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IFB NO. Y17-708-RM **ISSUED: September 19, 2016**

INVITATION FOR BIDS

FOR

ORANGE COUNTY CONVENTION CENTER DYNAMIC MESSAGE SIGNAGE UPGRADE

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PART H
TECHNICAL SPECIFICATIONS

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PART H
VOLUME II

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE
BID DOCUMENTS

INDEX OF DRAWINGS

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E001	SYMBOL LEDGED AND GENERAL NOTES ELECTRICAL	NONE
E002	SIGN SCHEDULES	NONE
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E011	OVERALL SITE PLAN - SYSTEMS	1" = 300'
E012	AREA SITE PLAN - WEST BUILDING	1" = 100'
E013	AREA SITE PLAN - NORTH/SOUTH BUILDING	1" = 100'
E014	AREA SITE PLAN - SOUTH	1" = 100'
E015	AREA SITE PLAN - N/NW OF NORTH/SOUTH BUILDING	1" = 100'
E016	AREA SITE PLAN - WESTWOOD BLVD	1" = 100'
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E801	RISER DIAGRAMS (SINGLE MODE) SYSTEMS	NONE
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SECTION 01 11 00 - SUMMARY OF WORK

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. Identify all Dynamic Message Signage fiber optic cable routing, exterior and interior, for single mode and multi mode fiber optic signs and record via as-built documentation.

2. Test all fiber optic cables which are utilized as part of the Dynamic Message Signage network per ASTM, ANSI, TIA/EIA-455-B, and BICSI Standards.

3. Re-terminate all existing fiber optic terminations which support Dynamic Message Signage per these contract specifications.

4. Repair all conduits and NEMA Boxes that have been damaged by vehicular traffic as shown on contract documents.

5. Provide all repairs and necessary new equipment to facilitate a complete operational Dynamic Message Signage System whether shown on drawing or not. Refer to Reno Sign Schedule on drawings. Work shall included but not be limited to:

   a) New NEMA cabinet and all required infrastructure to house all required electronics at sign location

   b) Re-terminate existing fiber cable at local sign NEMA cabinets.

   c) Install / replace serial converter in local sign NEMA cabinet with CAT-6 cable and connectors required to interface with sign controller.

   d) Install / Replace LAN switch and provide CAT-6 cable and connectors required to interface with sign controllers.

   e) Extend CAT-6 LAN service port from sign to local NEMA cabinet for local user programming and troubleshooting the sign controller.

   f) Install Surge Outlet in signs local NEMA cabinets.

   g) Repair / rework / reconnect grounding system at sign, all equipment to be bonded together at each sign.

   h) Provide power line surge device on circuit feeding each sign ahead of all electronics.

   i) Install new owner provided padlock on local sign NEMA cabinet.

   j) Install stenciled sign numbers, name plates, and other identification as required in the drawings and specs at each sign and associated equipment.

   k) Test fiber optic pathway including all fiber cable segments and to total “fiber channel” between all equipment.

6. Provide drawings to indicate final configuration of Dynamic Message Signage Upgrade. Contractor documents shall include: a detailed site plan with fiber optic routing mapped out

details, risers, wiring details (where applicable), ID#, IP Addresses, Part numbers, locations for equipment associated with the exterior signage, etc.

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:

- Preliminary 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. Costs for work areas that are not cleaned by the contractor will be cleaned by the Owner 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.

L. Contractor shall have the minimum to be considered for award of contract:

1. A minimum of (5) five similar (D.O.T. involved/coordinated &/or submittal of an M.O.T. plan) projects within the last (5) five years, with (3) three being able to be verified with a POC and contact information.

2. Installation of one hundred or more fiber optic terminations in a single project.

3. Prior experience tracing and testing existing cabling in an exterior (outside plant, OSP) premise distribution system including copper and fiber, and providing detailed reports.

4. Prior experience with exterior fiber optic splicing within an enclosed or controlled exterior (outside plant, i.e. vans and trucks) to protect work from the environment.

5. Project manager or project lead must have a valid and current RCDD license.

1.5 WORK UNDER OTHER CONTRACTS

A. Separate contracts may be issued to perform certain construction operations at the site. The contractor of this project will 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. 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/OrangeCountySafetyandHealthManual.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 to 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. A Level 1 (5 years) Background Check for the contractor's staff must be approved by Orange County's Security team prior to work in any County facility. Contractors are responsible for obtaining the necessary forms for background checks for work at the Convention Center.

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

D. The 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 Convention Center staff to obtain a 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 facilities without completed and approved background investigations.

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 is to 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 shall agree that if materials containing asbestos are subsequently discovered at any future time to have been included in the construction done by the Contractor or any of its Subcontractors or agents and were not specified in the design or required by the Contract document, Contractor

shall be liable for all costs related to the abatement of such asbestos and damages or claims against the County.

PART 3- EXECUTION (Not applicable).

END OF SECTION

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 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 29 00 Payment Procedures for administrative procedures governing applications for payment.
2. Division 01 Section 01 33 00 Submittal Procedures for requirements for the Contractor’s Construction Schedule.

1.03 MINOR CHANGES IN THE WORK

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

1.04 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract 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 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. Contractor and subcontractors will 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.

1.05 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.

1.06 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

1.01 RELATED DOCUMENTS

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

1.02 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.

1.03 SCHEDULE OF VALUES

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

1. The Contractor shall submit a schedule of values of the work including quantities and unit prices totaling the Contract Amount no later than twenty (20) days after receipt of the Notice to Proceed and prior to commencing work on the project.

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.

1.04 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: Refer to General Conditions, Article 18 – Payment and Completion

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. 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.

I. 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

E. 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

1.01 RELATED DOCUMENTS

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

1.02 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.

1.03 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.

1.04 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

3.01 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.

3.02 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

1.01 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.

1.02 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.

1.03 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. Attends: 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

1.04 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.

1.05 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.

1.06 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 01 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 01 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 01 29 00 "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.

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 activity, where revisions have been recognized or made. Issue the updated schedule concurrently 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

1.01 RELATED DOCUMENTS

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

1.02 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 and 27 sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.03 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.

1.04 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 and 27 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

2.01 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

3.01 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.

3.02 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.

3.03 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.

5. 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.

3.04 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. 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 (OCCC)

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 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 reviewed and accepted 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 Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The 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 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

C. 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.
6. Provide three (3) additional sets of black line drawing sets of As-Built Drawings.
7. Provide USB flash drive with all As-Built Drawings in AutoCAD 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 USB flash drive. 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 ½" 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 USB flash drive: At the completion of the project, submit one USB flash drive 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 CSI standard divisions. Bookmarks will be needed for the appropriate divisions.
4. Operations and Maintenance Manual: Specify the division name only in the bookmarks (1-46). 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.
6. Equipment Replacement Log: Contractor to prepare a log documenting all HVAC, electrical, plumbing, and fire protection equipment that was replaced as part of the project scope of work. Log shall include the following each piece of equipment that was removed and each piece of equipment that was added under the project scope: unit name, type, manufacturer, model number, serial number, and equipment location. Contractor shall submit this as an Excel file and PDF to be included with the USB flash drive.

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

D. 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

1.01 RELATED DOCUMENTS

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

1.02 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.

1.03 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.

1.04 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.

1.05 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, 836-2929. 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 virus-scanned 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 CAT-5e 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 (ISS-ESU).

(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 (ISS-ESU).

(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.

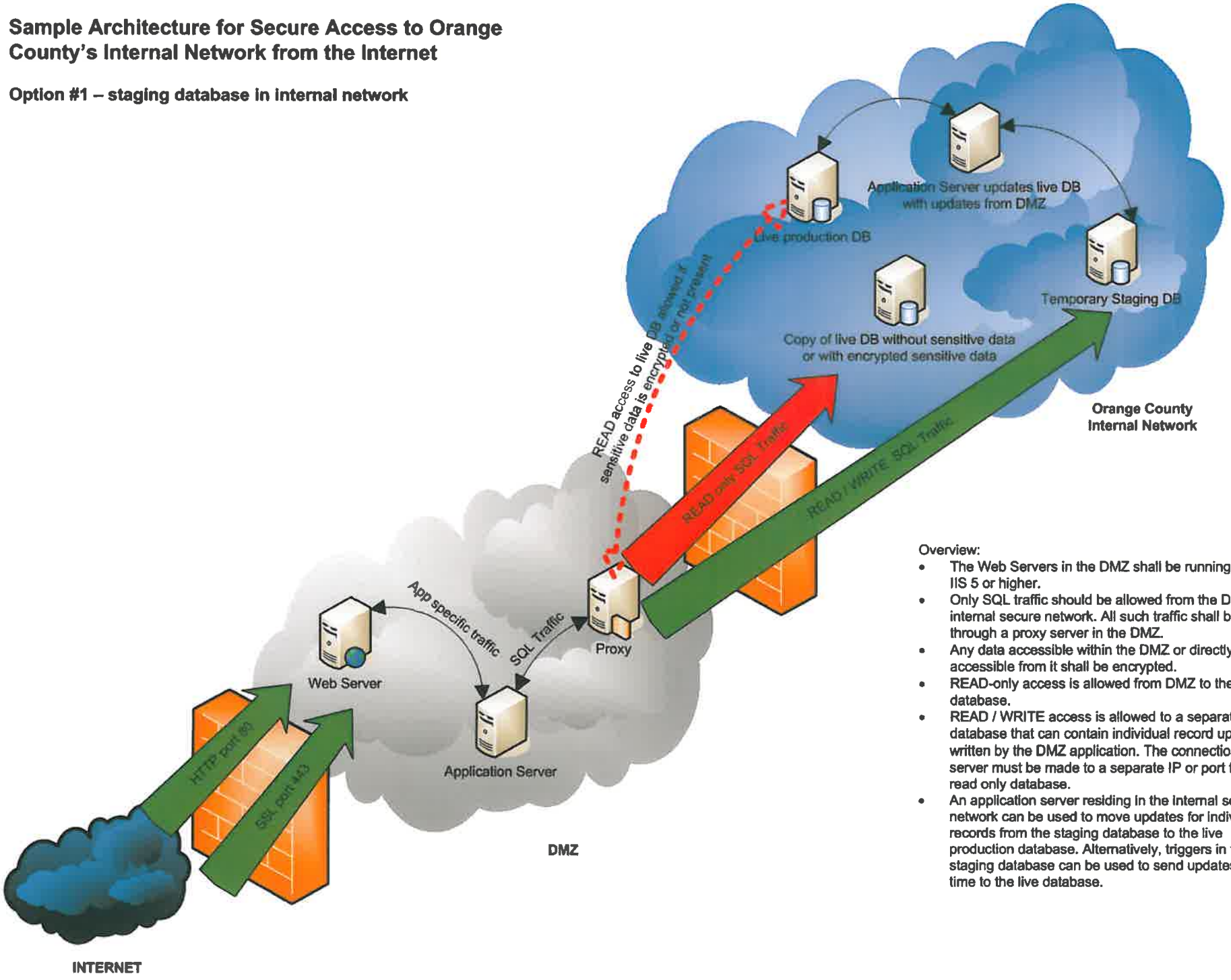
2. Front Page Extensions A series of scripts that can be employed using Microsoft FrontPage, visual HTML editor.

