ORANGE COUNTY CONVENTION CENTER
PHASE 1 HALL D CATWALK POWER

BID DOCUMENTS

FOR
ORANGE COUNTY
CAPITAL PLANNING & CONSTRUCTION GROUP
ORANGE COUNTY CONVENTION CENTER
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PHASE I HALL D CATWALK POWER

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TABLE OF CONTENTS

Division 1	**General Requirements**
01010	Summary of Work
01027	Application for Payment
01035	Modification Procedures
01040	Project Coordination
01045	Cutting and Patching
01200	Project Meetings
01300	Submittals
01380	Construction Photographs
01631	Product Substitutions
01700	Project Close-Out
01740	Warranties and Bonds
01800	Orange County BCC Standards Summary

Division 16	**Electrical**
16010	Basic Electrical Requirements
16012	Submittals
16014	Reference Standards and Regulatory Requirements
16015	Electrical Symbols and Abbreviations
16060	Minor Electrical Demolition for Remodeling
16061	Investigation of Existing Electrical Systems
16090	Tests and Performance Verification of Electrical System
16095	Demonstration of Completed Electrical Systems
16098	Operation and Maintenance Manuals
16111	Conduit
16123	Building Wire and Cable
16131	Outlet Boxes
16133	Pull and Junction Boxes
16141	Wiring Devices
16160	Cabinets and Enclosures
16170	Grounding and Bonding
16180	Equipment Wiring Systems
16190	Hangers and Supports
16195	Identification for Electrical Systems
16410	Power System Study With Arc Flash Analysis
16484	Motor Control
16691	Surge Protective Devices

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

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

1.02 PROJECT DESCRIPTION

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

1.03 SCOPE OF WORK

A. Summary of work:

1. Connection to existing switch gear installed under previous package. Existing switch gear is located at exterior location adjacent to West wood Lobby. Contractor shall provide and install new distribution equipment as indicated on project documents.
2. Contractor shall note that installation heights are 40+ feet in certain locations and is highly recommend to visit site prior to bidding to ensure proper lifts and access is taken into account.

B. All new interior color schemes and furniture will be selected by the County.

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

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

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

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

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

5. 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.

6. 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.

7. 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 active 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.

8. The contractor shall videotape or take pictures of pre-existing conditions of the interior and exterior of the building prior to the start of active construction. Failure to provide photographs or videotape 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 set of photographs (in a three-ring binder) or videotape of the site existing conditions shall be submitted to the Owner.

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

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

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

1.04 WORK UNDER OTHER CONTRACTS

A. Separate contracts may be issued to perform certain construction operations at the site.

1.05 WORK SEQUENCE

A. Portions of the facility shall remain fully occupied and operational during work. All work shall be fully coordinated in writing with Convention Center Staff prior to commencement of work.
B. The contractor may work on the weekends at his or her discretion. Weekend work shall not be an additional cost to the Owner. The contractor will coordinate with the Owner for access to the building on weekends and after hours work.
C. Convention Center shall direct contractor on which days and hours are acceptable for work.

1.06 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 coordinated 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 portions 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 use any portion of the site for storage or work areas or any legal purpose.

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 it’s 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.

8. Comply with Owners’ requirements for ingress and egress procedures, prohibitions against firearms, procedures for transportation of workers, safety and fire prevention requirements and pollution control requirements.

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. Smoking is not allowed inside the building.

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.

1.07 SECURITY AND IDENTIFICATION

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

B. Background Checks for the contractor's staff must be approved by Orange County's Security team prior to working in any County facility. Contractors are responsible for obtaining the necessary forms for background checks for work at the Convention Center. All contractor's staff background checks will be sent to Crystal.Rurut@occc.net for approval.

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

D. The 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.

F. Work hours will be scheduled around business activity. Work is required to be scheduled around no show activity in section of the building project work is scheduled. Contractor will be required to mobilize more than once to accommodate Convention Center show schedules.

1.08 OWNER OCCUPANCY

A. Owner Occupancy: The Owner will be occupying the building during construction. Normal occupancy hours are 7 AM to 6 PM Monday through Saturday and various shows may occupy the building at anytime. The contractor is to coordinate with the Owner's representative for areas in the building that work can be performed on 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.

1.09 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.

1.10 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

2.01 ASBESTOS FREE MATERIAL

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

PART 3 - EXECUTION (Not applicable).

END OF SECTION 01010

SECTION 01027
APPLICATION FOR PAYMENT

PART I GENERAL

1.01 RELATED DOCUMENTS

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

1.02 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 01300 – "SUBMITTALS".

1.03 SCHEDULE OF VALUES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. List of principal subcontractors
2. List of principal suppliers and fabricators
3. Schedule of Values
4. Approved Contractor's Construction Schedule (preliminary if not final)
5. Schedule of principal products
6. Schedule of unit prices (if applicable)
7. Submittal schedule (preliminary if not final)
8. List of Contractor's staff assignments
9. List of Contractor's principal consultants
10. Copies of building permits for trades requiring separate permits
11. Copies of authorizations and licenses from governing authorities for performance of the Work
12. Initial progress report
13. Report of Pre-construction Meeting
14. Initial settlement survey and damage report, (if required)
15. Listing of all long lead procurement items monthly applications for payment will be accompanied with updated schedule and review of as-built drawings

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

I. Application for Payment at Substantial Completion: Following issuance of the Certificate

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

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

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

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

1. Completion of Project Close-Out requirements
2. Completion of items specified for completion after Substantial Completion
3. Assurance that unsettled claims will be settled
4. Assurance that all work has been completed and accepted
5. Proof that taxes, fees and similar obligations have been paid
6. Removal of temporary facilities and services
7. Removal of surplus materials, rubbish and similar elements
8. Change of door locks to Owner's access
9. Submission of all close-out documents. Refer to Section 01700.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01035
MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 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 1 Section 01300 Submittals for requirements for the Contractor's Construction Schedule.
2. Division 1 Section 01027 Application for Payment for administrative procedures governing applications for payment.
3. Division 1 Section 01631 Product Substitutions for administrative procedures for handling requests for substitutions made after award of the Contract.

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. Comply with requirements in Section 01631 “Product Substitutions” - if the proposed change in the work requires that substitution of one product or system for a product or system not specified.

5. Contractor and subcontractors 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 01035

SECTION 01040
PROJECT COORDINATION

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

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

1.02 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 01200 “Project Meetings”.

C. Requirements for the Contractor’s Construction Schedule are included in Section 01300 “Submittals”.

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 in 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 “Submittals”.

4. Refer to Division-15 Section “Basic Mechanical Requirements,” and Division-16 Section “Basic Electrical Requirements” for specific coordination Drawing requirements for mechanical and electrical installations.

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 the

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 01040

SECTION 01045
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-1 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-16 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 Divisions 15 and 16 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.

4. Comply with requirements of applicable Sections of Division-2 where cutting and patching required excavating and backfilling.

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 01045

SECTION 01200
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-1 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 01300 Submittals.

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 01200

SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

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

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

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

C. The Schedule of Values submittal is included in Section 01027 "Applications for Payment".

1.03 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., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
2) Where multiple products are shown, highlight/circle or identify product intended to be used

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

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

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

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

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

1.04 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.

1.05 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.

1.06 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

1.07 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.

1.08 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.

1.09 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 01300

SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. General: This Section specifies administrative and procedural requirements for construction photographs.

1.03 SUBMITTALS

A. General: Refer to Division 1 Section “Submittals” for general requirements for submitting photographs.

B. Prints: Submit 3 prints of each view directly to the Project Manager within 5 days of taking photographs. The Project Manager will distribute prints as follows:

1. One print to the Contractor shall be retained in the field office at the project site and available at all times for reference.

2. One print to the Owner as the Owner’s permanent record.

3. One print shall be retained in the Architect’s files.

C. Extra Prints: When requested by the Architect, the photographer shall submit extra prints of photographs, with distribution directly to designated parties who will pay the costs for the extra prints directly to the photographer.

D. Negatives: Retain the photographic negatives 3 years after date of Substantial Completion. During this period, the photographer shall fill orders by the Architect for extra prints. Extra prints shall be priced at prevailing local commercial prices.

1.04 QUALITY ASSURANCE

A. Engage a qualified commercial photographer to take photographs during construction.

B. Photographer’s Qualifications: Photographer shall be a firm or an individual of established reputation who has been regularly engaged as a professional photographer for not less than 3 years.

C. Associated Services: Cooperate with the photographer’s work. Provide reasonable auxiliary services as requested, including access and use of temporary facilities including temporary lighting.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC COPIES

A. Provide 8" x 10" smooth surface gloss color prints on single-weight commercial-grade stock, mounted on muslin. Allow a 1" wide margin punched for standard 3-ring binder.

Place margin on the left edge for vertical shots and at the top for horizontal shots.

B. Identification: Label each photograph on the front in the bottom margin with project name and date the photograph was taken. On the back of each print provide an applied label or rubber stamped impression with the following information:

1. Name of the Project
2. Name and address of the photographer
3. Name of the Architect
4. Name of the Contractor
5. Date the photograph was taken
6. Architect's Project No.

C. Description of vantage point, in terms of location, direction (by compass point), and evaluation of story on construction.

PART 3 - EXECUTION

3.01 PHOTOGRAPHIC REQUIREMENTS

A. Take three (3) color project photographs at monthly intervals, coinciding with the cutoff date associated with each Application for Payment. The photographer shall select the vantage points for each shot each month to best show the status of construction and progress since the last photographs were taken.

B. Additional Photographs: From time to time the Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order, and are not included in the Contract Sum or an Allowance.

1. The Architect will give the photographer 3 days notice, where feasible.

2. In emergency situations, the photographer shall take additional photographs within 24 hours of the Architect's request.

