be bypassed.

c) The control unit shall indicate a trouble condition.

d) The alarm activation of any initiation device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.

e) The unit shall automatically reset itself after signaling is complete.

f) Any opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

C. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Central Monitoring Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
6. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

D. Smoke Detectors: A maintenance and testing service providing the following shall be included with the base bid:

1. Biannual sensitivity reading and logging for each smoke sensor.
2. Scheduled biannual threshold adjustments to maintain proper sensitivity for each smoke sensor.
3. Threshold adjustment to any smoke sensor that has alarmed the system without the presence of particles of combustion.
4. Scheduled biannual cleaning or replacement of each smoke detector or sensor within the system.

5. Semi-annual functional testing of each smoke detector or sensor using the manufacturers calibrated test tool.
6. Written documentation of all testing, cleaning, replacing, threshold adjustment, and sensitivity reading for each smoke detector or sensor device within the system.
7. The initial service included in the bid price shall provide the above listed procedures for a period of five years after owner acceptance of the system.

E. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.

1. Automatic Voice Evacuation Sequence:

a) The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.

b) All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

F. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.

G. Manual Voice Paging

1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
2. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
3. Facility for total building paging shall be accomplished by the means of an "All Call" switch.

H. Fire Suppression Monitoring:

1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.

I. Power Requirements

1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.

3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.
5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

J. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.

K. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.

L. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.

M. Where required by codes or Authority Having Jurisdiction:

1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.

N. The fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.

O. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

1.14 ZONING

A. Alarm Zones.

1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
   a) One per building, per floor for pull stations.
   b) One per building, per floor for automatic devices.
   c) One for each duct smoke detector.
   d) Zones as required by NFPA and FBC.

B. Notification Zones.

1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
   a) One (or more) circuit(s) for Catwalk Level
   b) One (or more) circuit(s) for A Hall Ceiling Devices

c) One (or more) circuit(s) for A Hall Wall Devices

d) One (or more) circuit(s) for remainder of (Scope Area).

2. Breakdown circuits as required for load and distances involved.

PART 2- PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

**A. All specified and indicated equipment on the construction documents is approved by the following manufactures.**

**1. Edwards Systems Technologies (EST)**
**2. Siemens Building Technologies, Inc. Fire Safety Division.**
**3. Simplex-Grinnell LP, A Tyco International Company.**

**B. Any interfaces between smoke control system and existing installed fire alarm system components shall be seamless and without excessive markup for required interface components.**

**C.** ~~A.~~ All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.

**D.** ~~B.~~ Provide all equipment to match existing equipment required to perform all functions and/or features included in this section of the specifications although not specifically noted or specified herein.

**E.** ~~C.~~ Modify/rework existing system and reprogram existing system as required for extension to new devices and/or as required for proper operation of system with new devices, adding new zone modules, adding surge suppression, adding power supply and battery capacity to meet regulatory requirements with new devices, etc.

2.2 RACEWAYS

A. General:

1. All raceways (conduit, wire ways, pull boxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 26 of these specifications.

2. All raceways (conduit, wire ways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.

B. Conduit: Comply with Section 27 except as noted below:

1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
2. Size: Minimum size shall be 3/4" conduit.

C. Boxes:

1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

2.3 FIRE ALARM CONTROL PANEL (NODE)

A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."

B. Provide (2) single pole 20A 120V circuit breaker in local emergency panel to each NODE location. (1) to be for NODE / TRSP panels and (1) for NAC's

C. C. The following FACP hardware shall be provided:

1. Power Limited base panel with red cabinet and door, 120 VAC input power.
2. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node
4. 2000 points of annunciation where one (1) point of annunciation equals:
   a) 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
   b) 1 LED on panel or 1 switch on panel.
5. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
6. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output.
7. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
8. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
9. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
10. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.
11. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
12. The FACP shall support (6) RS-232-C ports and one service port.
13. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
14. Modular Network Communications Card.
15. Programmable DACT for either Common Event Reporting or per Point Reporting.
16. Service Port Modem for dial in passcode access to all fire control panel information.

D. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:

1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface.
2. Dual alarm channels permit simultaneous transmission of different announcements to different zones or floors automatically or by use of the central control microphone. All

announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.

3. Eight channel digitally multiplexed audio for systems that require more than two channels of simultaneous audio. Up to 8 channels of audio shall be multiplexed on either a style 4 or style 7 twisted pair.
4. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.
5. Status annunciator indicating the status of the various voice alarm speaker zones and the status of fire fighter telephone two-way communication zones.
6. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
7. Amplifiers, voice and telephone control circuits
8. Addressable Signaling Line Circuits
9. Initiating Device Circuits
10. Notification Appliance Circuits
11. Auxiliary Control Circuits
12. Graphic Annunciator LED/Switch Control Modules

E. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

F. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

2.4 TERMINATION CABINETS

A. Terminal cabinets are to comply with applicable sections of these specifications.

2.5 "SYSTEMS" AND "LOCAL" GROUND BUS

A. Bus to comply with applicable sections of these specifications.

2.6 EMERGENCY POWER SUPPLY

A. General: Components include battery, charger, and an automatic transfer switch.

B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.7 ADDRESSABLE MANUAL PULL STATIONS

A. Description: Addressable single- or double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

B. Protective Shield: Where required provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a

battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.8 SMOKE SENSORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

1. Factory Nameplate: Serial number and type identification.
2. Operating Voltage: 24 VDC, nominal.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
5. Quick Connect Arrangement: Photoelectric sensor and electronics in a single piece construction which shall twist-lock onto a mounting base that attaches to a standard electrical box.
6. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
7. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
8. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
9. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
10. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
11. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Where acceptable per manufacturer specifications, ionization type sensors may be used.

C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.

1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary

relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.

3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
9. Where indicated provide NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.9 HEAT SENSORS

A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.

B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor based, rate-compensated, self-restoring and shall not be affected by thermal lag.

C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.

D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.10 ADDRESSABLE CIRCUIT INTERFACE MODULES

A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of water flow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.

B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.

C. Provide all required addressable modules required, whether shown on drawings or not, for control and monitoring equipment per NFPA.

D. There shall be the following types of modules:

1. Type 1: Monitor Circuit Interface Module:

a) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.

b) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for

the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.

2. Type 2: Line Powered Monitor Circuit Interface Module

   a) This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.

   b) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.

3. Type 3: Single Address Multi-Point Interface Modules

   a) This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.

   b) This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.

   c) This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.

4. Type 4: Line Powered Control Circuit Interface Module

   a) This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.

5. Type 5: 4-20 mA Analog Monitor Circuit Interface Module

   a) This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.

   b) All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.11 MAGNETIC DOOR HOLDERS

A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.
B. Material and Finish: Match door hardware.

2.12 STANDARD ALARM NOTIFICATION APPLIANCES

A. Horn: Piezoelectric type horn shall be listed to UL 464. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.

B. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

C. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.

D. Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480.

1. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC using and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.

2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.

3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.

4. The S/V installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension

E. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted / shielded wire.

2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.

3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.

4. The S/V installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension

F. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.

G. Accessories: The contractor shall furnish the necessary accessories.

2.13 NAC Power Extender

A. The IDNet NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.

B. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.

C. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The IDNET Addressable NAC Extender Panel when connected to an addressable panel shall connect to the host panel via an IDNet communications channel. Via the IDNET channel each output NAC can be individually controlled for general alarm or selective area notification.

D. For IDNet connected NAC extender panels up to five panels can be connected on a single IDNet channel.

E. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control panel may be used to activate all the circuits on the NAC power extender panel.

F. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

2.14 WEATHERPROOF COVER (FOR AUDIBLE AND/OR VISUAL DEVICES)

A. Constructed of clear polycarbonate.

B. For flush or surface mount devices.

C. Provide slotted version for audible/visual devices.

1. Maximum of 5 dB loss.
2. Provide with brass weep hole.

D. Provide unslotted version for visual only devices.

1. Maximum of 3 candela light intensity loss up to 110 candela light source.
2. Provide without weep hole.

E. Provide with weather gasket.

F. Spacers for additional depth as required.

G. Provide with tamper proof screws.

H. Design criteria:

1. Safety Technology International, Inc. #1220 (audible/visual) or #1221 (visual) series.

2.15 SURGE SUPPRESSION

A. Non-Addressable Initiation Devices:

1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 µs waveform, 500A per line with 10 x 700 µs waveform.

6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 µs waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 1500 pf.
9. Manufacturer:
   a) EDCO #PC642C series with #PCBIB base.

B. Addressable Initiation Devices and Data Loops:
1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 µs waveform, 500A per line with 10 x 700 µs waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 µs waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 50 pf.
9. Manufacturer:
   a) EDCO #PC642C-LC series with #PCBIB base.

C. Horn, Strobe, Control Power (Low Voltage):
1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 5KA with 8 x 20 µs waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 µs waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Series Resistance: 0.2 ohms total per pair.
9. Manufacturer:
   a) EDCO #P164 series (1 pair); #P264 series (2 pair), each with #SD12-PC base.

D. Power Circuit (120 volt):
1. UL 1449 listed.
2. Provide power connection to all panels requiring 120V power. Connect to local existing emergency branch 120V panel. Provide new CB matching existing type and AIC rating in existing space.
3. 15 amp, 120V rated.
4. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
5. Normal mode (L-N), and common mode (L+N-G) protection.

6. Internal fusing.
7. Hybrid design.
8. Indicators for normal operation and failure indication.
9. Enclosure:
    a) Fire retardant high impact, phenolic or plastic housing or metal enclosure.
10. Clamping voltage UL 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20 µs): 385V @ 120V.
11. Maximum Surge Capacity: 20,000 amps.
12. Maximum Continuous Operating Voltage: 115% of line voltage.
13. Provide hardwire connection or add 15 amp receptacle device to hardwired devices to match equipment being protected and maintain UL listing.
14. Provide additional 15 amp in-line fusing as required to comply with UL and the N.E.C. when connected to a 20 amp, 120V circuit.
15. Manufacturers:
    a) Leviton #51020-WM (hardwired).
    b) EDCO #HSP-121BL2.

E. Telephone Line Circuits
1. Must be UL 497 listed and labeled for primary protection.
2. Multi-stage hybrid protection circuit.
3. Plug-in replaceable modular design or individually mounted units.
4. Fail short/fail safe.
5. Surge capacity: 500 amp with 10 x 700µs waveform.
6. Clamp voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700µs waveform.
7. Maximum continuous operating voltage: 125% of peak operating voltage, minimum.
8. Manufacturers:
    a) EDCO #COHP(FS).

F. Terminations
1. Provide terminals sized for circuits required on project.
2. Where surge suppression modules are for mounting on 'M' block assembly, provide M block assembly complete with grounding system that mates with surge suppression equipment.

G. Terminal Cabinets
1. Provide terminal cabinets for all terminations and surge suppression equipment including

   120V ac power surge suppressor as required in Section 16691. Size terminal cabinets as required to facilitate installation of terminations and surge suppression in a neat and workmanlike manner.
2. Manufacturers:
    1. Space Age Terminal Cabinet

(a) Provide with white lettering on face

(b) Provide with all required accessories (ie. Terminal strips, back panel, and locks)

2.16 CABLE

A. Contractor shall provide and install cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed fire alarm system.

B. Fire alarm system cables installed in exterior and/or underground raceways shall comply with the applicable sections of NEC Article 800.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer’s recommendations. Provide and install fire stopping where penetrations are made through rated walls and floors.

B. Make final connections between new or modified components and the existing fire detection and alarm system.

C. Provide any programming required at the fire alarm control panels, remote panels or fireworks computers. This includes programming in support of outages, planned or unplanned, of the system.