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

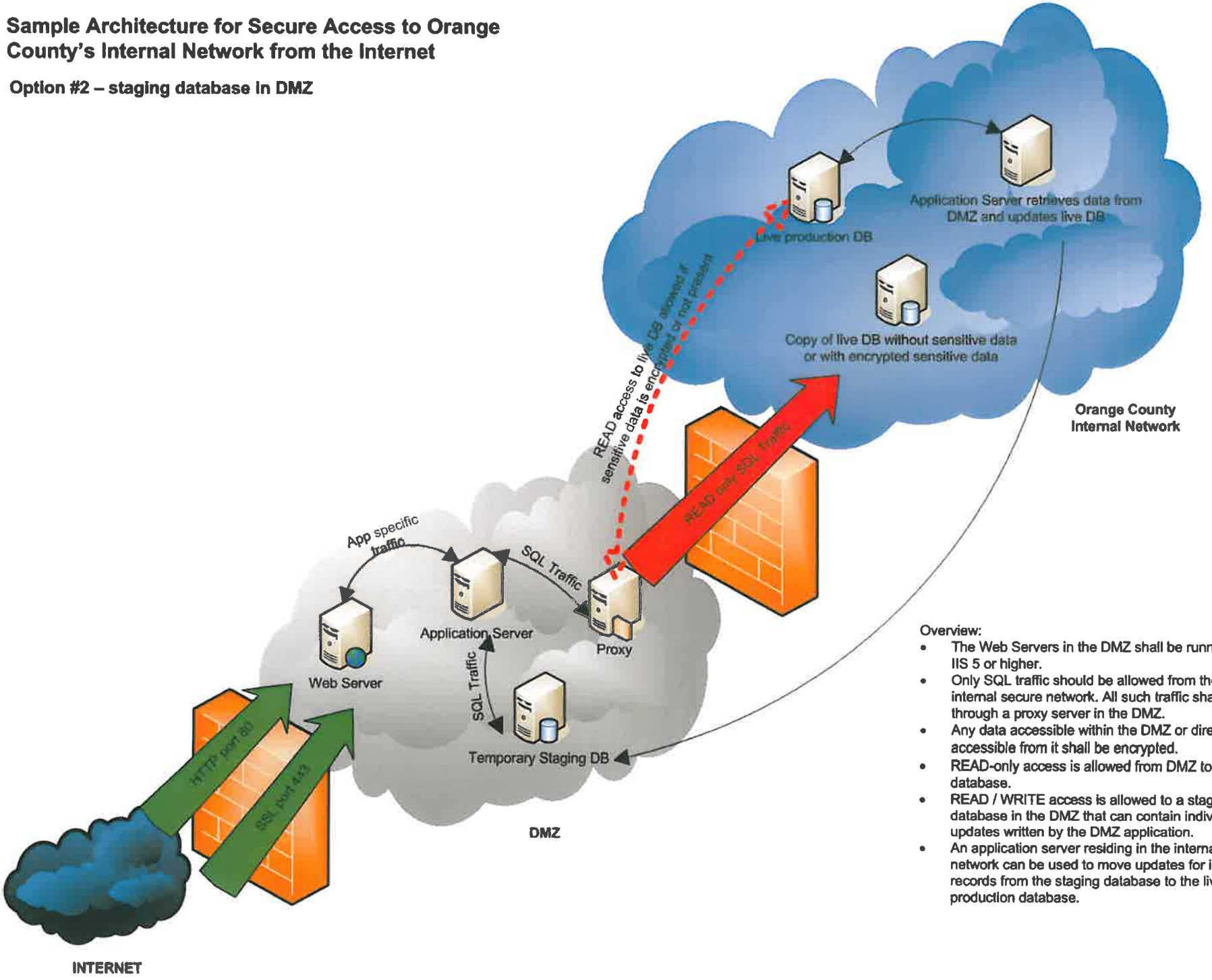


Overview:

- 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

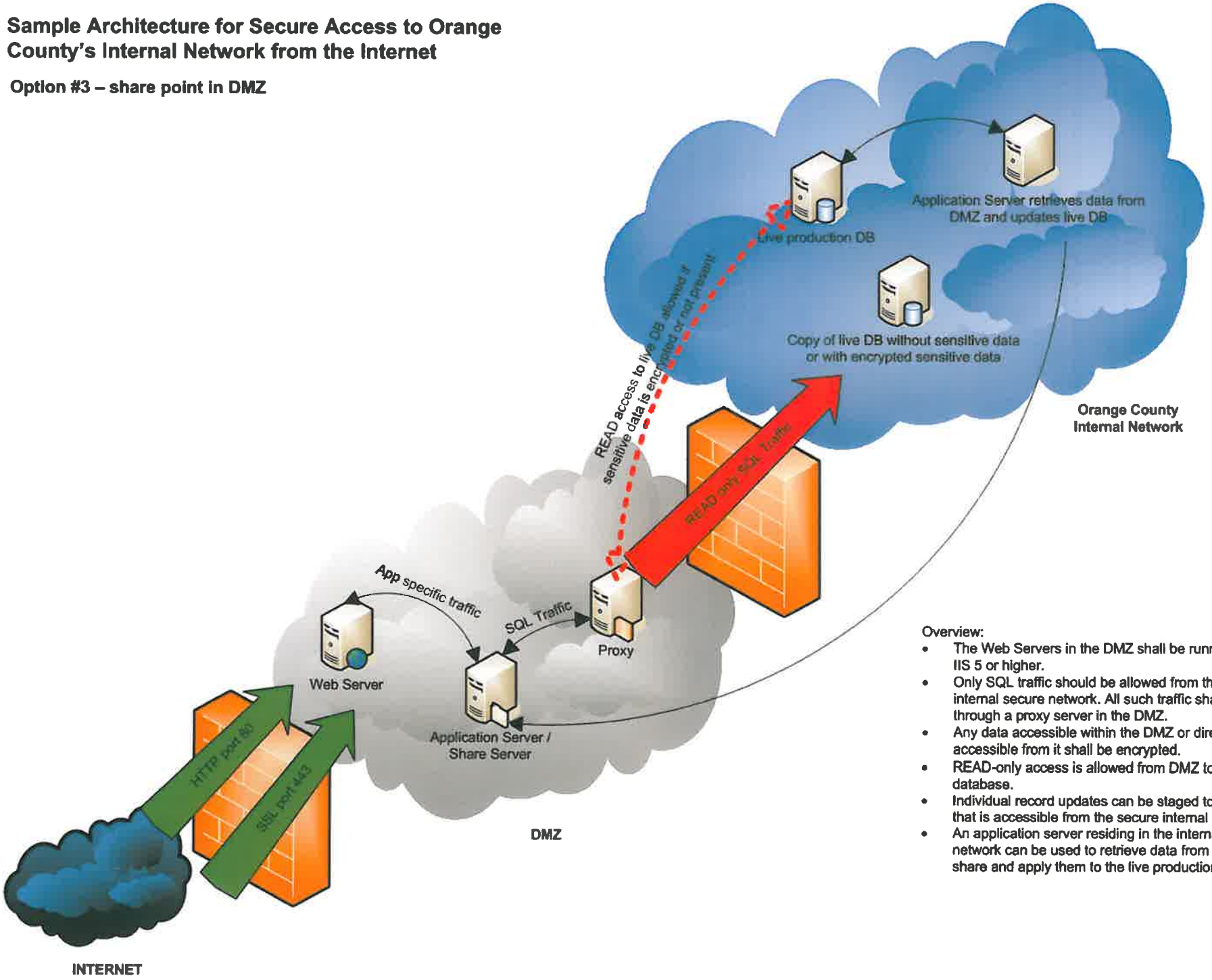


Overview:

- 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 26 01 00 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. O & M Manuals contain copies of all warranties, operation and maintenance instructions, and other pertinent information relative to the project that is used throughout the life of the facility. This section contains additional requirements for the preparation of Electrical (Power and Lighting) and Systems Operation and Maintenance Manuals.

1.3 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 inch x 11 inch sheets for Electrical and Systems. Refer to Division 01, General Requirements for additional requirements.

1. Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1 inch, maximum spline size to be 3 inch. Provide additional binders if 3 inch 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 Manuals at the end of this section. Description sheet is to be white with black letters, minimum of 11 inches 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. Operation and Maintenance for Electrical (Power and Lighting).

B. O & M Data:

1. Manufacturers' 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 - switchboard MDPA).

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 but are not limited to:

1. Completed forms and information per Division 01, General Requirements, and this section of the specifications. Reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
   a) Table of Contents
   b) Project Information Sheet
   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) Conductor Insulation Resistance Test
   f) DC High Voltage Cable Test Report
   g) Ground Test Information
   h) Motor Test Information
   i) Voltage and Amperage Readings (Tabulated Data)

j) Progress and Record Drawing Certification
k) 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. Warranties/Guarantees: Provide copy of warranties/guarantees. Original warranties/guaranties are to be incorporated into separate project warranty book with warranties/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) Time clocks.
   b) Photocells.
   c) Control devices, motor controls.
   d) UPS systems.
   e) Emergency generator systems.
   f) Automatic transfer switches.
   g) Transformers.
   h) Panelboards.
   i) Distribution panelboards.
   j) Switchboards.
   k) Each and every part of Division 27 sections of these Specifications.

7. For Sections 26
   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) Ground fault wiring devices; in addition to above provide:
      1. Wiring diagram.
   f) Grounding; in addition to above provide:
      1. Test results on each ground rod.
      2. Ground Test Information Form

8. Sections 26
   a) Product data and/or catalog sheets on equipment applicable to this project.
   b) Equipment supplier list for each sections equipment.
   c) Transformers; in addition to above provide:
      1. Recommended periodic testing procedures.
      2. Parts list.

3. Any special manufacture suggested O & M information.
4. Installation/removal instructions.
5. Check-Out Memo Form

d) Panels, distribution panelboards, switchboards; in addition to above provide:
1. Internal wiring diagrams.
2. Bus diagrams.
3. Operation and maintenance requirements, instructions, and recommended testing.
4. Parts list.
5. Copy of directory.
6. Voltage and Amperage Readings Tabulated Data Form
7. Check-Out Memo Form

e) Overcurrent protective devices; in addition to above provide the following for large circuit breakers:
1. Parts list.
2. Operation and maintenance requirements.
3. Wiring diagrams.
4. Testing data.
5. Installation/removal instructions.
6. Check-Out Memo Form

f) Motor Control; in addition to above provide the following:
1. Internal wiring diagrams.
2. Wiring diagrams.
3. Bus diagrams.
4. Operation and maintenance requirements, instructions, and recommended testing.
5. Parts list.
6. Copy of directory.
7. Testing data, motor test information sheets.
8. Check-Out Memo Form

9. Sections 26
a) Product data and/or catalog sheets on all equipment applicable to this project.
b) Equipment supplier list for each sections equipment.
c) Lighting fixtures; in addition to above provide the following:
1. Operation and maintenance requirements/instructions for special light fixtures (these fixtures to be determined by A/E) including:
(a) installation/removal instructions.
(b) special re-lamping instructions.
2. Parts list.

10. Sections 26
a) Product data and/or catalog sheets on all equipment applicable to this project.
b) Equipment supplier list for each sections equipment.
c) Lightning Protection System: In addition to the above provide:
1. Shop drawing.
2. Product data on all components.
3. Parts list.
4. Operation and maintenance procedures.
5. Copy of lightning protection system master label.
6. Installer's name, address, etc.

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) Emergency Generator, Emergency Control/System/Switchboard
   1. Internal wiring diagrams
   2. Wiring diagrams
   3. Bus diagrams
   4. Operation and maintenance requirements, instructions and recommended testing
   5. Parts list.
   6. Copy of directory.
   7. Testing data, motor test information sheets
   8. Check Out Memo Form
   9. Narrative of emergency system operation, controls, etc.

11. Section 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) Telephone, Computer 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.

1.4 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.

1.5 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.

1.6 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)

PROJECT INFORMATION SHEET

Project Name: _____

Project Number: _____

Substantial Completion Date: _____

Certificate of final Completion Date: _____

	Name & Address	Phone/Fax	Contact
Authorized Construction Representative			
Architect			
Mechanical Engineer			
Electrical Engineer	Matern Professional Engineering, Inc. 130 Candace Drive Maitland, Florida 32751	P: 407/740-5020 F: 407/740-0365	
Civil Engineer			
Structural Engineer			
Food Service Consultant			
Other Consultant(s)			

Brief Description of Project Scope:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

CHECK OUT MEMO

Check Out Memo 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 _____

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.

- The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.
- 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.*
- Written operating and maintenance information has been presented and reviewed in detail with the Contractor.
- 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.