C. Circumstances that could require additional photographs include, but are not limited to:

1. Substantial Completion of a major phase or component of Work.

2. Owner's request for special publicity photographs.

3. Special events planned at project site.

D. Immediate follow-up when on-site events result in construction damage or losses. Photographs to be taken at fabrication locations away from project site; these are not subject to unit prices or unit-cost allowances. Extra record photographs at time of final acceptance.

E. Construction projects over $1,000,000 shall include at least one of the photographs listed in 3.01.A be aerial.

END OF SECTION 01380

SECTION 01631
PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling request for substitutions made during bidding and after award of the Contract.

B. The Contractor's Installation Schedule and the Schedule of Submittals are included under Section "Submittals".

C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

D. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment".

1.03 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: The Contract will be awarded based on the design, methods, materials and/or equipment as addressed in the Contract Drawings and/or described in the Contract Specifications, without any consideration for substitution or "or-equal" replacement. Addressing, describing or naming an item is intended to establish the type, function, characteristics and quality required in order to establish a base for bidding.

1. Within thirty (30) days after Contract award, the Contractor may submit for approval substitutes for any equipment and/or material. In addition to the product documents, a written certification shall accompany the documentation indicating that the proposed substitute will have the same characteristics, will perform in accordance with the design requirements and that complies with all the requirements set for in the Contract. Any additional information required by the Owner or County Representative shall be provided by the Contractor. Rejection of any proposed substitute will be considered final and the Contractor shall not get into any agreement with manufacturers or providers until the submittal has been finally approved.

2. The submission of this documentation shall follow the requirements set quality required in order to establish a base for bidding.

1.04 SUBMITTALS

A. Substitution Request Submittal: Request for substitution will be considered if received within thirty (30) days after contract award. As long as this time allowance will not impact the construction schedule.

1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:
   a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
   b. Samples, where applicable or requested.
   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   e. A statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   f. Cost information, including a proposal of the net change, if any in the Contract Sum.
   g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

3. Engineer's Action: Within two weeks of receipt of the request for substitution, the Engineer will request additional information or documentation necessary for evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the project specified by name. Decision on the use of a product substitution or its rejection by the Engineer is considered final. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise request will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

2. Proposed changes are in keeping with the general intent of Contract Documents.

3. The request is timely, fully documented and properly submitted.

4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

6. A substantial advantage is offered to the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

B. The Contractor's submittal and Project Manager's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

C. Substitution request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.

2. Will provide the same warranty for substitution as for specified product.

3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.

4. Waives claims for additional costs which may subsequently become apparent. All costs associated with the substitution will be paid by the Contractor regardless of approvals given, and regardless of subsequent difficulties experienced as a result of substitutions.

END OF SECTION 01631

SECTION 01700
PROJECT CLOSE-OUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.01 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. Close-out requirements for specific construction activities are included in the appropriate Sections in Divisions 15 through 16.

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

1.03 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.

1.04 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.

1.05 RECORD DOCUMENT SUBMITTALS

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

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation; where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the

Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owner's representative.

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

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

3. Note related Change Order numbers where applicable.

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

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

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

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

D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

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

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

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed,

ready for continued use and reference. Submit to the Project Manager for the Owner's records.

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

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 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

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

1. Contacts: Set up a separate PDF for the contacts. No bookmarks are needed for this section.
2. As-Builts: All as-built drawings will be landscape.
3. Submittals: All technical submittal items (approved and approved as noted) will be provided and sorted by the 16 standard divisions. Bookmarks will be needed for the appropriate divisions.
4. Operations and Maintenance Manual: Specify the division name only in the bookmarks (1-16). Please note that all items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify works on the scanned documents.
5. Permitting: This should include the Certificate of Occupancy and any other document that the Project Manager may include pertaining to the permitting for the project.

3.03 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in Section - Temporary Facilities.

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

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

a. Remove labels that are not permanent labels.

b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.

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

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

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

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

END OF SECTION 01700

SECTION 01740
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-1 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 close-out requirements are included in Section "Project Close-Out".

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 of Division 2 through 16 for specific content requirements, and 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 01740

SECTION 01800
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.

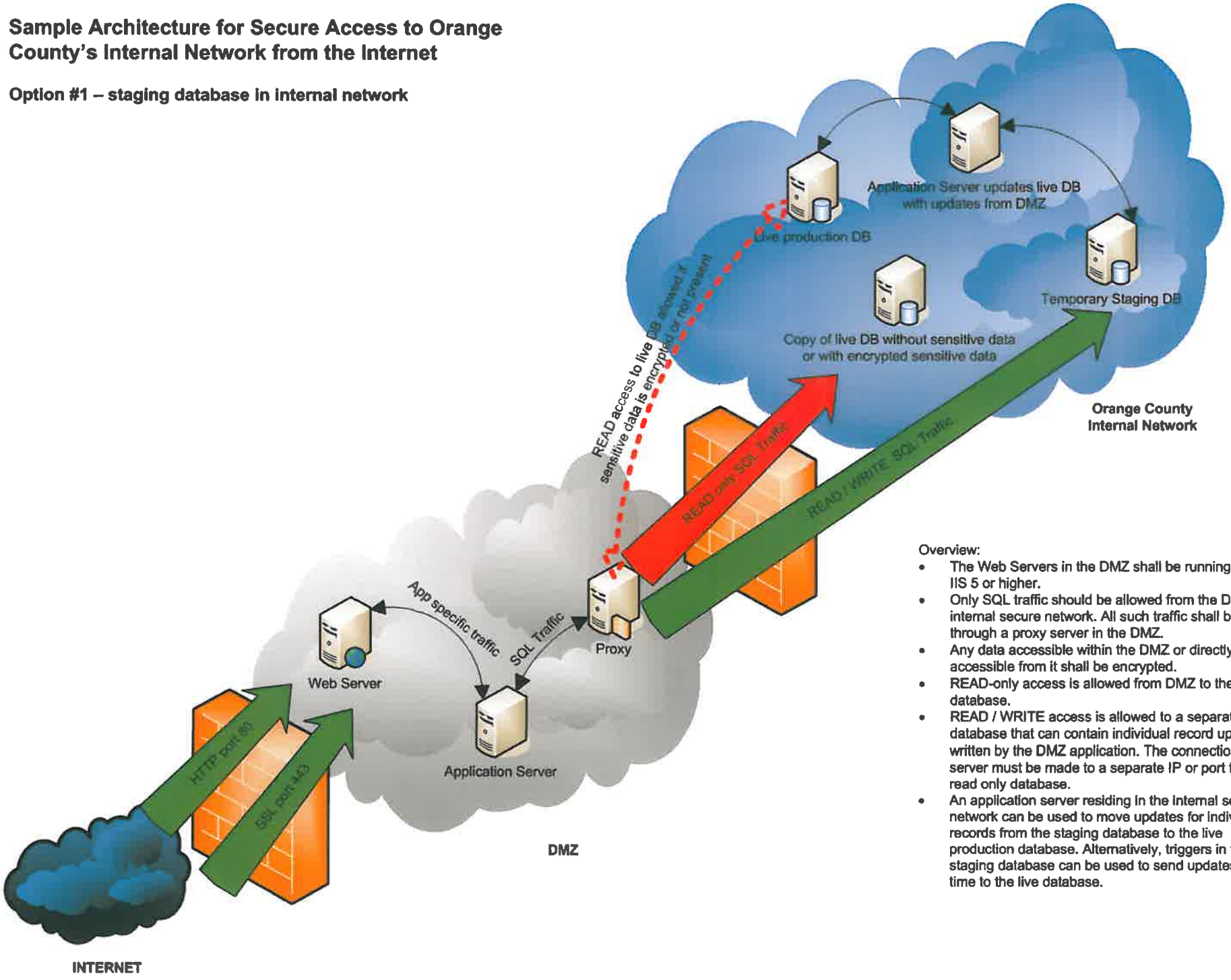
2. Front Page Extensions A series of scripts that can be employed using Microsoft FrontPage, visual HTML editor.