D. Test and certify the completed system in accordance with all regulatory requirements.

E. Update the system as-built drawings, CAD files and bitmaps.

F. Locate, install, and test fire alarm and detection systems in accordance with the equipment manufacturer's written instructions, and the latest editions of the NFPA, the National Electrical Contractors Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.

G. Modify/rework existing system as required for extension to new devices and/or as required for proper operation of entire system, adding new zone modules, surge suppression, power supply and battery capacity or new devices to meet regulatory requirements.

H. Rework/modify/reprogram existing fire alarm control panel and remote control panels to accept and reflect all changes made by alterations as specified.

I. Modify/update the existing fire alarm as-built (mylars and blueline) drawings and CAD files to reflect modifications, additions, etc., made by this project. Provide blueline sets of changes for approved and company with all additional requirements as outlined in specifications.

J. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.

K. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.

L. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.

M. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in fire alarm installation and service.

N. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.

O. Installation plans and wiring diagrams shall bear the signature and license number of the licensed Fire Alarm Planning Superintendent, the date of installation and the name, address, and certificate of registration number of the registered firm.

P. After completion of the installation of the system, the licensee shall complete a NFPA installation certificate. The installation certificate format shall be furnished by the State Fire Marshal. When an installation certificate form has been completed, legible copies shall be distributed as directed by the State Fire Marshal.

Q. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the installation certificate. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a “tie on” tag. It shall be as required in the Fire Safety Rules as promulgated by the Florida State Fire Marshal.

R. Power supplies are to be loaded to a maximum of 75% of their capacity. Provide additional power supplies where required to comply with this maximum loading requirement.

S. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate of-registration number of the registered firm.

T. All components shall be completely wired. System shall be fully operable when main power service has failed and the Emergency Standby Generator has assumed emergency system loads. This shall require that any devices, which required 120 volt power shall receive, supply from an emergency 120 volt source.

U. Installation of detectors:

1. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.

2. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.

3. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

3.2 RACEWAYS AND BOXES

A. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.

B. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.

3.3 WIRE/CABLE

A. Conductor: 98% conductivity, solid copper or stranded copper. If stranded conductors are used, then a compression lug shall be installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductors without crimpon lugs may be terminated into terminal strips of box-lug connectors.

B. Insulation: A type accepted by NEC for the application. Individual conductors shall be Type THHN/THWN. All cable shall be UL listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types.

C. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:

1. Multiplex Signaling Line Circuit: AWG #14, shielded twisted pair cable.
2. Initiating Circuits, Hard-Wired Devices: AWG #14, THHN/THWN conductors.
3. Notification Circuits: AWG #14, THHN/THWN conductors.
4. Initiating Circuits, Addressable Devices: AWG #14, shielded twisted pair cable.
5. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.

D. The above wire sizes shall be increased to size as required to comply with authority having jurisdiction or as required for voltage drop, load, etc. E. Color Coded:

1. Wiring shall be color coded as required to match existing system.
2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.

E. UL:

1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
2. Non-Power Limited: Fire protective signaling circuits classified as non-power limited shall use cable listed under UL Electrical Construction Materials Directory. Category HNHT, "NON-POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". all such cable shall have fire resistance, listing and markings as described in NEC 760.176. Minimum cable marking shall be NPLF.
3. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, "POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
4. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760.179. All such cable shall bear a cable marking that includes a Type designation as given in NEC Table 760.179(I). Provide Type FPL.

F. Connections of Installation Wiring:

1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.

2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.
4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

G. Rated Enclosures:

1. All vertical fire alarm wiring traversing more than one level shall be routed in rated enclosures. In addition, all horizontal wiring serving devices location on floors other than where wiring originates shall be routed in 2-inch concrete encasement, suitable rated building construction, or 2-hour wrap application enclosure accepted by local authority having jurisdiction.