_____
MANUFACTURER'S REPRESENTATIVE – PRINT NAME

_____
ADDRESS

_____
TELEPHONE, FAX, E-MAIL

_____
MANUFACTURER'S REPRESENTATIVE – SIGNATURE AND TITLE

_____
DATE CHECKED

WITNESSED BY:

_____
CONTRACTOR'S REPRESENTATIVE – SIGNATURE AND TITLE

***EXCEPTIONS NOTED AT TIME OF CHECK-OUT (USE ADDITIONAL PAGE IF NECESSARY)**

CONDUCTOR INSULATION RESISTANCE TEST

PROJECT NAME_____

CONDUCTOR FROM _____ TO

SIZE _____

INSULATION TYPE _____

INSULATION VOLTAGE RATING_____

DATE_____ TIME_____

WEATHER CONDITIONS_____

TEST VOLTAGE (DC)_____

RANGE _____

MEGGER INSTRUMENT/SERIAL NUMBER_____

TESTING METHODOLOGY _____

INSULATION RESISTANCE MEASUREMENT (ACCEPTABLE MEASUREMENT NOT TO BE LESS THAN (1) MEGOHM):

PHASE A TO GROUND _____

PHASE B TO GROUND _____

PHASE C TO GROUND _____

NEUTRAL TO GROUND _____

ISOLATED GROUND TO GROUND _____

CONTRACTOR'S REPRESENTATIVE _____

DATE_____

OWNER'S REPRESENTATIVE _____

DATE:_____

ENGINEER'S REPRESENTATIVE:_____

DATE:_____

DC HIGH VOLTAGE CABLE TEST

Project Name _____

Location _____

Description _____

Rated Voltage _____

TEST DATA

Set Leakage @ Test Voltage _____ma Variac_____----------
Pri. Voltage_____
Sphere Gap _____ Inches
Duct Temp._____ Ambient Temp._____ Weather_____
Cable Status_____ 1 hour prior to test

_____
_____

Phase or Conductor	A	B	C	Remarks
Starting Time	_____	_____	_____	
	MA	MA	MA	
0				
15 sec.				
30 sec.				
45 sec.				
1 min.				
2 min.				
3 min.				
4 min.				
5 min.				

Final Test Voltage _____

Time Finish: _____

KV DC after 1 min.

Test Procedure _____ Number of Terminals _____

Joints _____

Witnessed By:_____ Performed By: _____

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_____

MOTOR TEST INFORMATION

PROJECT NAME:_____
DESCRIPTION OF MOTOR:_____
NAME OF CHECKER:_____
DATE CHECKED:_____

Name and Identifying Mark of Motor (indicate at existing)_____

Manufacturer_____

Model Number_____

Serial Number _____

RPM _____

Frame Size _____

Code Letter _____

Horsepower _____

Nameplate Voltage and Phase _____

Nameplate Amps _____

Actual Voltage _____

Actual Amps _____

Starter Manufacturer _____

Starter Size _____

Heater Size, Catalog No. and Amp Rating _____

Manufacturer of Dual-Element Fuse_____

Amp Rating of Fuse _____

Power Factor _____

CONTRACTOR'S REPRESENTATIVE: _____

DATE:_____

SIGNATURE OF CHECKER:_____

DATE:_____

OWNER'S AUTHORIZED REPRESENTATIVE: _____

VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME _____

SWITCHGEAR/PANELBOARD _____

FULL LOAD AMPERAGE READINGS:
DATE _____
TIME _____

PHASE A _____
B _____
C _____
N _____
GROUND _____

FULL LOAD VOLTAGE READINGS:
DATE _____
TIME _____

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

VOLTAGE AT THE END OF THE LONGEST BRANCH _____

TYPE OF LOAD _____

NO LOAD VOLTAGE READINGS:
DATE_____
TIME _____

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

ENGINEER'S REPRESENTATIVE _____
DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE _____
DATE _____

CONTRACTOR'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.

_____
General Contractor

: _____
By: Authorized Signature And Title

_____
Date

_____
Subcontractor

_____
By: Authorized Signature And Title

_____
Date

SPARE PARTS / MAINTENANCE STOCK CERTIFICATION

This form verifies that the parts/stock listed below has been delivered to and received by Maintenance Department. Original shall be included in the Closeout Documentation Manual. Copies shall also be included in the O & M Manual.

Project Name: _____

Type/Name of Spare Parts/Attic Stock: _____

_____

Specification Reference: _____

Quantity of Spare Parts/Attic Stock: _____

_____

_____

Signature below by the Contractor and Subcontractor signifies that the spare parts/maintenance stock, required by the Contract Documents, have been delivered to the Owner.

_____
Contractor/CM

_____ Date: _____
Authorized Signature, Title

_____
Subcontractor

_____ Date: _____
Authorized Signature, Title

Signature by the Owner acknowledges receipt of the same spare parts/maintenance stock.

_____
Department

_____ Date: _____
Authorized Signature, Title

BINDER EXAMPLES FOR SUBMITTALS
Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder

MANUAL COVER (face)

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE

MPE NO. 2015-078

ELECTRICAL
OPERATION AND MAINTENANCE MANUAL

DATE
(substantial completion date)

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE

MPE NO. 2015-078

SYSTEMS
OPERATION AND MAINTENANCE MANUAL

DATE
(substantial completion date)

MANUAL COVER (Spine)

DYNAMIC MESSAGE SIGNAGE UPGRADE

2015-078

E L E C T R I C A L

OPERATION AND MAINTENANCE MANUAL

DATE

DYNAMIC MESSAGE SIGNAGE UPGRADE

2015-078

S Y S T E M S

OPERATION AND MAINTENANCE MANUAL

DATE

SECTION 26 05 00 - COMMON WORK RESULTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes Basic Electrical Requirements specifically applicable to Divisions 26 and 27 Sections.

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 Sections 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 qualified 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 Sections for additional work requirements.

F. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required for complete and properly operating systems..

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.

H. The Contractor shall provide and install panic hardware on all electrical room doors where the electrical room houses equipment rated 1200 amps or more per NEC Article 110.26. All electrical room doors shall open in the direction of egress.

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 permanent power and for temporary power, 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. Advise A/E of discrepancies or questions noted.

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 electrical 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 its 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 power, lighting, 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 buildings 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 72 hours in advance of any shut-down of existing systems. Perform work during non-general office operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.

K. Bid shall include all removal and relocation of all piping, fixtures or other 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 26 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 tamperproof screws are specified or required, Phillips head or Allen head devices shall not be accepted. For each type used, provide Owner with three tools. Owner will designate the specific hardware design to correspond with existing devices elsewhere in the building, to limit

special tool requirements.

L. 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 MISCELLANEOUS CIRCUITS REQUIRED

A. Provide 120 volt, 20 amp circuit to post indicator valves (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all required electrical. Coordinate final location and electrical requirements with valve installer after bid and provide all required electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

B. Provide 120 volt, 20 amp circuit to fire protection system panel and bell (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

C. Provide 120 volt, 20 amp circuit to intercom system panel (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with intercom system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

D. Provide 120 volt, 20 amp circuit to all fire alarm panels, remote panels, etc (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire alarm system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

E. Provide 120 volt, 20 amp circuit to fire and smoke dampers (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building ahs emergency generator system.

F. Provide 120 volt, 20 amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical

1.11 CARBON MONOXIDE ALARMS

A. In accordance with Rule 9B-3.0472, whether shown on drawings or not, provide a carbon monoxide alarm within 10 feet of each room used for sleeping purposes where the building has a fossil-fuel-burning heater or appliance, a fireplace, or an attached garage. Carbon monoxide alarms shall be hard wired to the building electrical system and receive primary power from the building 120 volt electrical system. Carbon monoxide alarms shall have battery backup. Carbon monoxide alarms shall be interconnected so that when one device detects CO all devices within the building sound alarm. Alarms shall be listed in accordance with UL 2034-96, Standard for Single and Multiple Station CO Alarms. Provide strobe lights in all spaces intended for the hearing impaired or where required by Federal and/or State regulations.

1.12 SMOKE ALARMS

A. Provide single and multiple station smoke alarms, whether shown on drawings or not, at locations required by Florida Building Code Chapter 9. Smoke alarms shall be hard wired to the building electrical system and receive primary power from the building 120 volt electrical system. Smoke alarms shall have battery backup. Smoke alarms shall be interconnected so that when one device detects smoke all devices within an individual dwelling unit sound alarm. Provide strobe lights in all spaces intended for the hearing impaired or where required by Federal and/or State regulations.

1.13 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.

1.14 Superintendent shall be employed by a currently licensed Florida Certified Electrical Contractor (EC) or currently licensed Florida Registered Electrical Contractor (ER).

1.15 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
8. Mechanical Division of the Specifications

9. Interior Design Drawings
10. Pool/Spa Equipment
11. Fountains
12. Landscape Architect Drawings
13. Lifts
14. Laundry Equipment
15. Kitchen Equipment
16. Conveyors
17. Flight Information Display Systems
18. Baggage Information Display Systems
19. Millwork Design Drawings and Shop Drawings

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 Division 26 Sections 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, Structural, 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.

I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes due to these coordination efforts shall be made at no additional cost to the Owner.

1.16 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.

1.17 CONCRETE PADS

A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4 6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Provide 3000 psi concrete.

B. Contractor to provide/install concrete pad for exterior pad mount transformers as required by power company.

C. Contractor to provide/install concrete pad for exterior generators as recommended by generator manufacturer and structural engineer (8" minimum).

1.18 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.

1.19 CUTTING AND PATCHING

A. New Construction:

1. Reference Division 01 - 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.

1.20 TRENCHING

A. Trench excavations in excess of 5 feet deep shall comply with OSHA Standard 29 C.F.R.s. 1926. 650 Subpart P.

1.21 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. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.

F. 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.

G. 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.

1.22 PROGRESS AND RECORD DRAWINGS

A. Keep two sets of blueline 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. All site raceways exactly as installed.
3. Any combining of circuits (which is only allowed by specific written permission) or change in homerun outlet box shall be made on as-builts.
4. Any circuit number changes on plan shall be indicated on as-builts.
5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..

C. Marked up prints as noted above are to be submitted to A/E for review.. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.

D. The changes and alterations shall be transferred to CAD (AutoCAD Release 2006 or higher). Obtain CAD disk of the construction documents by the A/E, from the A/E. Generate/update the CAD disks to include all changes, additions, etc. on the accepted marked up prints. Label each drawing "As-Built" and date. Submit as-built CAD disk and reproducible of the as-builts.

E. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit set prior to request for final payment and/or request for final observation.

F. 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.

1.23 "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.

1.24 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.

1.25 WASTE MATERIALS DISPOSAL

A. Contractor shall include in his bid the transport and disposal or recycling of all waste materials generated by this project in accordance with all rules, regulations and guidelines applicable. Contractor shall comply fully with Florida statute 403.7186 regarding mercury containing devices and lamps. Lamps, ballasts and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal. Contractor shall provide owner with written certification of accepted disposal.

1.26 SUBSTANTIAL COMPLETION

A. The Contractor shall be fully responsible for contacting all applicable parties [(A/E or Project Manager)] 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.

1.27 PROHIBITION OF ASBESTOS AND PCB

A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.

B. Prior to the final review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under Division 26 contain no asbestos or PCB's. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB's. This statement shall be signed and dated by a duly authorized agent of the manufacturer.

PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Requirements for submittals specifically applicable to Division 26 and 27 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 8-1/2" 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 01, 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

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE

PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

Matern Professional Engineering, Inc.
130 Candace Drive
Maitland, Florida 32751
Telephone No.: (407) 740-5020
Fax No.: (407) 740-0365

GENERAL CONTRACTOR:

SUBCONTRACTOR:

BINDER EXAMPLES FOR SUBMITTALS
Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE

MPE NO. 2015-078

ELECTRICAL SUBMITTALS

(Size To 8-1/2" x 11")

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE

MPE NO. 2015-078

SYSTEMS SUBMITTALS

(Size To 8-1/2" x 11")

ORANGE
COUNTY
CONVENTION
CENTER
DYNAMIC
MESSAGE
SIGNAGE
UPGRADE

MPE NO. 2015-078

ELECTRICAL
SUBMITTALS

(Size To 11")

ORANGE
COUNTY
CONVENTION
CENTER
DYNAMIC
MESSAGE
SIGNAGE
UPGRADE

MPE NO. 2015-078

SYSTEMS
SUBMITTALS

(Size To 11")

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Reference Standards and Regulatory Requirements applicable to Divisions 26 and 27 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 American Society of Mechanical Engineers International
ASTM	ASTM International American Society for Testing and Materials International
BOR	Board of Regents
BICSI	BICSI, Inc.
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 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 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
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
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
OSHA	Occupational Safety and Health Act
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.