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

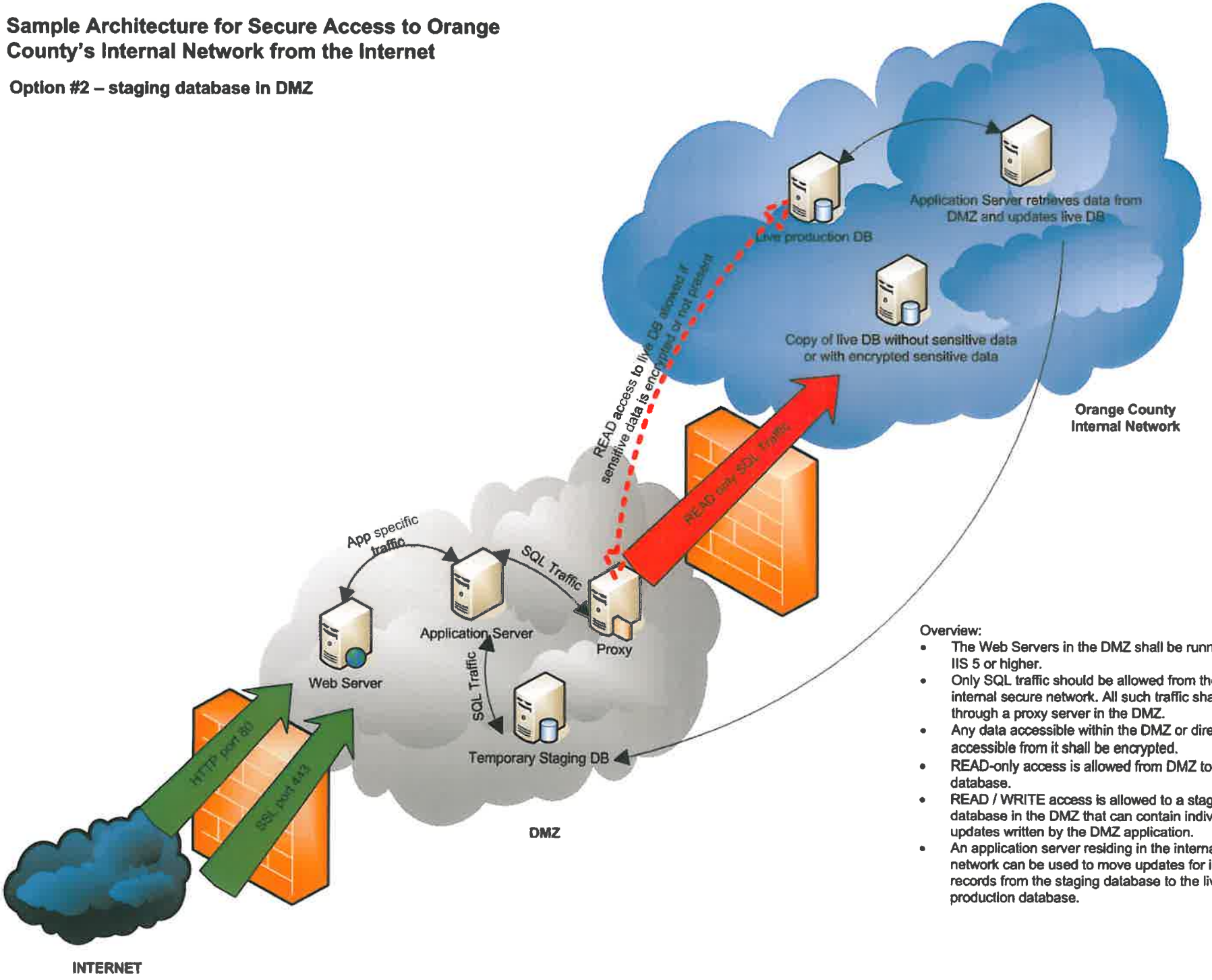


Overview:

- 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

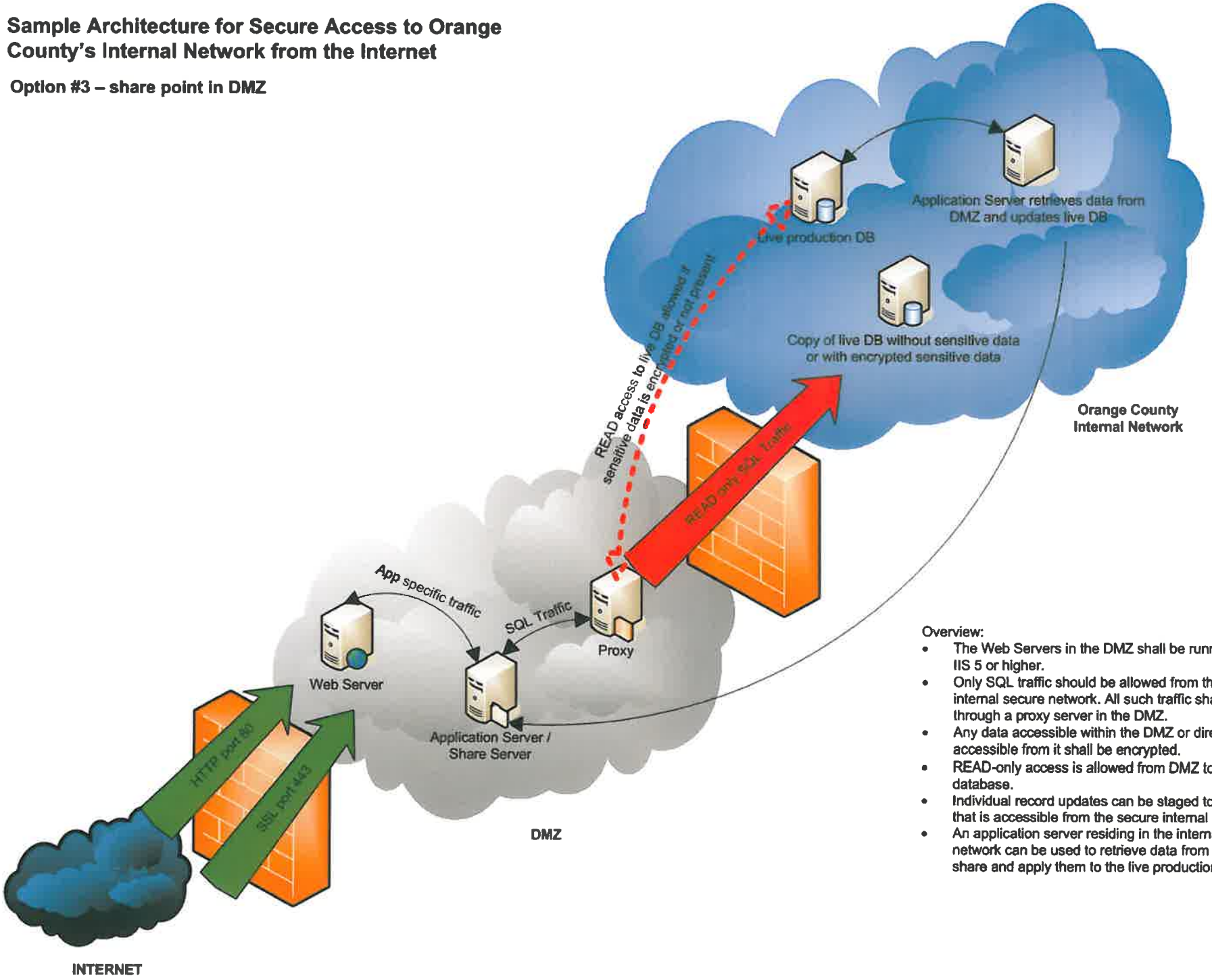


Overview:

- 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 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.

B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.

C. The Division 16 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 16 Sections for additional work requirements.

F. Coordinate and verify power 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 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 Orange County as they are made available by renovation. Remove items from job site and deliver to Orange County'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. Work shall be performed only during hours accepted by Owner. Protect existing buildings and equipment during construction.

K. See 16060 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 16013 and requirements in this Division of the Specifications for substitutions.

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 16 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 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 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 has emergency generator system.

C. 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 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.

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

1.12 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. Roll-up doors
2. Fire shutters
3. Roll-up grilles
4. Mechanical Division of the Specifications

5. 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 16 Contract Documents or not.

C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.

D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.

E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.

G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Structural, Mechanical, Electrical.

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.

1.13 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.

1.14 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).

1.15 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.

1.16 CUTTING AND PATCHING

A. New Construction:

1. Reference Division 1 - General Requirements.

2. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.

3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed finished surface.

B. Existing Construction:

1. See Section 16060 for additional requirements.

1.17 TRENCHING

A. All trench excavations in excess of 5 feet deep shall comply with OSHA Standard 29 CFRs 1926. 650 Subpart P.

B. Trench excavation in excess of 5 feet deep shall comply with OSHA Standard 29 CFRs 1926. 650 Subpart P. Contractor shall complete form as referenced in Section 00100 - Instructions to Bidders.

1.18 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.

1.19 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 AutoCAD (Auto CAD Release 2007 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.

1.20 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.

1.21 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.

1.22 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.

1.23 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.

1.24 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 this Division 16 contain no asbestos or PCB. Additionally,

all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. 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 16012
SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Requirements for submittals specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

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" (Sections 16700 through 16799). Where "SYSTEMS SUBMITTALS" (Sections 16700 through 16799) 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" for Sections 16700 - 16799 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. Special built light fixtures
        2. Each section of 16700 broad section (i.e., fire alarm, television, etc.).
        3. Special and/or modified equipment
        4. Main switchboard(s)
        5. 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.

1.5 PROCESSING SUBMITTALS

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

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

1. Project Addresses
2. Index
3. Separation Sheets
4. Basic Materials
5. Panelboards
6. Light Fixtures
7. Long Lead Items
8. 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 (16700) shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.

G. Shop Drawing Review Notation.

	Action	Description
1.	No Exception Noted	No exceptions taken. Resubmittal not required.
2.	Rejected	Not in compliance with Contract Documents. Resubmit.
3.	Submit Specific Item	Resubmit item as specified.

4.	Make Corrections Noted	Make corrections noted, resubmittal not required.
5.	Revise and Resubmit	Make corrections noted, resubmittal is required
6.	Review not Required	Not required for review. No action taken. Copy retained for reference.

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

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

1.6 DELAYS

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

1.7 RE-SUBMITTALS

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

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

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
PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

ELECTRICAL SUBMITTALS

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

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

SYSTEMS SUBMITTALS

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

ORANGE COUNTY CONVENTION CENTER PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

ELECTRICAL SUBMITTALS

(Size To 11")

ORANGE COUNTY CONVENTION CENTER PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

SYSTEMS SUBMITTALS

(Size To 11")

SECTION 16014
REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Reference Standards and Regulatory Requirements specifically applicable to Division 16 sections.

1.3 REFERENCES

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

AASHTO	American Association of State Highway and Transportation Officials
ACA	American Correctional Association
ADA	Americans with Disabilities Act
AHCA	Agency for Health Care Administration
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects
ANSI	American National Standards 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
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
FLA	State of Florida
FMC	Florida Building Code (Mechanical)
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
LTCR	Local Telephone Company Requirements
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	The Occupational Safety and Health Act
SBE	State Board of Education
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.
NEC	National Electrical Code
FAC	Florida Administrative Codes, Chapter 33-8, Rules of the Department of Corrections, County and Municipal Detention Facilities.