3.4 MANUAL PULL STATIONS

A. Install at 48 inches to top above finished floor.
B. All manual stations shall be in unobstructed locations.
C. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.
D. Provide, install, and connect additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.5 AUDIBLE SIGNAL DEVICES, VISUAL SIGNAL DEVICES OR COMBINATION AUDIBLE/VISUAL SIGNAL DEVICES

A. Shall comply with NFPA, the Americans with Disabilities Act and other applicable handicap/accessibility codes including but not limited to the following:

1. Wall mounted devices shall have their bottom edge at heights above the finished floor of not less than 80 inches and no greater than 96 inches.
2. In general, no place in any room or space required to have a visual signal appliance shall be more then 50 ft. (15 m) from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft. (30 m) across, without obstructions 6 ft. (2 m) above the finished floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft. (30 m) apart, in lieu of suspending appliances from the ceiling. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.
3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 ft. (15 m) from the signal. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3.6 END-OF-LINE DEVICE

A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.7 AUXILIARY CONTROL RELAYS

A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.

B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.

C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.8 SPRINKLER FLOW SWITCHES

A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm panel.

B. Run conduit and wiring to the flow switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.

C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.9 SPRINKLER VALVE SUPERVISORY SWITCHES

A. Coordinate the electrical and operating characteristics of the supervisory switches with the fire alarm panel.

B. Run conduit and wiring to the supervisory switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.

C. Provide all electrical including zones as required by authority having jurisdiction and codes.

3.10 INSTALLATION OF DETECTORS

A. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.

B. All concealed detectors shall be provided with a remote indicating lamp installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.

C. Label each device with point number.

3.11 INSTALLATION OF DUCT DETECTORS

A. Comply with all applicable codes and standards including but not limited to:

1. NEMA Guide for Proper Use of Smoke Detectors in Duct Applications
2. Full requirements of detector UL listing.
3. NFPA 90.
4. Refer to Part 1 – General for additional standards.

B. Location: To permit proper sampling of the air within a duct, locate supply air duct detectors downstream from fans, filters, humidifiers, and heating/cooling elements (if codes permit). Locate supply or return air duct detectors at least six duct widths (diameters) from any opening, detector, bend, or branch connection. When physical parameters or codes make it impossible to meet the six width requirement, locate the detector as far as possible from the obstacle.

C. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing.

D. All concealed detectors shall be provided with a remote indicating lamp installation in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.

3.12 MAIN FIRE ALARM CONTROL PANEL AND ASSOCIATED EQUIPMENT

A. Install all programming and software changes to existing fie alarm control panel to provide a complete and operational extension of the existing system as specified.

B. All functions/operations/performance specified are to match the same functions/operations/ performance of the existing fire alarm system.

C. All color graphic AutoCAD bit maps shall be updated and tested.

3.13 DOOR ELECTRIC LOCK AND HOLD-OPEN POWER SYSTEMS

A. General: Provide 24V-dc low voltage power to all building doors with openers, hold-open devices, closers or electric locks. Refer to Architectural door hardware schedule for doors that may have electric holders or locks. Low voltage power supplies for door hardware shall be furnished separately from the fire alarm system. The fire alarm system shall only provide the unlocking or release control signals and auxiliary control relays at power supplies, in order to reduce power draw on fire alarm system power supplies and batteries.

B. Low Voltage Power: Provide a low voltage transformer on each floor having doors with electric hardware. Transformer shall be 120-24V ac, sized as required to handle load served. Mount in a NEMA 1 enclosure above accessible corridor ceiling outside the first door closest to fire alarm riser. Provide transformer primary fusing to comply with NEC. Provide a 24V ac-24V dc rectifier on the secondary side of the transformer. Provide dedicated branch circuit from closest 120V normal power panel. Provide necessary interposing auxiliary control relay(s) to accept unlocking/release and restore signals from the fire alarm system.