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, 5th edition 2014
k) Florida Fire Prevention Code, 5th edition 2014
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, 2011
r) National Energy Conservation Policy Act
s) National Electrical Safety Code
t) National Electrical Manufacturers Association
u) NFPA 1 Fire Code, 2012
v) NFPA 101 Life Safety Code, 2012
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 or #12 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 12 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.

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 26 - GROUNDING AND BONDING

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. Equipment grounding conductors.

2. Bonding.

B. 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.

C. 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 NEC 250, 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.

D. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed within 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.

E. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to NEC 250.

1.3 REFERENCES

A. ANSI/NFPA 70 National Electrical Code
B. NFPA 780 Standard for the Installation of Lightning Protection Systems
C. UL 467 Grounding and Bonding Equipment

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. Mechanical connectors.

2. Ground bus bars and associated components.

3. Testing equipment and procedures

B. Product data shall prove compliance with specifications, National Electrical Code, manufacturers' specifications, and written installation data.

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual locations of grounding electrodes.

B. Submit test results indicating resistance of each ground rod.

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).

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 NEC, 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. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.

B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.

C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the grounding bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.

E. 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.

F. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.

G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.

H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.3 LIGHTNING PROTECTION SYSTEMS

A. Repair and recertify existing lighting protection system where exterior equipment is being renovated.

B. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.

C. See Section 26 41 13 Lightning Protection System.

3.4 EXTERIOR GRADE (OR FREE STANDING ABOVE GROUND) MOUNTED EQUIPMENT

A. General:

1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc)

mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.

2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC 250 based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.

B. Electrical equipment connection rack mounted equipment.

1. Bond all metal parts as noted above.

C. Complete installation shall exceed the minimum requirements of NEC 250 and, when applicable, NFPA 780.

3.5 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 installed to permit the 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. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.

I. Grounding provisions shall include double locknuts on all heavywall conduits.

J. Bond all metal parts of pole light fixtures to ground rod at base.

3.6 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.

3.7 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. 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 26 08 13 Tests and Performance Verification.

3.8 INTERFACE WITH OTHER PRODUCTS

A. Interface with site grounding system.

B. Interface with lightning protection system installed under Section 26 41 13 Lightning Protection System.

C. Interface with communications system installed under systems sections series specification sections.

3.9 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 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. Liquidtight 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 1.

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 non-metallic 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 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 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 thereto.

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-C-52 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. 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" 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 Division 27 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.

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. They shall be permanently mechanically riveted.

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.

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. 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
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 non-linear 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. 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 26 43 00 - SURGE PROTECTIVE 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. Section includes requirements for surge protective devices.

1.3 REFERENCES

A. The latest edition of the following references shall apply to the work of this section:

1. ANSI/IEEE C62.33 Standard Test Specifications for Varistor Surge Protective Devices
2. ANSI/IEEE C62.41 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
3. ANSI/IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
4. NFPA 70 National Electrical Code
5. NFPA 780 Standard for Installation of Lightning Protection Systems
6. UL 96A Standard for Lightning Protection Components
7. UL 1363 Standard for Safety Relocatable Power Taps
8. UL 1449, 3rd Edition Standard for Safety for Surge Protective Devices

1.4 REGULATORY REQUIREMENTS

A. Equipment Certification: Surge protective devices shall be listed by Underwriters Laboratories shall bear the UL seal and be marked in accordance with referenced standard. Surge protective devices shall be UL listed and labeled for intended use.

B. Surge protective devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 70 and NFPA 780).

C. Comply with all standards and guides as listed under “References” above.

1.5 DESIGN REQUIREMENTS

A. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on Drawings or specified in this Section for systems with voltages between 120/208VAC(single phase).

B. Equipment specified covers Surge Protective Devices (SPD).

C. Provide surge protective devices for the following equipment:

1. On distribution and branch panels as called for on Drawings or in these Specifications.
2. All electronic communications equipment installed under Divisions 27 and 28 including, but not limited to, fire alarm, intercom, security, television, premise distribution, and sound systems.
3. All or any electronic equipment installed under Division 27 including electronic time clocks, controls systems, etc.

4. Additional locations as required by NFPA 780.
5. At point of use locations (receptacles, plug-in units) as required.
6. On all automatic transfer switches (ATS).

1.6 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.

B. Submit Product Data for each type of surge protective device:

1. Dimensions.
2. Means of mounting.
3. Compliance with UL Standards referenced.
4. Compliance with IEEE Standards referenced.
5. Design type (Hybrid, MOV).
6. Internal fusing.
7. Recommended overcurrent protection.
8. Size of wire leads.
9. Visual failure indicator.
10. Warranty.
11. Performance data showing compliance with performance as specified herein.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O & M) data as called for in Section 26 01 00 Operation and Maintenance Manuals.

B. O & M data to include:

1. All accepted shop drawings, product data, and/or cutsheets.
2. Installation, connection, and maintenance information on each type of surge suppression.
3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.

1.8 QUALITY ASSURANCE

A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.

B. The surge protective device manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor. Factory representatives are to accept installation prior to Substantial Completion.

1.9 COORDINATION/PROJECT CONDITIONS

A. Verify proper grounding is in place.

B. Verify proper clearances, space, etc. is available for surge protective devices.

C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge protective device.

1.10 WARRANTY

A. All surge protective devices shall be warranted to be free from defects in materials and workmanship for a period of five years.

B. Any surge protective device 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.

1.11 DEFINITIONS/ABBREVIATIONS

A. VPR: UL Voltage Protection Rating

B. MCOV: Maximum Continuous Operating Voltage

C. SCCR: Short Circuit Current Rating

D. IN: Inominal

PART 2 - PRODUCTS

2.1 GENERAL

A. Surge protective devices shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (N-G) mode protection.

B. Surge protective devices shall be of a hybrid design, and include circuitry with tight, wave-tracking clamping characteristics.

C. Surge protective devices shall be designed to withstand a maximum continuous operating voltage of not less than 115 percent of nominal RMS line voltage.

D. Surge protective devices shall contain internal safety fusing to disconnect the surge protective device from the electrical source if the surge protective device fails, in order to prevent catastrophic failure modes.

E. Surge protective devices shall be fail safe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.

F. Surge protective devices shall be UL 1449 listed under UL Category Code VZCA and shall be accepted for the location in which they are installed.

PART 3 – EXECUTION

3.1 GENERAL

A. Provide, install and connect surge protective devices at each branch panel as noted on drawings.

B. Provide, install, and connect surge protective devices at location where Divisions 27 and 28 equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect surge protective devices to equipment being protected and maintain UL listing.

C. Provide surge protective devices at panel feeding exterior site lighting circuits for each circuit and for each panel feeding site signage.

3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Surge protective devices for other than Divisions 27 and 28 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.

B. Surge protective devices for Divisions 27 and 28 equipment power source shall be coordinated with the individual specification section contractor. Locate in terminal cabinet with surge protective devices and bond together.

C. Surge protective devices shall be close nippled to the device being protected in a position near

the neutral bus which will minimize lead length between surge protective devices and the buses or control breaker to which the surge protective device connects. Suppressor leads shall not extend beyond the surge protective device manufacturer's recommended maximum lead length without specific acceptance of the Engineer.

D. Location shown on Drawings is diagrammatic only. Provide flush mount trim for surge protective device units at flush mounted panelboards. Provide NEMA 4X enclosures for TVSS units in exterior locations.

E. Surge protective devices shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

F. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and accepted connections unless otherwise noted. Referenced to a common earth ground.

G. Surge protective devices shall be installed in a manner that allows simple replacement within short periods of downtime.

H. Surge protective devices other than point of use type and those for exterior lighting poles shall be installed with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30 amp, 3 phase CB, 100,000 AIC for the surge protective device. At the distribution secondary and/or subpanels location, provide dedicated 20 amp or 30 amp, 3 phase CB, for the surge protective device. Label disconnect or CB "Surge Protector." Fused disconnects may be substituted for the CB, with the acceptance of the Engineer. Contractor to change rating of CBs noted above as required to properly provide system as recommended by manufacturer.

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 01 - 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 01, 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. 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) 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. Point-to-point wiring diagrams of system.
      5. Shop drawing as submitted and accepted in submittal process.
      6. Check-Out Memo Form
   f) Grounding; in addition to above provide:
      1. Test results on each ground rod.
      2. Ground Test Information Form

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.

8. Point to point wiring diagrams and block diagrams of entire Dynamic Message Signage Upgrade as installed and verified to be complete. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals. Block diagrams shall be required with submittals.

9. Riser diagrams, site plans, and floor plans showing exact conduit runs and number / type of cable. All devices shall be identified by the same applied identification symbol as shown on the drawings. Contractor shall trace out and locate on site plans the routing of all underground fiber cable and conduit used by Dynamic Message Signage.

10. Contractor to provide a detailed fiber schematic indicate each fiber strand (by number and color) and all terminations, patches, fusion splices, connection to equipment (indicate what port on equipment patch cables are connected to) fiber run distance as obtained by OTDR test, and reference number for Fiber test result sheet for each fiber.

11. 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 / equipment address and associated sign #.

1. IP address, Sub net, gateway, MAC address of device. (switches, modules, sign controllers, etc)

2. Provide configuration data file for all LAN switches.

d) A list of every address of every device connected to network equipment that is provided for purposes of Dynamic Message Signage function.

e) Complete network wiring diagrams for all components and interfaces to equipment supplied by others or existing.

12. All drawings required herein shall be on AutoCAD 2007 or higher.

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)

PROJECT ADDRESSES

OWNER:

ARCHITECT:

CONSULTING ENGINEER: Matern Professional Engineering, P.A.
130 Candace Drive
Maitland, Florida 32751
Telephone No.: (407) 740-5020
Fax No.: (407) 740-0365

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 01 05 - INVESTIGATION OF EXISTING COMMUNICATIONS 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 SCOPE

A. Test the essential features of the following existing communications systems:

1. Dynamic Message Signage / Server
2. Building grounding systems

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. Test the operation of each of the following existing devices and associated systems:

1. Dynamic Message Signage / Server
   - **a)** Test each sign for power and message display. Both from server and via local port on sign controller.
   - ~~a)~~**b) Test Fiber Optic cabling at each sign.**
   - ~~b)~~**c)** Identify and physically damaged equipment, raceway, cable, etc.
2. Ground System
   - a) Submit "GROUND TEST INFORMATION" Form (see form at the end of this Section) for each and every grounding system in the project, including but not limited to: each ground rod installation; each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment); and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
   - b) Testing shall be three (3) point method in accordance with IEEE recommended practice.
   - c) Where grounding resistance is greater than value required by this Specification,

Contractor is to bring this to the Engineer's and Owner's attention in wiring along with attached 'GROUND TEST INFORMATION" Form.

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 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 01 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 01 - 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 and 27 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 and 27 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 / 27 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.

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. 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.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. 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.

H. Coordination between contractor and DOT for all work which is to be performed over active roadway. Provide all safety equipment required by local AHJ.

I. The Contractor shall coordinate all work on underground fiber cable with Orange County Traffic Engineering.

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 01 - 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.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Requirements for submittals specifically applicable to Division 27 Sections, in addition to Division 01 - 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. 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 New and Existing which are used to support this system, 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. 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.

4. Point to point wiring diagrams and block diagrams of system to be installed.

5. Submit a detailed step by step testing procedure for any active components, component/ system functional checkout and test.

a) Include 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.

6. Shop Drawings: Submit plan of building(s) and site showing pathways with all installed cables and pathways noted.

1. Detailed floor plan / site plan layouts and riser diagrams showing system components and their location, interconnections, wiring/cabling, and interface and connection with other disciplines.

2. Coordination Drawings in accordance with the requirements of Division

3. Detailed data as requested by designer.

7. 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.

1. Contractor shall have documented previous work experience with Orange County Traffic engineering or other equivalent local government entity in the capacity of OSP Fiber Optic cabling installation and Communications systems.