1.4 REGULATORY REQUIREMENTS

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

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

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

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 16015
ELECTRICAL SYMBOLS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Symbols and abbreviations specifically applicable to all Division 16 sections in addition to those in Division 1 - 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
   AC 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
   BIDS Baggage Information Display System
   BLDG Building
   BRKR Breaker
   BTU British Thermal Unit
   BTUH BTU Per Hour
   C Conduit
   CB Circuit Breaker
   CBM Certified Ballast Manufacturers
   CCTV Closed Circuit Television
   cd Candela
   CFM Cubic Feet per Minute
   CH Chiller
   CKT Circuit
   CKT BRKR Circuit Breaker

C/L Center Line
Clg Ceiling
Comp Compressor
Conn Connection
Cond Condenser
Cont Continuous
CRI Color Rendering Index
CT Current Transformer
CU Copper
CU Compressor Condenser Unit
CW Cold Water
DB Direct Burial
DC Direct Current
Disc Disconnect
DN Down
DPST Double Pole Single Throw
DWG Drawing
EC 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
FHC Fire Hose Cabinet
FLA Full Load Amperes
FT Feet
FLR Floor
FC Footcandles
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)
HPF High Power Factor
HPS High Pressure Sodium
HP Horsepower
HR Hour
HS Heat Strip
ICTC Intercom Termination Cabinet
IMC Intermediate Metallic Conduit
Incand Incandescent
in Inches
JB Junction Box
kVA KiloVolt Ampere

kW Kilowatts
kWH Kilowatt Hour
K Kelvin
LLD Lamp Lumen Depreciation
LED Light Emitting Diode
LIU Light Interface Unit (Fiber Optic Patch Panel)
LT Light
LTG Lighting
LTS Lights
LPF Low Power Factor
MCB Main Circuit Breaker
MLO 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
NPT National Pipe Thread
NF Non Fused
NC Normally Closed
NO Normally Open
NIC Not in Contract
No. Number
OB Outlet Box
OD Outside Diameter
OL Overload
OLS Overloads
OS&Y Outside Screw and Yoke (Sprinkler)
% Percent
Ø Phase
P Pole
PL Compact Fluorescent Lamp
PT Potential Transformer
PSF Pounds per Square Foot
PSI Pounds per Square Inch
PB Pullbox
PNL Panel
PR Pair
Pri Primary
PTZ Pan, Tilt, Zoom
PVC Polyvinyl Chloride
Recept Receptacle
RPM Revolutions per Minute
RS 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
VFD Variable Frequency Drive
VHF Very High Frequency
VHO Very High Output
V Volt
VA Volt Amperes
Vol. Volume
VV Video Visitation
W Wire
W.P. Weatherproof
XFMR Transformer
Y Wye
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 16060
MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the requirements for electrical demolition.

B. Provide and install all equipment, labor, material, accessories, and mounting hardware for completion of minor electrical demolition for remodeling.

1.3 REFERENCES

A. NFPA 70 National Electrical Code
B. Underwriters Laboratories

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

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

C. Demolition drawings are based on field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner, Architect/Engineer at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner, Architect/Engineer and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. For the full period of time the system is deactivated, a safety fireman's watch is required to be provided to enact a fire watch for areas that experience a loss of fire protection and notification coverage due to the modifications.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Notify Owner, Architect/Engineer and Telephone Utility Company at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Electrical Service Systems: Maintain existing system in service until new system is complete and ready for serviceand new system is accepted.. Disable system only to make switchovers and connections. Notify] the Architect/Engineer and gain Orange County Convention Center approval at least 1 week before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

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

B. Remove abandoned wiring to source of supply.

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

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

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

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

I. Seal openings in walls, floors, etc. and fire stop in accordance with the accepted UL detail to maintain integrity of assembly.

J. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate and as required to comply with the requirements of the NEC.

K. Extend existing installations using materials and methods compatible with existing electrical installations. Extension must meet or exceed the materials/methods specified in the contract documents.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused, including but not limited to:

1. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

2. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

END OF SECTION

SECTION 16061
INVESTIGATION OF EXISTING ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes testing and documentation of existing electrical systems.

1.3 REFERENCES

A. IEEE Recommended Practices

1.4 DESCRIPTION

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

1. Alarm and bells.
2. Fire detection devices, smoke detection devices.
3. Intercommunication equipment.
4. Television system.
5. Emergency lighting fixtures.
6. Grounding System
7. Controls and alarms.

B. Each system shall be tested once only, and after completion of testing, results given to the Owner, Engineer and/or Owner's representative. Point out any non-operational function noticed during testing.

C. Document the existing conditions and operation of the existing electrical systems prior to any work.

D. Contractor is responsible for all non-working systems and their components unless non-working status is verified prior to work on system.

1.5 TIME

A. The testing shall be held at a date to be agreed upon in writing by the Owner or his Representative.

1.6 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. Fire Alarm System:

a) Test each pull station and record location of each tested device, and note either operational or non operational.

b) Test each heat detector and record location of each tested device and note either operational or non operational.

c) Test each duct mounted smoke detector with canned smoke and verify alarm

activation, remote pilot light activation and damper operation. Record location of each tested device and note either operational or non operational.

d) Test each smoke detector with canned smoke and record location of each tested device and note either operational or non operational.

e) Test tamper switches by closing the valve until signal is activated and verify trouble signal indication at the fire alarm control panel and annunciators. Record location of each tested device and note either operational or non operational.

f) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.

g) Test Fire Alarm System sufficiently to determine existing operating condition of system. Pull the pull stations, check automatic detectors. Test minimum of one manual device per zone, and one automatic device per zone.

h) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.

2. Lighting and Exit Lighting Fixtures In Areas of Remodel and/or Renovation:

a) Test all lighting fixtures and exit lights for proper operation, list bad ballasts, lamps or broken lenses. Record location of fixtures tested.

b) Test light switches, relay controls, and photo cell controls for proper operation and record location of tested device and note operational or non operational.

3. Wiring Devices (Outlets) In Areas of Remodel and/or Renovation:

a) Test receptacles for continuity, open grounds, open neutrals etc. Use circuit testers and record location and results of tested device.

4. Ground System:

a) Test ground system at each permanent building and at each Service being replaced or modified.

b) Submit Ground Test Information Form (included at the end of this section) for every grounding system in the project. This includes, but is not limited to:

1. Ground rod installation.

2. Water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment).

3. Building steel ground connection (test building steel to ground and test building steel to building service equipment).

c) Testing shall be 3-point method in accordance with IEEE recommended practice.

d) Where grounding resistance is greater than value required by this Specification, Contractor is to bring this to the attention of the Engineer and Owner in wiring, along with the 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 16095 Demonstration of Completed Electrical Systems.

3.2 INVESTIGATION/TESTING FORMS

A. Submit Existing Facilities Investigation Form and advise Owner/Engineer of all deficiencies in system(s) prior to work. All systems will be assumed to be fully operational if Form not received by Engineer prior to work on system.

B. Submit five copies of the Existing Facilities Investigation Form for each device tested, signed by the Contractor, Subcontractor and Owner, and submit each test result to the Owner's Authorized Representative.

Attachments:
Existing Facilities Investigation
Ground Test Information

END OF SECTION

EXISTING FACILITIES INVESTIGATION

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 16061 Investigation of Existing Electrical Systems.

All equipment was found to be operational except as noted herein (list below):

_____
PRIME CONTRACTOR

_____
AUTHORIZED SIGNATURE AND TITLE

DATE_____

_____
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 Form to the Owner's Authorized Representative, signed and dated by the Contractor. The Owner’s Authorized Representative’s signature and date is required to verify receipt of Form. Retain copy(ies) and submit copy of Form in each Operation and Maintenance Manual. Contractor shall submit quantities of Forms 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_____

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

SECTION 16090
TESTS AND PERFORMANCE VERIFICATION OF ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section 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 three 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. System:

1. General: After installation of all conductors and before final acceptance, make required tests to determine proper functioning of all circuits. Furnish all necessary instruments required to make tests and correct any deficiencies found. Prior to energizing, circuits shall be "rung-out" to verify opens, intentional and non-intentional grounds, continuity and detect short circuits by accepted constant megger.

2. Procedure:

a) All wires in conduit that are shorted or unintentionally grounded shall be replaced.

b) Insulation resistance of all feeder conductors and all conductors AWG #1 and larger shall be tested. This is to include all new conductors and/or all existing conductors that are connected and/or extended. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps, and connections are made, except connection to source and point of final termination at distribution or utilization equipment.

c) Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using AVO Biddle (or accepted equal) megger at not less than 1000 volts dc. Resistance shall be measured from conductor to conduit (ground). Testing methodology shall conform to short-time or spot-reading procedural recommendations of AVO Biddle Instruments for specific megger being used. Acceptable insulation resistance of conductors rated at 600 volts shall not be less than 1 megohm.

d) Conductors that do not satisfy test requirements of paragraph c) above, shall be removed, replaced, and testing repeated on new cable at no additional cost to the Owner. All tests shall be performed by licensed electrician trained in the use of test instruments. Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed and complete Conductor Insulation Resistance Test form (see Section 16098 Operation and Maintenance Manuals) and submit five copies to Engineer for acceptance. Test shall be witnessed by Owner’s Representative and Engineer (if so desired). Final acceptance data is to be submitted in O & M Manual.

e) Test reports shall identify each feeder conductor tested, date, time, and result of test, weather conditions and range, test voltage, and serial number of the megger instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced and an additional test shall be performed.

f) Observe all safety instructions set by testing equipment manufacturer. Application of voltage testing involves risk of electric shock and sparking.