C. Wiring: Electric hardware shall be connected for fail-safe operation. Upon loss of normal power hardware shall unlock without unlatching. Hold-open doors shall release for closure. Restoration of hardware power shall be automatic after the fire alarm system unlock control is reset. Provide all wiring necessary to connect transformer. Provide all low voltage wiring to connect electric locks. Extend wiring down hinge side of stair door jam through hinge plate into door and through door to electric lock mechanism.

D. Fire Alarm Unlocking Control: All door hardware circuits shall be controlled by fire alarm system. Upon receipt of signal from fire alarm system all door holders shall release and stair/egress door electric locks power system shall be disabled allowing all locks to unlock (without unlatching). Signal to activate shall be automatic fire alarm signal or manual command initiated in the building Fire Control Room. Manual unlock override command shall be through override system. Reference paragraph entitled "FIRE DEPARTMENT OVERRIDE CONTROL PANEL". Provide pilot light and 3-position override switch. ON position (illuminated red pilot light) shall initiate failsafe operation. OFF position shall restore low voltage power. Provide separate override switch for door openers associated with Atrium Smoke Exhaust System.

E. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.

3.14 ELEVATORS

A. Operation of elevators under fire or other emergency conditions - elevators having a travel distance of 25 feet or more shall conform to the requirements of ANSI A17.1, Safety Code for Elevators and Escalators, 2004 Edition, Rule 2.27.3, as incorporated herein by reference.

B. When an automatic sprinkler system is required to be installed throughout a building for complete fire protection coverage, the provisions of ANSI A17.1, Rule 2.8.2, which is incorporated herein by reference, shall be applicable. When an automatic sprinkler system is required to be installed, the automatic sprinkler system shall be a pre-action sprinkler system and the pre-action sprinkler shall be installed in the elevator machine room and elevator hoistway. An accepted fixed temperature (135 degrees F.) heat detector shall be installed in the elevator machine room, elevator pit, and elevator hoistway as an integral part of the pre-action sprinkler system to automatically disconnect the main power supply to the affected elevator(s) prior to the application

of water. The main power supply shall not be self-resetting. The activation of sprinklers outside of the hoistway or machine room shall not disconnect the main power supply. The sprinkler

head located in the elevator machine room and elevator hoistway shall have an activation temperature greater than the accepted fixed temperature heat detector.

C. Provide detectors with auxiliary relay complete with tie into elevator controller as required by all codes, or provide separate zone.

3.15 CABLE IDENTIFICATION

A. Provide and install permanent cable markers on all cables/wire lines, telephone lines, etc. at terminal strips, terminal cabinets and at main equipment.

3.16 SURGE PROTECTION

A. General

1. Provide, install and connect new surge suppression equipment as specified herein, including protection of equipment power source, cable/wire entering or leaving building housing, main fire alarm system equipment, ground lugs, #6 copper ground wire in 3/4"c. to existing main building service ground.
2. Extreme care shall be taken by contractor to assure a properly surge protected system.
3. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
4. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.

B. Equipment Selection

1. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

C. Equipment Installation

1. Install surge suppression equipment per manufacturer’s recommendation at each wire terminal as noted under Part 1.
2. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
3. Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet (FACP).
4. Coordinate with Section 16691 contractor to assure that surge suppression for 120V ac power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.

D. Ground Installation

1. Ground Bus Connections.
   a) Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
   b) Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
   c) Connect terminal cabinet "local" ground bus to "systems" ground bus installed per 16170 with minimum #6 copper insulated wire (unless otherwise noted) in conduit.

d) Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.

2. Surge suppression equipment grounding.

a) Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge Suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.

b) Coordinate with Section 16691 contractor to assure that 120V ac power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section for same system (i.e. fire alarm, intercom, television, etc.).

3. Conductors.

a) Conductors shall meet requirements of Section 16123. Minimum size to be #12 THWN.

b) Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.

c) Do not bundle unprotected conductors with protected conductors.

d) Conductors shall be kept as short as possible.

e) Conductors shall be secured at 12" intervals with an accepted copper clamp.

f) Grounding conductors shall be properly connected to the building service ground by accepted clamps.