2. Contractor shall have work experience on “DOT Corridor”

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) Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

i) 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.

j) Previous work experience within the last (5)

8. As-Built Documentation

a) Refer to O & M Manual Requirements section 27 01 00

D. 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.

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 01, 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

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE

PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

Matern Professional Engineering, P.A.
130 Candace Drive
Maitland, Florida 32751
Telephone No.: (407) 740-5020
Fax No.: (407) 740-0365

GENERAL CONTRACTOR:

SUBCONTRACTOR:

BINDER EXAMPLES FOR SUBMITTALS

Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder

ORANGE COUNTY CONVENTION CENTER
DYNAMIC MESSAGE SIGNAGE UPGRADE

MPE NO. 2015-078

COMMUNICATIONS SUBMITTALS

(Size To 8-1/2" x 11")

ORANGE COUNTY
CONVENTION
CENTER
DYNAMIC MESSAGE
SIGNAGE UPGRADE

MPE NO. 2015-078

COMMUNICATIONS
SUBMITTALS

(Size To 11")

SECTION 27 05 10 - SYMBOLS AND ABBREVIATIONS 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Symbols and abbreviations specifically applicable to all Division 26 and 27 sections in addition to those in Division 01 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

A. In general the symbols used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted.

Corps of Engineers.
Special Symbols as shown in schedules or legends.

1.4 ABBREVIATIONS

A. The following abbreviations or initials are used.
A/C Air Conditioning
AFD Adjustable Frequency Drive
A.C. Alternating Current
ADD # Addendum #
A/E Architect/Engineer (or Engineer when Architect not applicable)
AFF Above Finished Floor
AFG Above Finished Grade
AHU Air Handler Unit
AIC Amps Interrupting Capacity
AL Aluminum
ALT Alternate
AMP Ampere
ANSI American National Standards Institute
AWG American Wire Gauge
@ At
B.C. Bare Copper
BLDG Building
BRKR Breaker
BTU British Thermal Unit
BTUH BTU Per Hour
C. Conduit
C.B. Circuit Breaker
CBM Certified Ballast Manufacturers
cd Candela
CFM Cubic Feet per Minute
CKT. Circuit
CKT BRKR Circuit Breaker
C/L Center Line
Clg. Ceiling

Comp. Compressor
Conn. Connection
Cond. Condenser
Cont. Continuous
C.R.I. Color Rendering Index
C.T. Current Transformer
CU. Copper
C.U. Compressor Condenser Unit
C.W. Cold Water
D.B. Direct Burial
D.C. Direct Current
Disc. Disconnect
DN. Down
DPST Double Pole Single Throw
DWG Drawing
E.C. Electrical Contractor (or General Contractor)
ELEV. Elevator
EMT Electrical Metallic Tubing
Equip. Equipment
EST Estimate
FAAP Fire Alarm Annunciator Panel
FACP Fire Alarm Control Panel
FARP Fire Alarm Remote Panel
FATC Fire Alarm Terminal Cabinet
FCCP Fire Alarm Command Center Panel
FLA Full Load Amperes
FT. Feet
FLR Floor
F.C. Footcandles
F.O. Fiber Optic
FVNR Full Voltage Non-Reversing
GAL. Gallon
Galv. Galvanized
GPH Gallons per Hour
GPM Gallons per Minute
GFI Ground Fault Interrupting
GRS Galvanized Rigid Steel Conduit
GND. Ground
HTG Heaters
HT Height
HZ Hertz (Cycles)
HR. Hour
IMC Intermediate Metallic Conduit
Incand. Incandescent
in. Inches
J.B. Junction Box
KVA KiloVolt Ampere
KW Kilowatts
KWH Kilowatt Hour
K Kelvin
LED Light Emitting Diode
LIU Light Interface Unit (Fiber Optic Patch Panel)
LT. Light
LTG. Lighting

LTS. Lights
L.P.F. Low Power Factor
M.C.B. Main Circuit Breaker
M.L.O. Main Lugs Only
Maint. Maintenance
MH. Manhole; Metal Halide
MFG. Manufacturer
max. Maximum
MCM/KCMIL Thousand Circular Mils
MPH Miles Per Hour
MM Millimeter
Min. Minimum
MCP Motor Circuit Protector
MTD Mounted
N. Neutral
NEC National Electrical Code
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association
N.P.T. National Pipe Thread
NF Non Fused
N.C. Normally Closed
N.O. Normally Open
NIC. Not in Contract
No. Number
OB Outlet Box
OD Outside Diameter
O.L. Overload
OLS Overloads
OS&Y Outside Screw and Yoke (Sprinkler)
% Percent
Ø Phase
P. Pole
PL Compact Fluorescent Lamp
P.T. Potential Transformer
PSF Pounds per Square Foot
PSI Pounds per Square Inch
PB Pullbox
PNL Panel
PP Patch Panel
PR Pair
Pri. Primary
PTZ Pan, Tilt, Zoom
PVC Polyvinyl Chloride
Recept. Receptacle
RPM Revolutions per Minute
R.S. Rapid Start
SCA Short Circuit Amps
Sec. Secondary
SHT Sheet
S/N Solid Neutral
SPST Single Pole Single Throw
SF Square Foot
SW. Switch
SWBD Switchboard

Sys. System
THHN; THWN Nylon Jacketed Wire
TSP Twisted Shielded Pair
TTB Telephone Terminal Board
TTC Telephone Terminal Cabinet
TV Television
TVTC Television Terminal Cabinet
TVEC Television Equip. Cabinet
TYP Typical
Temp. Temperature
UL Underwriters' Laboratories
UTP Unshielded Twisted Pair
V Volt
VA Volt Amperes
Vol. Volume
W Wire
W.P. Weatherproof
Yd. Yard
Yr. Year
3R Rainproof
4X Stainless Steel Dustight, Watertight

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 26 05 19 - BUILDING WIRE AND CABLE 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 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 meeting 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 or #12 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 12 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.

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: 120/108V 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 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

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 NEC. 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 27 05 00 Common Work Results for Electrical and Section 27 05 07 Submittals.

1.4 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.

1.5 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 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Wall and ceiling outlet boxes and small junction and pullboxes.
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. All conduits and wire pathways penetrating enclosures shall be sealed with an approved duct plug to be water and air/gas tight.

E. A raceway shall be provided for all electrical systems.

F. 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.

G. 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.

H. Section includes: Wall and ceiling outlet boxes and small junction and pullboxes.

I. 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 pullboxes 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 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 face plate 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 DUCT PLUGS

A. Construction of duct plugs to be high impact plastic components and durable elastic gaskets, no metal or metallic part should encompass the construction of the duct plug in any manner.

B. Duct plug must be water and air/gas tight.

C. Must be equipped with a manner of securing a pull rope to the Duct Plug.

D. Duct Plug must be expandable type, to properly seal duct. No tapered plug will be permissible.

E. Design Selection: Innerduct brand, or approved equal.

2.5 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).

2.6 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.

2.7 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.

2.8 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.

2.9 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.

2.10 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.

2.11 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 Grounding and Bonding.

S. Identify conduit under provisions of Section Identification for Electrical Systems.

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 as-built (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 <u>not</u> 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 35 - PULL AND JUNCTION BOXES 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 01 Specification Sections, apply to this Section.

1.1 DESCRIPTION

A. Provide and install pull and junction boxes as shown on drawings or as required by the National Electric Code (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 Outlet Boxes of these specifications.

1.2 - 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).

1.3 SUBMITTALS

A. Submit actual shop drawings on all pull boxes showing.

1. Covers.
2. Dimensions - inside and out.
3. Rating of concrete or gauge of metal.
4. Manufacturer.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of pull and junction boxes.

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.

1.6 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: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.

A. Material: Cast aluminum.

B. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. Provide all hubs as required for conduit connections.

2.4 IN-GROUND PULL BOXES:

A. Material: Precast concrete, or composolite.

B. Bottom: Open with 6" of gravel for drainage.

C. Cover: Meet Florida Dept. of Transportation requirements for installed location. (Pedestrian, heavy traffic, light traffic).

D. Solid sides constructed to facilitate conduit entries.

PART 3- EXECUTION

3.1 GENERAL

A. Install per N.E.C.

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 inches (150 mm) 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 inch (150 mm) separation. Provide minimum 24 inches (600 mm) 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 (2) 3/8" all-thread rod hangers minimum.

M. Pull and junction boxes used for Systems Sections 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: Boxes larger than 100 cubic inches (1 600 cubic centimeters) in volume or 12 inches (300 mm) in any dimension.

1. Interior Dry Locations: Per NEC, with screw covers.

2. Other Locations: Use hinged enclosure under provisions of Section Cabinets and Enclosures.

Q. Outdoor Locations: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

3.2 IN GROUND PULL BOXES

A. Provide and install ground rod in each pull box. Connect #2 copper ground wires (counterpoise) to ground rod, run out pullbox 6" over conduits to next pull box; tie to respective building electrical ground rod at each building.

B. Install pull boxes flush with finished grade. Provide extensions as required.

C. In ground pullboxes to have interior watertight pull box mounted inside in-ground pull box as required by Local Authority Having Jurisdiction.

3.3 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.

3.4 ADJUSTING

A. 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 01 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. All nameplates shall be permanently mechanically riveted.

G. Letter Size:

1. 1/8 inch for identifying individual equipment and loads.
2. 1/4 inch for identifying grouped equipment and loads.

H. 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.

I. 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 junction and pull boxes (larger than 4-11/16 inch), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number (if applicable).

J. 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).

K. All receptacles shall be clearly labeled with panel/circuit designation.

L. 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
Fire Alarm	Popsicle Orange K02410
Fiber Optics	Plum Purple K01929
Communications System	Daisy Yellow K01813
Telephone	Clover Green K02012
Grounding	Fluorescent Green K03106

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. 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.

D. Where two colors apply to the same raceway, paint on opposite corners leaving room for panel/ckt./system/etc., labeling in center.

E. 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 (Division 27).

4. Each existing communications cover plate (Division 27) 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 08 00 - DEMONSTRATION OF COMPLETED COMMUNICATIONS 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. This section includes the requirements for demonstration of completed electrical systems:

1.3 DESCRIPTION

A. Demonstrate to Owner the essential features of the following electrical systems:

1. Premise Distribution System

B. Upon completion of testing, each system is to be demonstrated only once.

1.4 TIME

A. The demonstration shall be held upon completion of all systems at a date to be agreed upon in writing by the Owner or his representative.

1.5 ATTENDING PARTIES

A. The demonstration shall be held by this Contractor in the presence of the Owner, Engineer, and the manufacturer's representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

A. Demonstrate the function and location (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.

B. Demonstrate by sending message to Dynamic Message Signage (each) with personnel in the field to verify message was received and displayed.

C. Performance Verification and Demonstration to Owner

1. Submit one copy of Check Out Memo Form for each O & M Manual. (Form at end of this section.) Form shall be signed by the contractor, subcontractor and Owner's authorized representative for "each" type of equipment and system. Complete an individual form for each item, equipment and system.

END OF SECTION

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_____

Equipment Manufacturer_____

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:

_____
MANUFACTURER'S REPRESENTATIVE (PRINT)

_____
ADDRESS

_____
TELEPHONE/FAX/EMAIL

_____
MANUFACTURER'S REPRESENTATIVE (SIGNATURE, TITLE)

_____
DATE CHECKED

WITNESSED BY:

_____
CONTRACTOR'S REPRESENTATIVE (SIGNATURE, TITLE)

*EXCEPTIONS NOTED AT TIME OF CHECK-OUT (USE ADDITIONAL PAGE IF NECESSARY):

SECTION 27 08 13 - TESTS AND PERFORMANCE VERIFICATION OF COMMUNICATIONS 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. This section pertains to the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.

B. Operate system for a 3-day period. Do performance verification work as required to show that the System is operating correctly in accordance with design. Supply instruments required to read data. Adjust System to operate at the required performance levels.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 TESTS

A. Premise Distribution System:

1. General

a) Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.

b) 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.

c) Test all cables/outlets.

d) 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.

e) 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.

f) Contractor shall “PING” all Dynamic Message Signage from Dynamic Message Signage server to verify proper communication with controller and provide screen shot from server to show all sign responding back “OK”.

g) Contractor shall test all Dynamic Message Signage and confirm all signs are communicating with server and new messages can be sent to signs prior to demonstration to engineer and owner.