3. Take readings of voltage and amperage at building main disconnect switch and at main for each panel, at primary and secondary side of each transformer and at the end of the longest branch circuit at each panel. The above readings shall be taken 1) "no load" conditions and 2) "full load" conditions with all equipment using electricity. Tabulate readings, complete Tabulated Data Voltage and Amperage Readings form (see Section 16098 Operation and Maintenance Manuals) and submit five copies to the Engineer for acceptance. Final accepted data is to be submitted in O & M Manual.

B. Motors:

1. Test run each motor via motor's control unit in both manual mode and automatic mode. Verify proper operation, voltage and rotation.

2. Test run each motor furnished under this Division of the Specifications and all existing motors specifically noted on the Drawings and/or Specifications to be tested:

a) With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate +/- 10% from the nameplate ratings, the condition shall be corrected. Notify the Engineer immediately should deviations occur.

b) Record results of existing motors tested and submit values to A/E in writing.

c) Test the insulation resistances of all motor windings to ground with a megger before applying line voltage to the motors. If these values are less than 1 megohm, the Contractor furnishing the motor shall be responsible for correcting the error.

d) Determine power factor of motor(s) at full load.

e) Tabulate readings, complete Motor Test Information form (see Section 16098 Operation and Maintenance Manuals) and submit five copies to the Engineer for acceptance. Final accepted data is to be submitted in O & M Manual.

C. Grounds:

1. Test each raceway for raceway continuity as called for in Section 16170 Grounding and Bonding.

2. Test each grounding system used in the project as called for in Section 16170 Grounding and Bonding.

3. Submit Ground Test Information form (see Section 16098 Operation and Maintenance Manuals) for 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).

4. Grounding resistance shall be as called for in Section 16170 Grounding and Bonding.

5. Testing shall be 3-point method in accordance with IEEE recommended practice.

6. Transformer grounding.

D. Communications:

1. See specific sections of these Specifications for further requirements.

E. Switchboard:

1. See specific sections of these Specifications for further requirements.

F. Service Ground Fault Protection System:

1. See specific sections of these Specifications for further requirements.

G. Ground Fault System:

1. The ground fault protection system shall be performance tested when first installed on site. The test shall be conducted in accordance with instructions that shall be provided with the equipment. A written record of this test shall be made and shall be provided to the Authority Having Jurisdiction and to the Engineer of Record.

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 O & M 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. (See Section 16098 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 copy (for each O & M 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/systems installed per Sections 16700 thru 16799.

e) Any other equipment noted to be checked-out by Engineer during construction.

f) Main Switchboard

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 16095
DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the requirements for demonstration of completed electrical systems:

1.3 DESCRIPTION

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

1. Communications Systems
   a) Each and every system included in Sections 16700 through 16799.
2. Electrical Entrance Equipment
   a) Circuit breakers
   b) Fuses and fuseholders
   c) Meters (where applicable)
3. Miscellaneous Electrical Equipment
   a) Electrical systems controls and equipment
   b) Electrical power equipment
   c) Motor control centers
   d) Motor control devices
   e) Relays
   f) Special transformers
   g) Starting devices
   h) Surge suppression equipment
4. Lighting Fixtures (include relamping and replacing lenses)
   a) Exit and safety fixtures
   b) Fixtures, indoor and outdoor
5. Distribution Equipment
   a) Lighting and appliance panelboards
   b) Distribution panels
   c) Switchboard
   d) Voltage stabilizers
6. Standby Electrical Equipment
   a) Batteries
   b) Battery chargers
   c) Controls and alarms
   d) Emergency generators, transfer switches
   e) UPS systems
7. Wiring Devices
   a) Low-voltage controls
   b) Switches: regular, time

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 testing 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 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 "start-stop operation" how to work the controls, how to reset protective devices, how to replace fuses, and what to do in case of emergency.

C. Performance Verification and Demonstration to Owner

1. Submit Check Out Memo form for each item, equipment, and system. Copy to be included in each Operation and Maintenance Manual.

END OF SECTION

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 _____

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 and reviewed in detail with the Contractor.
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, E-MAIL

_____
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 16098
OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 and Division 16 Specification Sections apply to this Section.

B. The requirements in this section of the specifications are in addition to all requirements in sections referenced above.

1.2 SUMMARY

A. This section includes the requirements for Operation and Maintenance Manuals (O & M Manuals) specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 OPERATION AND MAINTENANCE MANUALS

A. General: Refer to Section 01770 Closeout Procedures.

B. O& M Manuals shall consist of a minimum of one (or if required) two hard cover view type 3-ring binder(s) sized to hold 8 1/2" x 11" sheets; one (1) for ELECTRICAL OPERATION AND MAINTENANCE (Power and Lighting) (black); one (1) for SYSTEMS OPERATION AND MAINTENANCE (Sections 16700 thru 16799) (blue). Where SYSTEMS OPERATION AND MAINTENANCE (Sections 16700 thru 16799) is not applicable, only one (1) binder is required. 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. ELECTRICAL OPERATION AND MAINTENANCE for Power and Lighting, (and if required) SYSTEMS OPERATION AND MAINTENANCE for Sections 16700 - 16799.

C. 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 - 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.

D. O & M Manuals to include:

1. Completed forms and information per Division 1, General Requirements, and this section of the specifications.
   a) Table of Contents
   b) Project Addresses
   c) Reinforced Separation Sheets tabbed with the appropriate specification reference number and typed index for each Section in the Systems Schedule
   d) Check Out Memo
   e) Conductor Insulation Resistance Test Memo

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 16012 "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 16012 "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) Control devices, motor controls.
   b) Transformers.
   c) Panelboards.
   d) Distribution panelboards.
   e) Switchboards.
   f) Each and every part of the Systems sections of these Specifications, 16700 thru 16799.

7. For Section 16100 thru 16199:
   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 16400 thru 16499:
   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. Section 16500:
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 16700 thru 16799
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) Fire Alarm, Sound/Paging, Television, Security, Closed Circuit systems.
1. Product data and/or catalog sheets on equipment applicable to this project.
2. Parts list.
3. Installation/removal instructions.
4. Wiring diagrams of panels.
5. Point-to-point wiring diagrams of system.
6. Operation and maintenance requirements.
7. Shop drawing as submitted and accepted in submittal process.

8. Check-Out Memo Form

f) 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 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.

1.5 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 ADDRESSES

OWNER:

ARCHITECT:

CONSULTING ENGINEER: Matern Professional Engineering, Inc.
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)

CONDUCTOR INSULATION RESISTANCE TEST MEMO

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 REPORT

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 _____ No. 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:

(a) Name and identifying mark of motor (indicate at existing)

(b) Manufacturer

(c) Model Number

(d) Serial Number

(e) RPM

(f) Frame Size

(g) Code Letter

(h) Horsepower

(i) Nameplate Voltage and Phase

(j) Nameplate Amps

(k) Actual Voltage

(l) Actual Amps

(m) Starter Manufacturer

(n) Starter Size

(o) Heater Size, Catalog No. and Amp Rating

(p) Manufacturer of dual-element fuse

(q) Amp rating of fuse

(r) Power Factor

CONTRACTOR'S REPRESENTATIVE:

DATE:

SIGNATURE OF CHECKER:

DATE:

OWNER'S AUTHORIZED REPRESENTATIVE:

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)

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

_____ ENGINEERS REPRESENTATIVE

_____ OWNER'S AUTHORIZED REPRESENTATIVE

_____ CONTRACTORS REPRESENTATIVE

_____ DATE

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

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

ELECTRICAL OPERATION AND MAINTENANCE BROCHURE

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

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

SYSTEMS OPERATION AND MAINTENANCE BROCHURE

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

ORANGE COUNTY CONVENTION CENTER PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

ELECTRICAL OPERATION AND MAINTENANCE BROCHURE

(Size To 11")

ORANGE COUNTY CONVENTION CENTER PHASE I HALL D CATWALK POWER

MPE NO. 2012-188C

SYSTEMS OPERATION AND MAINTENANCE BROCHURE

(Size To 11")

SECTION 16111
CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes 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. Aluminum Rigid Metallic Conduit (RMC) NEC 344
3. Intermediate Metal Conduit (IMC) NEC 342
4. Flexible Metal Conduit (FMC) NEC 348
5. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
6. Electrical Metallic Tubing (EMT) NEC 358
7. Rigid Polyvinyl Chloride Conduit (Type PVC) NEC 352
8. Fittings and Conduit Bodies

1.3 REFERENCES

A. ANSI C80.1 Electrical Rigid Steel Conduit, Zinc Coated
B. ANSI C80.3 Steel 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, Orange County and other federal codes where applicable.

2.2 MINIMUM TRADE SIZE

A. Homeruns: 3/4" C.
B. Underground Branches: 3/4".
C. Aboveground Branches: 1/2".
D. Flexible and seal-tite metallic conduit 1/2" C (maximum 6' long).
E. Rigid conduit - 3/4".
F. Non-metallic conduit 3/4" C.
G. EMT - 3/4".
H. Flexible and seal-tite metallic conduit 1/2" C. (maximum 6' long).

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 INTERMEDIATE METAL CONDUIT

A. Comply with:
1. UL Standard 1242.
2. NEC 342.

B. Conduit material: Zinc coated steel.

C. Fittings:
1. Threaded.
2. Zinc plated malleable iron.
3. Insulated bushings on terminations.

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

2.5 FLEXIBLE METAL CONDUIT

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. Malleable iron, zinc plated.
4. Threaded rigid and IMC conduit to flexible conduit coupling.
5. Direct flexible conduit bearing set screw type not acceptable.

2.6 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. Zinc plated malleable iron or steel.

2.7 ELECTRICAL METALLIC TUBING

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. Zinc plated malleable iron or steel.
4. Concrete tight.
5. T&B Series 5031/5030.

2.8 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. NEMA TC 3.
2. 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.

2.9 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 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 30". 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 then 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 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, 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 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).