4. Grounding Connectors

a) Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.

b) All connectors and fittings shall be of the Nicopress crimp or compression set screw type.

c) Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

5. Telephone Circuits

a) Systems utilizing telephone company pairs as a transmission medium shall be provided with a suppressor conforming to device in Part 2 of this specification.

b) Suppressors shall be installed at each point where interface is made to telephone company pairs.

c) In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:

1. Where the modem or coupling device is furnished by the telephone company the suppressors shall be installed on the system side of the modem or coupling device.

2. Where the modem or coupling device is furnished by the system contractor, the suppressor shall be installed on the telephone line side of the modem or coupling device.

3.17 EXISTING CONDITIONS

A. Existing fire alarm control panel and all associated electrical in area of renovation is to be removed, complete.

B. All existing fire alarm wiring and conduit in area of renovation is to be removed complete.

C. Contractor shall investigate existing conditions prior to bid.

1. Existing exposed structure may require additional smoke detectors per NFPA. Visit and carefully examine site prior to bid and include additional detectors in base bid.

3.18 CONDUIT/BOX IDENTIFICATION

A. Contractor shall identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" OC.

3.19 DEMONSTRATION

A. When system is complete it shall be demonstrated to owner's representative who shall be given complete instructions, spare parts, manuals and maintenance information.

3.20 SYSTEM TESTING

A. Prior to certification of the fire alarm system the contractor shall accomplish a complete test of the fire alarm system in accordance with NFPA 72, Chapter 10, paragraph 10.4 Testing.

B. Perform a complete, functional, component by component test of the entire fire alarm and detection system. This is a one-time test. Provide a detailed step by step testing procedure, which is unique to this project, reflecting the type of system and the number and location of all components.

C. Demonstrate the proper operation of each component as follows with a one-time test:

1. Ionization, photoelectric, and duct smoke detectors: activate the detector with a "false smoke" product which has been specifically formulated for testing smoke detection systems.

2. Heat detectors: activate the detector by utilizing the detector check button.

3. Pull Stations: activate the station by operating the station in its normal mode.

4. Audible and Visual Alarms: verify proper operation when the system is put into the alarm mode.

5. Sprinkler Flow Switches: open the sprinkler system's inspection test valve. Verify that the flow switch sends an alarm signal within the allowed time corresponding to the switch's time delay setting.

6. Fire Alarm Panels: functionally check-out and test the panel per the manufacturer's written instructions. Demonstrate the proper operation of each modular component. Demonstrate automatic power change to batteries and back to building power upon a drop in voltage below the voltage threshold as specified by the panel manufacturer.

D. Demonstrate the supervisory function at each device loop circuit, and at all single component wiring runs such as for the sprinkler valve supervisory switches.

3.21 CERTIFICATION

A. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing form. The Inspection and Testing form format shall be as indicated in NFPA 72, Chapter 10, Figure 10.6.2.3 Inspection and Testing form. When an Inspection and Testing form

has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.

B. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.22 FINAL DRAWINGS

A. As-built drawings shall be given to the Owner’s representative, at time of instruction, in addition to those to be supplied as general requirements of the job.

3.23 AUTHORITY HAVING JURISDICTION

A. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at time of design. However, it is this contractor's responsibility to coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the Engineer's attention at least seven days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the Authority Having Jurisdiction.

3.24 COMMISSIONING

A. The smoke control system shall be commissioned to ensure installation quality, proper function, and overall performance.

B. Commissioning shall be performed after system and component testing has been completed by the installing contractor(s).

C. The Engineer of Record, installing contractors, and facility staff shall participate in commissioning activities including meetings, scheduling, developing test protocols, and performing functional testing.

D. Functional testing shall demonstrate that revised smoke control components operate as a system and as intended per the new sequence of operations.

E. Functional testing shall also demonstrate that any components removed from smoke control service have been modified to meet their new requirements.

F. Functional testing shall be completed in phases to accommodate construction schedules, coordinate with facility staff, and simplify the commissioning process.

END OF SECTION