2. Fiber Optic Cable Testing:

a) 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.

b) Testing Equipment: Tester shall be as manufactured by Agilent Technologies, Fluke, Microtest, Noyes or Wavetek.

c) 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:

1. Measure and record normalized fiber loss at operating wavelength in dB/km.
2. Detect and record point faults or discontinuities.
3. Measure and record overall length of cable.

d) 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 PDF format on CD’s as well as (2) hardbound copies in 3-ring binders. Documentation of testing shall include:

1. 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.
2. OTDR trace(s) shall be submitted with request for substantial completion.

3. Copper UTP Cable Testing:

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 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 without meeting these requirements.

c) 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) 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. 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.

   a) 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.

   b) 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.

   c) 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).

5. Acceptance:

   a) Contractor shall provide the Engineer with written notification of testing schedule ten (10) days prior to commencement.

   b) 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.

6. System Commissioning:

   a) 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.

B. UPS System

1. Simulate power outage during system operation and record run time of each UPS to 20% battery capacity.

2. Record each UPS Load % as indicated on UPS

3.2 DATA PROCESSING

A. Testing Data.

1. Tabulate data for submission.

2. Submit data on 8 1/2" x 11" sheets with date and name of checker with one copy for each operation and maintenance manual.

3. Where specific performance verification information is called for in the specifications, use copies of the sheets provided for recording readings.

4. Data shall be submitted and accepted before check-out memos are signed or a request for final inspection is made.

B. Equipment Check-out.

1. At completion of construction after all performance verification and testing information has been gathered, submitted, and approved, provide one copy of this information to the authorized manufacturer's representative of the equipment.
    a) Manufacturer's authorized representative must be trained by the manufacturer and authorized to inspect, adjust, test, and repair equipment.
2. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is in operation, and sign a Check Out Memo for a record. Check Out Memo is at end of Section Operation and Maintenance Manuals.
    a) Check out of equipment is to include examining performance of equipment and certifying equipment has been installed per manufacturer's recommendations, that all necessary adjustments have been performed and that equipment is operating properly.
3. Submit one (1) copy (for each operation and maintenance manual) of the memo on each major item of equipment. Accepted memos shall be inserted in each O & M manual with the performance verification information and submittal data. Memos shall be submitted and accepted before instruction to owner or a request for final inspection.
4. Items requiring check-out memos are all major items of equipment such as (but not limited to):
    a) Panels, distribution panels, switchboards.
    b) Transformers.
    c) UPS equipment.
    d) Equipment/system installed per Sections Systems..
    e) Any other equipment noted to be checked-out by engineer during construction.
    f) Generators and all controls/annunciation
    g) Main Switchboard
    h) IPS Equipment
5. Do not submit Check-out Memo form at the time Submittal Brochures are submitted. This form shall be completed and submitted before Instruction in Operation to Owner or a request for final inspection.

END OF SECTION

SECTION 27 10 01 - PREMISE DISTRIBUTION WIRING SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. Contractor to provide a complete and operational communications system to interface all Dynamic Message Signage indicated on drawings with existing Daktronix Dynamic Message Signage server. Including all switches, media converters, modules, and programming.

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. Video – Broadband and base band Analog Video, Digital Video, Video Conferencing.

3. 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 / Panel mounted Fiber Distribution Units (FDU's), UTP cables shall terminate on rack-mounted / panel 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 manufacturers 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 manufacturers 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. The contractor shall provide the necessary equipment to have all fiber optic splices and terminations are conducted in an environmentally controlled enclosure. The Contractor shall coordinate with County IT and Security, FHP, DOT, and Traffic engineering for work to be done in the roadways. The contractor is responsible for the cost associated with FHP, DOT and Traffic engineering. Contractor shall also coordinate and contract DAKTRONICS for all programming of existing signs. The contractor is responsible for the cost associated with Daktronics.

H. The Contractor is advised that circuit routing for this system is not shown on the project drawings. The Contractor shall perform testing on all existing Fiber Optic cable, any deficiencies in performance shall be reported to the owner and the engineer. 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 firestopping where penetrations are made through rated walls and floors. Provide and install duct seal in all conduits within Nema boxes and IDF rooms.

I. Refer to attachments.

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. Media Converters
6. LAN Switches as indicated
7. Conduits, outlet boxes, cabinets, identification, etc.: Conform to applicable sections in these specifications. Provide/install complete with all required basic materials.
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. All backbone cable shall be installed in conduit or cable tray.

D. Provide a complete and operational communications network including Fiber optic and copper cable to support all Dynamic Message Signage noted in sign schedule and located at and around the OCCC Site.

E. System shall be capable of communication to all Multi Mode fiber signs from existing Daktronis server located in West Building W220 Server Room via RS-232 Serial to F.O. medial converters and serial data cable to sign controllers / server.

F. System shall be capable of communication to all Single Mode fiber signs from existing Daktronis server located in West Building W220 Server Room via LAN TCP/IP hardened

switches located at sign and connected via SM F.O. to local IDF/MDF in OCCC NSB or West Building as noted on drawings. Provide CAT 6 Cables from hardened switch to sign controllers.

G. Where existing fiber is being reused contractor shall re-terminate as indicated on drawings and in specifications below, and provide As-Built documents indicating exact conduit routing, fiber termination, equipment connected to fiber strands (including polarity when necessary) and fiber test results.

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-455 “Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components”
5. TIA/EIA-606 “Administration Standard for Telecommunications Infrastructure of Commercial Buildings”, CSA T528.
6. TIA/EIA-607 “Commercial Building Grounding/Bonding Requirements”.
7. TSB-67 “Transmission Performance Specification for Field Testing of Unshielded Twisted Pair Cabling Systems”.
8. TIA/EIA TSB-72 “Centralized Optical Fiber Cabling Guidelines”.
9. *TIA/EIA PN-3398 TSB-75 “Additional Horizontal Cabling Practices for Open Offices”.
10. ANSI/NFPA 70 National Electrical Code, CSA C22.1.
11. BICSI Telecommunications Distribution Methods Manuals
12. BICSI Telecommunications Installation Manuals
13. County Codes and Regulations.
14. Underwriters Laboratories (UL)
15. FCC -Federal Communications Commission
16. ADA Requirements
17. Occupational Safety and Health Regulations (OSHA)
18. National Fire Protection Association (NFPA)
19. Florida Statutes and Administrative Rules
20. Cabling System Certified Cabling Catalog
21. American Society for Testing and Materials (ASTM)
22. EIA/TIA-492AAAA - Detail Specification for 50 Micrometer Core Diameter/125

Micrometer Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers.

23. EIA/TIA TSB-36 - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Cables.
24. EIA/TIA TSB-40-A - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Connecting Hardware.
25. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems
26. LPC - Lightning Protection Code (NFPA-780).
27. UL Certified - UL's LAN Cable Certification Program.
28. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
29. UL 1666 - Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts.
30. UL 1449, 3rd Edition – Standard for Safety for Surge Protective Devices.
31. UL 497, UL 497A, UL 497B
32. ANSI - American National Standards Institute
33. NEMA - National Electrical Manufacturer's Association
34. 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 (including Outside Plant Fiber Optics) 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 for a minimum of (5) five years. 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. The contractor shall have previous experience working with DOT (Department Of Transportation) fiber optic cable. The Contractor shall provide a list of a minimum (3) three similar projects (with (2) two being DOT projects) within the last 5 years.

1.7 SUBMITTALS

A. Submit in accordance with Section 27 05 00 Common Work Results for Communications and Section 27 05 07 Submittals.

1.8 PROJECT RECORD DOCUMENTS

A. Submit in accordance with Section 27 05 00 Common Work Results for Communications 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 Communications 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. Coordination: Contractor shall coordinate all installation with OCCC IT and Security as well as with Trevor Slaight with Daktronics. Trevor's main contact is through email at Trevor.Slaight@Daktronics.com or by phone at 605-691-9725.

C. 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.

D. 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.

E. 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.

F. Fiber being affected by this project is shared by OCCC and OC Traffic Engineering. All work shall be coordinated with OC Traffic Engineering. It shall be understood to the contractor all outages to existing serves being fed by fiber shall be coordinate and approved prior to outage by OCCC Project Management and OC Traffic Engineering. All work shall be performed during normal daylight hours except for the cantilever signs hung over the roadway(s). All work to be done to those specific signs shall be completed overnight. Contractor shall coordinate with FDOT and FHP. Contractor shall be responsible for those costs.

1.11 DEFINITIONS

A. 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.

B. 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.

C. 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.

D. 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 (5) MM Serial Media Converters.

B. Provide (5) Hardened LAN Switches.

C. Provide (5) Fiber SFP Modules for hardened switches

1.13 MAINTENANCE SERVICE AND WARRANTY

A. Furnish service and maintenance of premises wiring, Media Converters, and Surge devices 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 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. Exterior Nema enclosures shall be clearly stenciled on the rear of the enclosure with the corresponding sign number.

E. Labeling guidelines are ANSI/TIA 606 Administration Standards for Telecommunication Infrastructure of Commercial Buildings with Owner specific asset nomenclature.

F. 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.

G. 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.

H. Place a riser or OSP fiber label on the door of FDUs 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. Contractor shall provide extra copy of all labels to OCCC.

L. 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.

M. 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.

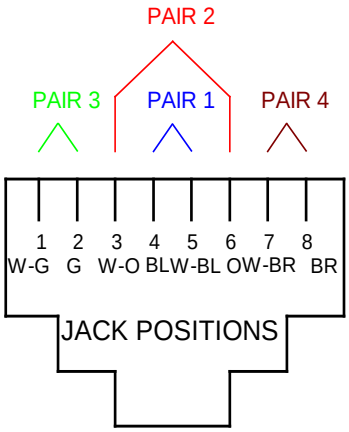
2.4 OUTLETS

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.

2.5 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

2.6 FIBER OPTIC CABLING

A. Single Mode Fiber Optic Cabling:

a) Existing OSP: (12SM) (96SM) strand

B. Multi Mode Fiber Optic Cabling (24-Strand):

a) Existing OSP: (6MM)

C. Hybrid Mode Fiber Optic Cabling (24-Strand):

a) Existing OSP: (12SM/12MM) and (24SM/24MM)

D. Composite cables are approved with compliance of above specifications where applicable.

E. All terminations shall utilize a Factory terminated pigtail assembly and be fusion spliced to fiber cable. Fusion splice shall be made in splice tray located inside FDU's. Fiber splice tray shall be by same manufacturer as FDU. Only use the manufacturer's specified adhesives and hardware for terminations. Only terminate in a dust free environment, making certain to maintain the cleanliness of the termination area. Follow manufacture's guidelines for terminations. Do not over pull the cabling (pull only by the aramid yarn strength member) or exceed it maximum bend radius. Do not over tighten the Velcro tie wraps.

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.

2.7 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 Patch Panel.
    a) Provide CAT-6 modules as required to terminate all cabling.
    b) Basis of Design: Panduit #CPPL48WBLY
3. Approved 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 110-connector 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

2.8 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 (0U): Use at Sign and DOT Cabinet
    a) Basis of Design: Corning #SPH-01P (or approved equal)
2. Blank Panels for all unused opening in FDU

a) Basis of Design: Corning (or approved equal)

3. Coupling Panels for "FDU", (Single-Mode)

a) SC Style Connectors

b) Basis of Design: Corning #CCHCP12 (or approved equal)

4. Coupling Panels for "FDU", (Multi-Mode)

a) ST Style Connectors

b) Basis of Design: Corning #CCHCP06 (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) new 6’ duplex patch cables at each FDU Location inside building and in DOT cabinets

3. Provide (2) new 3’ duplex patch cable at all sign locations from media converter to FDU.

D. Provide label indicating each strand ID and location of other end termination. (FDU/NODE/TRSP/ROOM#). And discrete cable identifier.

2.9 SERIAL FIBER CONVERTER (MM)

A. Fully-digital transceiver unit designed for implementing simplex or full-duplex RS-232 drop and repeat poll-and-respond traffic signalization/communications data networks utilizing two optical fibers.