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 16190 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 accordance 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.

3.10 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 pipe cutter; 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.

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

Q. Grounding and bonding of conduit under provisions of Section 16170 Grounding and Bonding .

R. Identify conduit under provisions of Section 16195 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

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

SECTION 16123
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. 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. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM/kcmil) based copper conductors.

1.3 REFERENCES

A. ANSI/NFPA 70 National Electrical Code
B. NEC 330
C. 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 C. Remove incorrect insulation types in new work.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 16195 Identification for Electrical Systems.

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

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

3.6 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents and Section 16090 Tests and Performance Verification of Electrical System.

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 A/E. 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 A/E 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 A/E to match existing, color-code shall be as follows:
Neutrals: 120/208V system white; 277/480V system natural gray
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 noted 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 or 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 or noted on drawigs. 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

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

SECTION 16131
OUTLET BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes 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 16133 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. 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 and having 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'. 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
Thermostats	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 16 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 16133
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 1 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 16131 Outlet Boxes.

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/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 on 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.

2.4 IN-GROUND PULL BOXES (where applicable or called out on drawings.)

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 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. Install all labels and identification as required by the NEC and applicable sections of these Specifications.

N. Pull and junction boxes used for systems (Sections 16700-16799) larger than 25 square inches shall be hinged cover type.

O. Do not fasten boxes to ceiling support wires.

P. Support boxes independently of conduit.

Q. 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.

2. Other locations use hinged enclosure under provisions of Section 16160 Cabinets and Enclosures.

R. Boxes Installed Outdoors: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

3.2 IN-GROUND PULL BOXES(Where indicated on drawings.)

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

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

SECTION 16141
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 1 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. 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. 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 Certification receipt. (See Section 16098 Operation and Maintenance Manuals).

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. 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.

D. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed.

E. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the Drawings. Metallic plates shall be engraved with black fill.

F. 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.

G. 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.

H. 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 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.

2.6 FLUORESCENT DIMMERS

A. Dimmers shall be electronic type equal to type specified on drawings. Dimmers shall be complete including remote control where required. Special dimming ballasts shall be included on fixtures to be dimmed. Ballasts shall be approved by the dimmer manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Division 1 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. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on bottom.

F. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

G. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.

H. 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.

I. 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.

J. In finished areas provide same type of plate for all surface mounted devices as for recessed mounted devices.

K. 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.

L. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.

M. 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.

N. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.

O. All devices shall be installed so that only one wire is connected to each terminal.

P. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.

Q. Receptacles shown to be floor mounted shall be installed in floor boxes (with coverplates) which are approved for this use.

R. Connect wiring devices by wrapping conductor around screw terminal.

S. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

T. Install protective rings and split nozzle on active flush cover service fittings.

U. Install local room area wall switches at door locations on the lock side of the door approximately four inches 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 16160
CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Hinged cover enclosures.
2. Cabinets.

B. Cabinets and enclosures are to include:

1. Terminal blocks.
2. Mounting panel.
3. Ground bus/bar.
4. All accessories as required for a complete and operating system.

C. Provide and install cabinets and enclosures as specified herein for all systems specified in Division 16 Specifications (including Sections 16700 - 16799) and Division 17 when included in Specifications.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

A. Conform to the requirements of the following:

1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA ICS 4 Terminal Blocks
3. ANSI/NFPA 70 National Electrical Code

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

1.4 SUBMITTALS

A. Submit Product Data: Provide manufacturer's standard data for enclosures and cabinets.

B. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under “References and Regulatory Requirements.” Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

C. Submit actual shop drawings on all cabinets and enclosures showing:

1. Covers.
2. Dimensions - inside and out.
3. Gauge of metal.
4. Manufacturer.
5. Terminal mounting plate, construction, etc.
6. Ground bus/bar.

1.5 EXTRA MATERIALS

A. Provide two of each cabinet key.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless specifically called for otherwise on Contract Drawings, provide cabinets as specified herein for terminal cabinets mounted indoors. Similarly, provide hinged cover enclosures as specified herein for terminal cabinets mounted outdoors or in locations other than NEMA 1 locations. Also provide hinged cover enclosures for locations where size required is not available in cabinet construction, or if specifically specified as enclosure in Contract Documents.

B. Size:

1. Dimensions of cabinets and enclosures shall meet the dimensions shown on Drawings, dimensions required by NEC, or dimensions sized as required to facilitate all equipment/connections involved installation, whichever is largest.

2. Coordinate with Sections 16700 through 16799, Section 16691 Surge Protective Devices, (if included, Division 17 of these Specifications to assure that size of equipment cabinet or enclosure will house and facilitate proper installation and access to equipment, to be installed/mounted in cabinet or enclosure.

C. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.

D. Provide accessory feet and/or mounting brackets for free-standing equipment.

E. Cabinets and enclosures installed outdoors shall be fully weatherproof and watertight.

2.2 HINGED COVER ENCLOSURES

A. Construction:

1. Interior Locations: NEMA Type 1 steel (unless otherwise noted).

2. Exterior Locations: NEMA Type 4X:

a) Within 10 Miles of Ocean or Gulf: Stainless steel or fiberglass.

b) Other Exterior Locations: Primed and phosphatized steel.

B. Covers: Continuous hinge.

C. Enclosure Finish:

1. NEMA 1:

a) Manufacturer's standard metallic gray enamel over phosphatized surfaces.

2. NEMA 4X:

a) Other Exterior Locations: Epoxy painted.

D. Lock/Handle:

1. Provide/install key lock handle on all enclosures mounted in rooms/areas/spaces that are not electrical rooms or mechanical rooms. Enclosures installed in electrical rooms need not be and are not required to be lockable.

E. Interior Mounting Plate:

1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.

2. Plate/panel is to be metal.

F. Ground Bus/Bar:

1. Each enclosure housing surge suppression equipment or other equipment shall have local ground bar/bus installed. See "Local Ground Bus/Bar" below.

G. Manufacturers:

1. Hoffman.
2. Electromate Corporation.
3. Carlon for NEMA 4X.

2.3 CABINETS

A. Construction: Code gauge steel with removable endwalls.

B. Finish:

1. Boxes: Galvanized steel.
2. Fronts: Gray baked enamel.

C. Fronts:

1. Electrical or Mechanical Room Locations: Screw cover with flush handle or as noted below.
2. Other Locations: mono-flat with concealed trim clamps, concealed hinges, and flush lock lockable handle.
3. Flush or surface type as shown or called for in Contract Documents.

D. Interior Mounting Plate:

1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
2. Panel/plate may be constructed of wood if painted with fire retardant paint of a flame spread rating of Class A, if it meets all applicable codes, and it is acceptable to the Authority Having Jurisdiction; otherwise plate to be metal.
3. Panel/plate shall be metal.

E. Ground Bus/Bar:

1. Each cabinet housing surge suppression equipment or other equipment shall have local ground bar/bus installed. See "Local Ground Bus/Bar" below.

F. Manufacturer:

1. Sq. "D" Class 6650 Series.

2.4 TERMINAL BLOCKS

A. Terminal Blocks: ANSI/NEMA ICS 4.

B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

C. Signal and Control Terminals: Modular construction type suitable for channel mounting, with tubular pressure screw connectors rated 300 volts.

D. Provide ground bus terminal block with each connector bonded to enclosure.

2.5 LOCAL GROUND BUS/BAR

A. Size to handle #6 through #14 AWG copper ground wire.

B. Length as required for circuits.

C. Manufacturer:

1. Sq. "D" #PK***GTA Series.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

3.2 INSTALLATION

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

B. Install enclosures and cabinets plumb. Anchor securely to wall and structural supports at each corner.

C. Install cabinet fronts plumb.

D. Install per NEC and as required for proper clearance. Coordinate with panels.

E. Provide and install terminal cabinets as shown on Drawings or as required by the NEC.

F. Provide and install terminal cabinets wherever required for a complete and operating distribution system whether shown on Drawings or not.

G. Install local ground bus/bar in each terminal cabinet/enclosure that houses surge protective devices or other equipment and bond to cabinet enclosure via mounting screws or #6 AWG copper ground wire.

H. Ground local ground bus to systems ground bus/bar with minimum #6 AWG copper ground wire. Increase size if so required on Drawings.

I. Install all labels and identification as required by the NEC and applicable sections of these Specifications.

END OF SECTION

SECTION 16170
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 1 Specification Section, apply to this Section.

1.2 SUMMARY

A. Section Includes

1. Grounding electrodes and conductors.
2. Equipment grounding conductors.
3. 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. Ground rods and couplings.
2. Mechanical connectors.
3. Ground wells.

4. Ground bus bars and associated components.
5. Triangle Ground ring conductor.
6. Exothermic welding materials and molds.
7. 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 of each ground rod. See Section 16090 Tests and Performance Verification of Electrical System.

PART 2- PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: 3/4".

C. Length: 30' (minimum). Increase lengths as required to meet and achieve specified resistance.

2.2 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. 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.

2.3 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).

2.4 GROUNDING WELL COMPONENTS

A. Grass Non-Traffic Areas:

1. Well: Sleeve 18” long, diameter 12” (minimum).
2. Well Cover: High-density plastic, composolite, or cast iron with legend "GROUND" embossed on cover.
3. Material: Structural Plastic, composolite, or concrete.
4. Manufacturer: Carson 2200 Series or equal by Quazite.
5. Increase depth, diameter or size as required to provide proper access at installed location.

B. Paving and Low Traffic Areas:

1. Well: Minimum 12” long by 12” wide by 18” deep with open bottom.
2. Well Cover: Traffic rated for use with "GROUND" embossed on cover.
3. Material: Composolite.
4. Manufacturer: Quazite.
5. Increase depth, diameter or size as required to provide proper access at installed location.

2.5 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” on center spacing. Lugs to be manufactured by Burndy or T&B.

C. Standoff supports to be 2" polyester as manufactured by Glastic No. 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 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 GROUNDING ELECTRODES

A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by braising or clamping

with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on Drawings.

B. Each rod shall be die stamped with identification of manufacturer and rod length.

C. Install rod electrodes at locations indicated and/or as called for in these Specifications.

D. Ground Resistance:

1. Main Electrical Service (to each building) and Generator Locations:

a) Grounding resistance measured at the two new main services electrode systems and at each generator electrode system shall not exceed 5 ohms.

2. Other Locations:

a) Resistance to ground of all non-current carrying metal parts shall not exceed 5 ohms measured at motors, panels, buses, cabinets, equipment racks, light poles, transformers, and other equipment.

3. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two or more rods connected together but not connected to the grounding electrode conductor.

E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc. of ground rod locations, it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80’ or more in length.

F. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.

G. Verify that final backfill and compaction has been completed before driving rod electrodes.

H. Install ground rods not less than 1’ below grade level and not less than 2’ from structure foundation.

3.3 GROUNDING ELECTRODE CONDUCTOR

A. Conductor shall be sized to meet (or exceed as required to meet these Specifications and/or Drawings) the requirements of NEC 250.

3.4 EQUIPMENT GROUNDING CONDUCTORS

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.

3.5 MAIN ELECTRICAL SERVICE

A. Existing Services:

1. Contractor shall verify that the electrical service is properly grounded as required by the NEC at MSB-1, MSB-2, MSB-3, and MSB-4.

2. Provide and install electrical service grounding at each building as called for herein for all existing services that do not comply with the grounding specified above.

3. Supplement existing electrical service grounding at each building as required to comply with all requirements in these specifications.

4. If exterior ground rod electrode does not exist at each buildings main electrical service, provide and install these ground rods as called for main electrical service, exterior of building. Connect all counterpoise conductors required elsewhere thereto.

B. Complete installation shall meet and exceed the requirements of the NEC 250.

C. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.

D. Provide and bond to all of the following:

1. Ground rods.

2. Metal water pipe (interior and exterior to building).

3. Building metal frame, structural steel and/or reinforced structural concrete.

4. All piping entering or leaving all buildings (including chilled water piping).

5. Encased Electrodes.

E. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in respective service. This ground conductor shall also be run individually from the main switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of

length and location as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to ground rod electrode as called for below:

1. Three 30’ ground rods in a delta configuration at no less than 30’ spacing driven to a minimum depth of 30’ plus 1’ below grade.
2. Bond ground rod electrodes together with a bare copper ground conductor that matches size required by applicable table in NEC 250, but in no case less than #2/0.
3. Provide additional rod electrodes as required to achieve specified ground resistance.

F. Ground/bond neutral per NEC 250.

G. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to a concrete encased electrode per NEC 250.52(A)(3).

H. Bond grounding electrodes to site counterpoise grounding system and lightning protection system where provided.

I. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC 250.

3.6 TRANSFORMER GROUNDING

A. Ground all transformers and enclosures of 120/208V and 277/480V "separately derived systems" as specified herein.

1. Ground per NEC 250 and these Specifications.
2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.
3. Connect transformer neutral/ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC 250) provide, install and connect supplemental grounding electrode as follows:
   a) Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
   b) Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to building steel/structure in addition to any other available electrode specified in NEC 250.
   c) Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or more 30’ ground rod electrodes at no less than 30’ spacing, driven vertical to a minimum depth of 30’ plus 1’ below grade.
5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30’ ground rod electrodes at no less than 30’ spacing, driven vertical to a minimum depth of 30’ plus 1’ below grade.
6. Where transformer is mounted exterior to building, one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system (wherever counterpoise system is available).
7. Ground to water system service pipe as required by NEC 250.

B. Provide additional ground electrodes as required to achieve specified ground resistance.

C. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.

D. Complete installation shall exceed the minimum requirements of NEC 250.

E. Equipment ground conductors shall be provided in addition to above grounding. See 'Equipment Grounding Conductors.'

F. Provide and install ground bus bar on wall near transformer (or in associated electrical room for exterior mounted transformers). Connect to ground lug in transformer bonded to transformer enclosure/neutral with copper ground conductor sized per applicable table in NEC 250.

G. Multiple separately derived systems may be grounded as allowed in NEC 250.30(A)(4).

3.7 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. Main electrical service rack mounted equipment.

1. Ground per "Main Electrical Service."

2. Bond all metal parts as noted above.

C. Electrical sub service rack mounted equipment.

1. Ground per "Main Electrical Service," except do not bond neutral to ground.

2. Bond all metal parts as noted above.

D. Electrical equipment connection rack mounted equipment.

1. Bond all metal parts as noted above.

E. Grounding electrodes (ground electrodes system) shall be:

1. Located at each rack location.

2. For service equipment: Ground electrode required per "Main Electrical Service."

3. For equipment connection equipment: Two or more 30' ground rods at no less than 30' spacing, driven vertical to a minimum depth of 1' below grade. Bond the two or more ground rods together with a size to meet applicable table in NEC 250, but no less than a #2 copper ground conductor. Provide additional rod electrodes as required to achieve specified ground resistance.

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

3.8 LIGHTING FIXTURES

A. All new and removed/reinstalled fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.

B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.

3.9 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

A. One 30 ft. ground rod electrode shall be driven vertically to a minimum depth of 30’ plus 1’ below grade in each manhole, handhole or pullbox (in ground).

B. The complete installation shall exceed the minimum requirements of the NEC.

C. Provide additional ground rod electrodes as required to provide resistance called for herein.

D. Where more than one ground rod electrode is required bond the two or more ground rod electrodes together with a copper ground conductor.

E. Bond to counterpoise system (whenever counterpoise system is provided.)

F. Bond grounding electrode to all exposed metal parts of manhole, handhole, and pullbox (including metal cover) with #6 copper ground conductor. Connect to ground rod electrode with exothermic weld. Connect to metal cover with exothermic weld. Connect to other metal parts with exothermic weld or UL accepted grounding clamp. Provide 3’ or more slack ground cable on cover connection as required to facilitate removal of cover.

3.10 HAZARDOUS LOCATIONS

A. Ground in hazardous locations shall be done in accordance with applicable portions of NEC 500, 501, 502, 503, 511 and 514.

3.11 EXISTING GROUND SYSTEM

A. Connect new main service ground to existing building ground system tying together all services to equipotental ground.

B. Conductor shall be minimum of 4/0 CU.

C. Bond to building service and counterpoise ground systems.

3.12 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. 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.

K. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.

L. Bond together reinforcing steel and metal accessories in pool and fountain structures and bond to electrical system per NEC.

M. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten full length rebars which contact the connected rebar (by Division 16 Contractor). Provide size and length of rod to meet NEC requirements.

3.13 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 NEC for service ground, etc.) in PVC 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 Section 16700-16799 system.

F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC 800.100(B).

3.14 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.

3.15 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 twenty-four 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 16090 Test and Performance Verification.

D. Ground rod resistance test results shall be submitted to Engineer and Building Department prior to Substantial Completion. A test report certified by the Contractor shall be submitted as a close-out document for the project.

3.16 INTERFACE WITH OTHER PRODUCTS

A. Interface with site grounding system.

B. Interface with existing lightning protection system, installed during original construction.

C. Interface with communications system installed under 16700 series specification sections.

3.17 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 16180
EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

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

1. Electrical connections to equipment specified under other sections.

1.2 RELATED SECTIONS

A. Summary of Work

B. Conduit.

C. Building Wire and Cable.

D. Boxes.

1.3 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 16012.

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 COORDINATION

A. Submit under provisions of the General Requirements of the Contract Documents and Section 16010.

B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

E. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

C. Cord Construction: ANSI/NFPA 70, Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions under provisions of Section 16061.

B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations (including inside of coolers/freezers).

C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment and in cooler/freezers.

D. Provide receptacle outlet where connection with attachment plug is required. Provide cord and cap where field-supplied attachment plug is required.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices as required.

G. Modify equipment control wiring with terminal block jumpers as required.

H. Provide interconnecting conduit and wiring between devices and equipment where required.

I. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 EQUIPMENT CONNECTION SCHEDULE

A. By local authority and as required for a complete and operating service.

B. X-ray Machine(s):

1. Electrical Connection: Flexible conduit; provide field-installed disconnect switch.
2. Voltage: 120 volts, 1 phase, 60 Hz.
3. Load rating: 0.6 kva
4. 2 #10, 3/4"c. (plus ground).
5. Use manual motor starter switch with pilot light for disconnect switch.
6. Connect 1"c. from each conveyor to x-ray monitor in console.

C. Electric Door(s):

1. Electrical Connection: liquid tight flexible conduit with local field installed disconnect switch and field installed control switch.
2. Voltage: 120 volts, 1 phase, 60 Hz.
3. Load rating: 1/2 hp.

D. CCTV Equipment:

1. Electrical Connection: wiremold plug strips as required with surge suppression.
2. Voltage: 120 volts, 1 phase, 60 Hz.

3. 2 #10, plus ground, 3/4"c.
4. Use manual motor starter switch with overloads and with pilot light for disconnect switch.
5. Connect unit provided control switch as recommended by manufacturer. (3/4"c.)

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
PHASE I HALL D CATWALK POWER

SECTION 16190
HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Conduit and equipment supports.

2. Anchors and fasteners.

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

C. All conduit and supports shall be coordinated with Rigging services to avoid conflict with rigging points.

1.3 REFERENCES

A. NECA National Electrical Contractors Association

B. ANSI/NFPA 70 National Electrical Code

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

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

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide corrosion resistance.