B. Environmentally hardened units for use in unconditioned out-of-plant or roadside installations.

C. Plug-and-play design requiring no electrical or optical adjustments.

D. LED indicators are provided for rapidly ascertaining equipment operating status, and these units are available in either stand-alone or rack-mount configurations.

E. Provide Hardened, high ambient temp 12VDC 500ma (MIN) panel mount power supply.

F. Basis of Design: Interlogix D9100 IFS RS-232/422 Data Transceiver.

1. No substitution will be accepted.

2.10 HARDENED LAN SWITCH (SM)

A. Hardened LAN Switch with 4 Ethernet 10/100 ports and 2 Dual-Purpose Uplinks (Each Dual

Purpose Uplink port has one 10/100/1000 Ethernet Port and one SFP based Gigabit Ethernet port, one port active) □

B. Each switch supports two (2) Cisco IE3000-8FE modules, one (1) Cisco IE3000-8FX module, or one (1) Cisco IE3000-8FE module and one (1) Cisco IE3000-8FX module

C. Provide AC-DC expansion Power Module, Input AC 110-220V/1.4A, 50-60Hz. Output 54VDC/1.2 A, DIN-Rail Mount.

D. Switch and power supply shall be DIN mountable.

E. Basis of Design: Cisco IE-3000-4TC

1. Acceptable substitution: Moxa EDS-608

2. Acceptable Substitution: Red Lion N-Tron 508FX2-A

2.11 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.

2.12 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. Properly ground system per applicable sections of these specifications.

7. Support raceways, backboards, and cabinets as required by manufacturer's instructions.

8. Install raceways to conform to applicable sections of these specifications.

9. 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.

10. 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.

11. Components of the premise distribution system shall be installed in a neat, workmanlike manner consistent with the best telephone and data practices.
12. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the building.
13. Identification markings and systems shall be uniform.
14. T568A wiring codes as shown on the drawings shall standardize all twisted pair wiring.
15. Contractor shall re-program all Dynamic Message Signage controllers with new Sign ID designation. Daktronix server shall also be updated with new sign ID's.
16. Refer to attachment for MM Serial Converter installation requirements. Note they are daisy chained and polarity sensitive.
17. Incorrect wiring down stream will affect upstream devices.

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 non-shielded 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. 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.

3. 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.

4. 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."

5. No box shall be smaller than that required by NEC 314.28(A) (1) and (2).

E. 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.

F. 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.

G. 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 12-inch 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 1-4 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 12-inch 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.

10. All Fiber Optic terminations shall be terminated inside a mechanically controlled environment. Underground, tent and temporary structures are not considered acceptable termination areas. Only clean, low humidity temperature controlled environments are considered acceptable for Fiber Terminations.

H. All conduits and/or innerducts containing fiber optic cables shall have a pull string to accommodate the future installation of additional fiber optic cables.

I. 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.

J. 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 3-ring 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

interlogix
A UTC Fire & Security Company

D9110
D9110-R3
D9120
D9120-R3
D9130
D9130-R3
D9110E
D9110E-R3
D9120E
D9120E-R3
D9130E
D9130E-R3

IFS Fiber Module Installation & Operation Instructions

P/N 1062846 • REV B • ISS 01AUG11

D9100 SERIES

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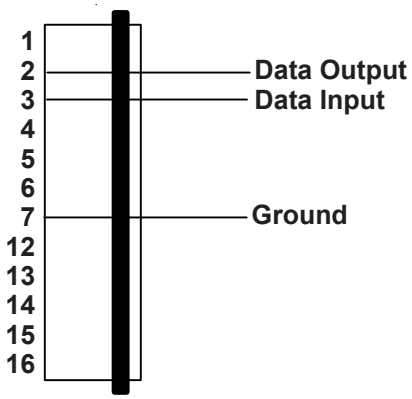

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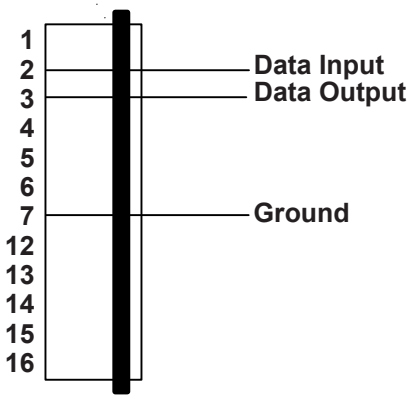
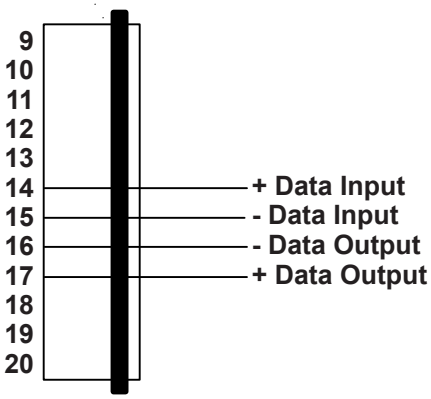
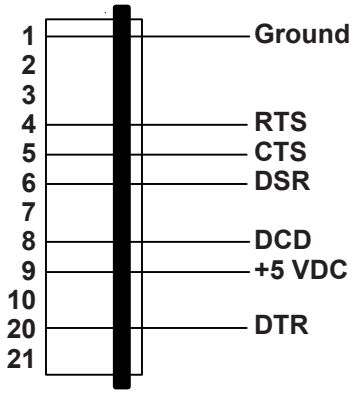


RS - 422 DATA

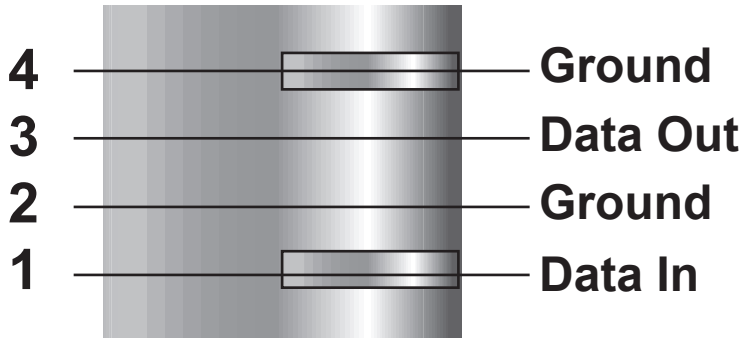


CONTROL LINES

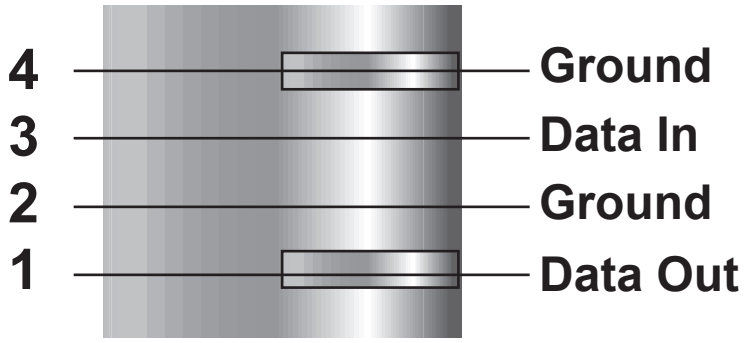


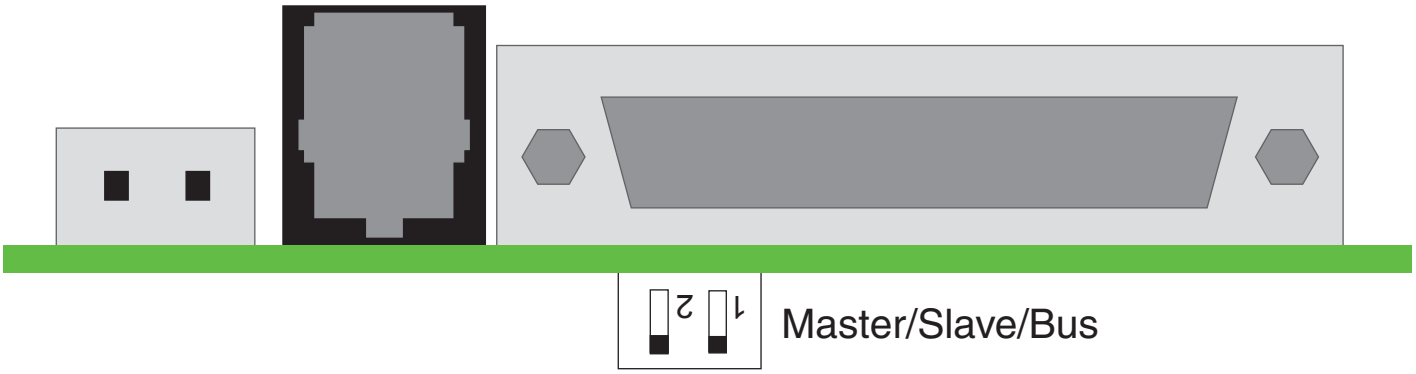
D9100 SERIES

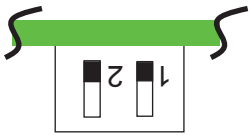
A/B SWITCH POSITION A



A/B SWITCH POSITION B

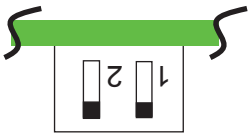






Slave

Master

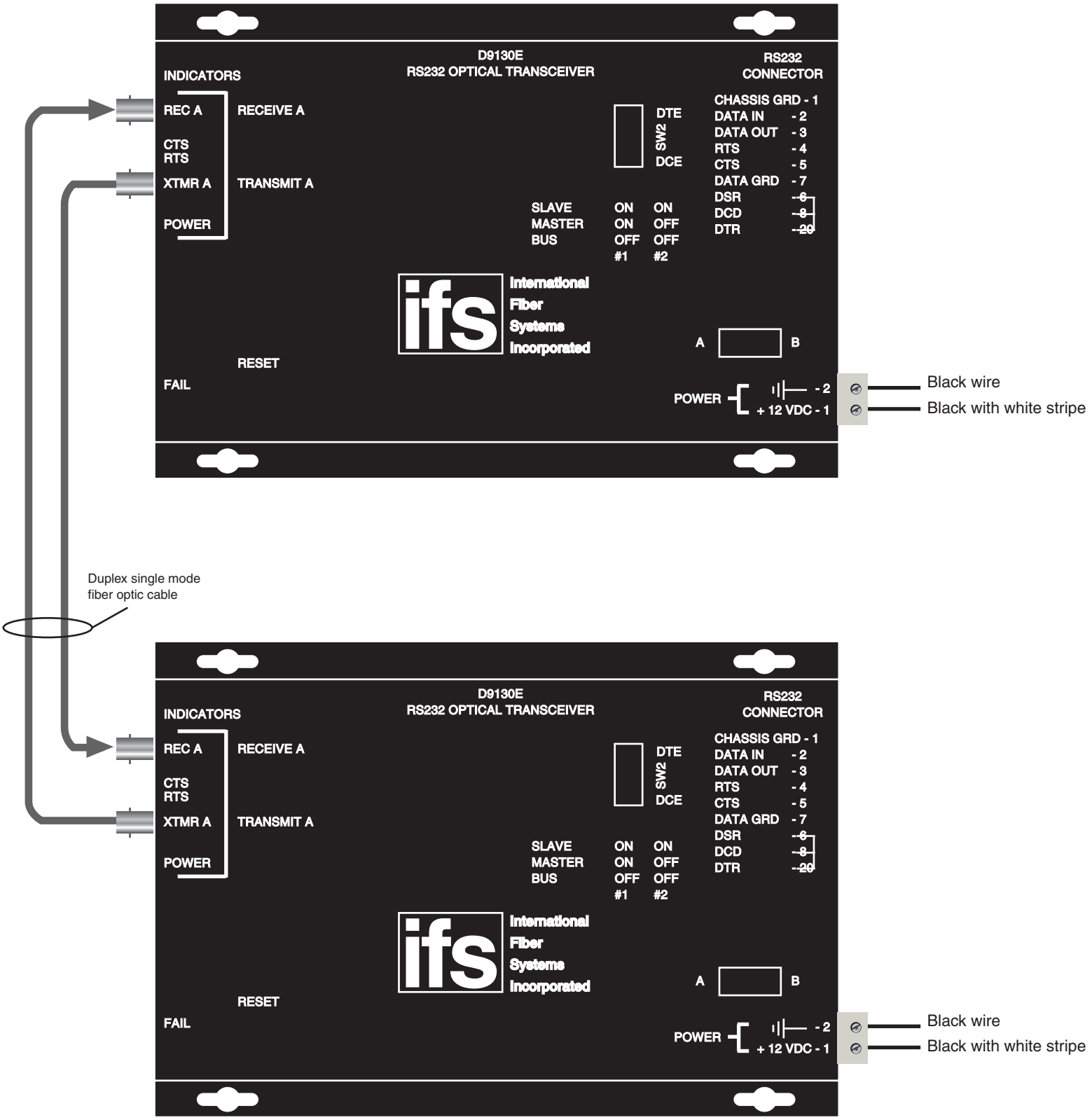


Bus

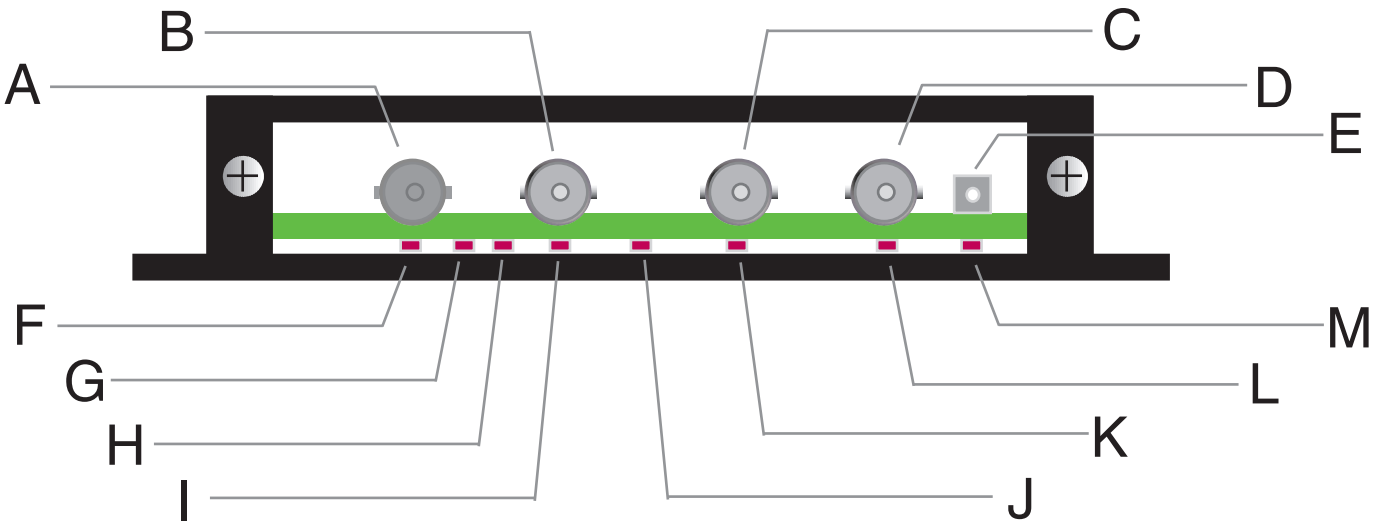
Note: The MASTER / SLAVE / BUS switch is functional only on the D9100 Series units, not the D9100E Series units.

REPEATER CONFIGURATION

POINT - TO - POINT CONFIGURATION



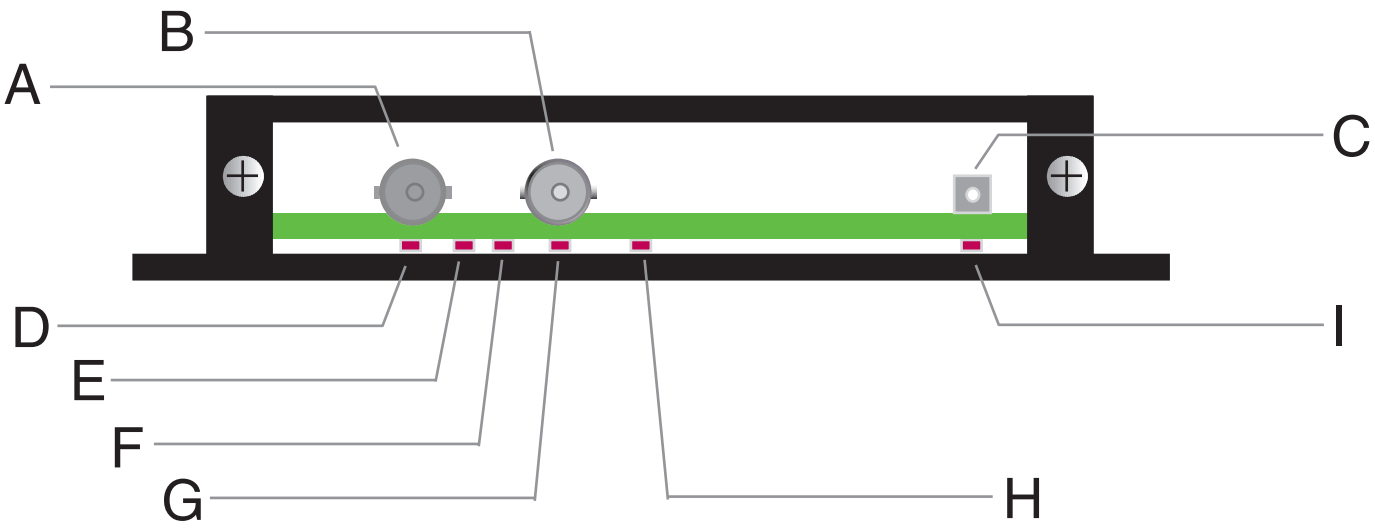
D9100



A	Data Receive Channel A	
B	Data Transmit Channel A	
C	Data Receive Channel B	
D	Data Transmit Channel B	
E	Reset Switch	
F	Receive Channel A	LED illuminates
G	CTS (Clear To Send)	LED illuminates
H	RTS (Request To Send)	LED illuminates
I	Transmit Channel A	LED illuminates
J	Power	LED illuminates
K	Receive Channel B	LED illuminates
L	Transmit Channel B	LED illuminates
M	Fail	LED illuminates

NOTE: WITHOUT PROPER FIBER CONNECTION, LED's DO NOT INDICATE CORRECT OPERATIONAL STATUS OF THE UNIT.

D9100E



A	Data Receive	
B	Data Transmit	
C	Reset Switch	
D	Receive	LED illuminates
E	CTS (Clear To Send)	LED illuminates
F	RTS (Request To Send)	LED illuminates
G	Transmit	LED illuminates
H	Power	LED illuminates
I	Fail	LED illuminates

NOTE: WITHOUT PROPER FIBER CONNECTION, LED's DO NOT INDICATE CORRECT OPERATIONAL STATUS OF THE UNIT.

FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation.

Changes or modifications not expressly approved by International Fiber Systems, Inc. could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CLASS 1 LASER PRODUCT
(For purposes of IEC 60825-1)

Complies with FDA Performance Standard for Laser Products
Title 21
Code of Federal Regulations
Subchapter J

ifs

Comprehensive Lifetime Warranty

(a) Seller warrants to the original End User that products and any services furnished hereunder will be free from defects in material and workmanship as of the date of delivery, and will conform to Seller's published technical specifications. The foregoing shall apply only to failures to meet said warranties which appear within that period of time during which the Products are installed in their original installation for the original End User and operator of such Products; provided, however, that in the event of product discontinuance, warranty support is limited to five (5) years from the announcement of discontinuance. Notwithstanding the preceding sentence, the duration of the warranty period for products not manufactured by Seller (e.g., fiber optic cabling, test equipment, power supplies or batteries) shall be the warranty period offered by the original manufacturer, if any.

(b) The conditions of any tests shall be mutually agreed upon and Seller shall be notified of, and may be represented at, all tests that may be made. The warranties and remedies set forth herein are conditioned upon (a) proper storage, installation, use and maintenance, and conformance with any applicable recommendations of Seller and (b) Buyer promptly notifying Seller of any defects and, if required, promptly making the product available for correction.

(c) If any product or service fails to meet the foregoing warranties, Seller shall thereupon correct any such failure either at its option, (i) by repairing any defective or damaged product or parts of the products, or (ii) by making available any necessary repaired or replacement products or parts thereof. Any repaired or replacement part or product shall be warranted for the remaining period of the original Warranty Period. Seller shall pay, or credit Buyer for, the cost of freight for all return shipments of products or parts to Buyer. Where a failure cannot be corrected by Seller's reasonable efforts, the parties will negotiate an equitable adjustment in price.

(d) The preceding paragraph sets forth the exclusive remedies for claims based on defect in or failure of products or services, whether the claim is in contract, indemnity, warranty, tort (including Seller's negligence), strict liability or otherwise and however instituted. Upon the expiration of the warranty period, all such liability shall terminate and BUYER shall have a reasonable time, within thirty days after the warranty period, to give written notice of any defects which appeared during the warranty period. The foregoing warranties are exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED OR STATUTORY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY. Seller does not warrant any products or services of others which BUYER has designated.

Contacting us

For help installing, operating, maintaining, and troubleshooting this product, refer to this document and any other documentation provided. If you still have questions, contact us during business hours (Monday through Friday, excluding holidays, between 5 a.m. and 5 p.m. Pacific Time).

Sales and support contact information

North America	**Toll-free:** 855.286.8889 in the US, including Alaska and Hawaii; Puerto Rico; Canada. Outside the toll-free area: 503.885.5700. E-mail: *techsupport@interlogix.com*
Europe	Select *Contact Us* at www.utcfssecurityproducts.eu
Australia	security.tech.support@interlogix.com.au

Note: Be ready at the equipment before calling.

Online

Another great resource for assistance with your Interlogix product is our online publication library. To access the library, go to our website at the following location:

http://www.interlogix.com/transmission[1]

1. Many Interlogix documents are provided as PDFs (portable document format). To read these documents, you will need Adobe Reader, which can be downloaded free from Adobe's website at *www.adobe.com*.

Product Disassembly Instructions for WEEE

Per European Directive 2002/95/EC Waste Electrical and Electronic Equipment

Required Tools:

One number 2 Phillips (crosstip) screwdriver.
One number 2 flat screwdriver.

For the enclosed box version:

1. **Locate and remove box cover securement screws. Usually, but not limited to, at least 4 screws.**
2. **Lift off box top cover.**
3. **Locate and remove securement screws for printed circuit board.**
4. **If there are multiple boards to the assembly, continue removing securement screws until none are left.**
5. **Lift off printed circuit board.**
6. **Disassembly of box version of product is complete.**

For rack version:

1. **Locate and remove securement screws for printed circuit board. Usually, but not limited to, at least 4 screws.**
2. **If there are multiple boards to the assembly, continue removing securement screws until none are left.**
3. **Lift off printed circuit board(s).**
4. **Disassembly of rack card version of product is complete.**

Trademarks and patents

Interlogix and IFS names and logos are trademarks of UTC Fire & Security.

Other trade names used in this document may be trademarks or registered trademarks of the manufacturers or vendors of the respective products.

Manufacturer

UTC Fire & Security Americas Corporation, Inc.
2955 Red Hill Avenue, Costa Mesa, CA 92626-5923, USA

Authorized EU manufacturing representative:
UTC Fire & Security B.V.
Kelvinstraat 7, 6003 DH Weert, The Netherlands

Certification

CE N4131

ACMA compliance

Notice! This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Canada

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Union directives

2004/108/EC (EMC directive): Hereby, UTC Fire & Security declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2004/108/EC.

2002/96/EC (WEEE directive): Products marked with this symbol cannot be disposed of as unsorted municipal waste in the European Union. For proper recycling, return this product to your local supplier upon the purchase of equivalent new equipment, or dispose of it at designated collection points. For more information see: www.recyclethis.info.

Contact information

For contact information, see www.interlogix.com.