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

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

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

D. Do not use spring steel clips and clamps.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

END OF SECTION

SECTION 16195
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 1 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 conduits, 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, Inc. as suitable for purpose specified and shown.

PART 2- PRODUCTS

2.1 NAMEPLATES

A. Nameplates shall be laminated phenolic plastic, chamfered edges.

1. 120/208 Volt System:
   a) Black front and back, white core, lettering etched through outer covering, white engraved letters on black background.
2. For 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 Sections 16700 through 16799), 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	Popsicle Orange K02410
Normal Power 277/480 volt	Leather Brown K02501
Normal Power 120/208 volt	Glossy Black K01601
Fiber Optics	Plum Purple K01929
Sound System	Daisy 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	Clover Green K02012
Grounding	Fluorescent Green K03106

B. Conduit (not subject to public view) longer then 20’ shall be painted with above color paint band 20 ft. on center. Paint band shall be 4" in length, applied around entire conduit. Where conduit is 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 (areas that can be seen by the public) shall be painted to match surface to which it is attached. Provide written request to A/E for interpretation of those public areas which may be 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 conduits shall have orange colored tape. Power/lighting conduits 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 16410

POWER SYSTEM STUDY WITH ARC FLASH ANALYSIS

PART 1 GENERAL

1.01 SCOPE

A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or an approved engineering firm.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E - Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Std. 1584-2002 equations that are presented in NFPA70E-2009, Annex D.

The scope of the studies shall include all new distribution equipment supplied by the equipment Manufacturer under this contract as well as all directly affected existing distribution equipment associated with the Project.

1.02 DESCRIPTION

A. Provide all labor, materials, and equipment necessary to properly and completely perform a Power System Study for the electrical distribution and control equipment and submit results in a report.

B. Electrical distribution and control equipment is to include all equipment installed under this contract and all existing equipment that this project is connecting to, complete from new equipment to existing power company transformer(s) via all applicable existing power distribution and control equipment.

C. Provide an up to date electrical system single-line diagram as required by NFPA 70E, “Standard for Electrical Safety in the Workplace”, as referenced in OSHA 29 CFR 1910 Subpart S, Appendix A. This information shall include nameplate data for electrical components (e.g. transformers, medium voltage switchgear, panelboards, switchboards, motor control centers, etc.) for all portions of the electrical system from the utility intertie through the lowest rated panel.

D. Cable sizes, types and lengths between electrical equipment components and up to date utility source data shall be provided for an accurate single-line representation of the electrical system. Unique characteristics of the equipment installation shall be provided which may impact the magnitude of the potential hazard (e.g. open space versus enclosure). Overcurrent device settings shall be verified.

E. Data collection may require removal of barriers, opening of front panels, etc. while equipment is energized. The Contractor must provide proof (written documentation) that its employees working on the premises of the Building have been properly trained in the use and application of personal protective equipment (PPE) and the hazards of working on or near energized equipment. The Contractor must provide its own PPE protection with a minimum arc thermal performance rating (ATPV) of 40 calories/cm^2.

F. The contractor shall be responsible for obtaining all required data of all equipment.

G. The study shall verify adequacy of all equipment implemented under these specifications and to verify the correct application of circuit protective devices and other system components specified completely coordinated with the existing system.

H. A comprehensive analysis of the Building electrical system noted above shall be performed for all equipment 480 volt and higher and 240 volt served by a 125kVA or larger transformer based on the up to date single-line diagram provided from "Section A". This analysis shall include the following:

1. Short Circuit Study – A short circuit analysis shall be performed in accordance with ANSI standard C37 and IEEE standard 141-1993 (Red Book) for each electrical component as defined in "Section A. "
2. Coordination Study – A coordination study shall be performed in accordance with IEEE 242-2001 "Buff" to determine the proper overcurrent device settings that will balance system reliability through selective coordination while minimizing the magnitude of an electrical arc flash hazard incident.
3. Incident Energy Study – An incident energy study shall be done in accordance with the IEEE 1584-2004a, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70, "Standard for Electrical Safety in the Workplace", latest revision, in order to quantify the hazard for selection of personal protective equipment (PPE). Tables that assume fault current levels and clearing time for proper PPE selection are not acceptable.

I. Reconcile arc flash protective device setting recommendations with the protective device time-current coordination study.

J. Adjust the System Design to optimize the results of the study as it relates to safety and reliable electrical system operation (e.g. overcurrent device settings, working distances, current limiting devices). This includes mitigation, where possible, of incident energy levels that exceed 40 calories/cm^2. A qualified engineer with power systems design experience shall provide this assistance

K. The intent /goal of the protective system included herein is to establish arc flash levels that result in PPE levels of Category 2 or less.

L. Identify locations where Category 2 cannot be achieved.

M. The study shall address the case when the system is being powered from the normal source as well as from the on-site generating source.

N. Minimum as well as maximum possible fault conditions shall be covered in the study.

O. Fault conditions of all motors shall be considered.

1.03 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis

4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code, latest edition
2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.04 SUBMITTALS FOR REVIEW/APPROVAL

A. The short-circuit and protective device coordination results shall be submitted prior to receiving final approval of the distribution equipment shop drawings and~~/or~~ prior to release of equipment drawings for manufacturing. This preliminary submittal of study data shall be sufficient to ensure that the selection of device and characteristics will be satisfactory.

1.05 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report.. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies of the short-circuit input and output data, where required, shall be provided on CD in PDF format.

B. For large system studies with more than 200 bus locations, the contractor is required to provide the study project files to the Owner in electronic format. In addition, a copy of the computer analysis software viewer program is required to accompany the electronic project files, to allow the Owner to review all aspects of the project and print arc flash labels, oneline diagrams, etc.

C. The report shall include the following sections:

1. Executive Summary.
2. Descriptions, purpose, basis and scope of the study
3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties

4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
6. Details of the incident energy and flash protection boundary calculations
7. Recommendations for system improvements, where needed
8. One-line diagram

D. Arc flash labels shall be provided in hard copy only. For large system studies (more than 200 bus locations) arc flash labels shall be provided in hard copy and label images shall be provided in electronic format.

E. Report shall include:

1. Available fault current at each equipment location with comparison to equipment rating
2. Overcurrent device settings (e.g. pick-up, time delay, curve), “as found” and “as recommended”
3. Incident energy level (calories/cm^2) for each equipment location and recommended PPE
4. Overcurrent device coordination curves including related section of the single-line diagram
5. List of prohibited energized work locations based on arc flash results.

1.06 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

D. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

1.07 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using the latest revision of the SKM Systems Analysis Power*Tools for Windows (PTW) software program or prior approved equal.

PART 2 PRODUCT

2.01 STUDIES

A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved engineering firm.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.02 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination ~~may~~ shall include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor when available.

D. Include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.03 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.

B. Minimum transformer design impedances shall be used when test impedances are not available.

C. Provide the following:

1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Tabulations of calculated quantities
6. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault
at each:

1. Electric utility’s supply termination point
2. Incoming switchgear
3. Unit substation primary and secondary terminals

4. Low voltage switchgear
5. Motor control centers
6. Standby generators and automatic transfer switches
7. Branch circuit panelboards
8. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.04 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility’s overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.05 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE Std. 1584-2002 equations that are presented in NFPA70E-2009, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE Std. 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.06 REPORT SECTIONS

A. Input data shall include, but not be limited to the following:

1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
3. Reactor data, including voltage rating, and impedance.
4. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance (X”d), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
5. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.

B. Short-Circuit Output Data shall include, but not be limited to the following reports:

1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    a. Voltage
    b. Calculated fault current magnitude and angle
    c. Fault point X/R ratio
    d. Equivalent impedance
2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    a. Voltage
    b. Calculated symmetrical fault current magnitude and angle
    c. Fault point X/R ratio

d. Calculated asymmetrical fault currents
    1. Based on fault point X/R ratio
    2. Based on calculated symmetrical value multiplied by 1.6
    3. Based on calculated symmetrical value multiplied by 2.7
e. Equivalent impedance

3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    a. Voltage
    b. Calculated symmetrical fault current magnitude and angle
    c. Fault point X/R ratio
    d. No AC Decrement (NACD) Ratio
    e. Equivalent impedance
    f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
    g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis

C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
    a. Current transformer ratio
    b. Current setting
    c. Time setting
    d. Instantaneous setting
    e. Recommendations on improved relaying systems, if applicable.
2. Circuit Breakers:
    a. Adjustable pickups and time delays (long time, short time, ground)
    b. Adjustable time-current characteristic
    c. Adjustable instantaneous pickup
    d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations
1. Arcing fault magnitude
2. Protective device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance

6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

PART 3 EXECUTION

3.01 FIELD ADJUSTMENT

A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the contractor and/or electrical equipment manufacturer's field service personnel.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of any required major equipment modifications.

3.02 ARC FLASH WARNING LABELS

A. The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy or energy range corresponding to reported Hazard risk category.
6. Working distance
7. Engineering report number, revision number and issue date.

D. Labels shall be machine printed, with no field markings.

E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600, 480 and applicable 208 volt panelboard, at least one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each switchboard, one arc flash label shall be provided.
4. For each main switchboard with Utility Service, one flash label shall be provided for each section.

F. Labels shall be field installed by the contractor.

3.03 ARC FLASH TRAINING

A. The contractor of the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours).

END OF SECTION

SECTION 16484
MOTOR CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section of the Specification covers factory-assembled, metal-enclosed motor control units for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.

B. Motor control units shall include all protective devices and equipment as listed on Drawings or as included in these Specifications, with necessary interconnections, instrumentation, and control wiring.

1.3 FURNISHING OF EQUIPMENT

A. Unless specifically noted otherwise, automatic motor starters for all equipment requiring them shall be furnished under the section or division where equipment is specified, and installed under this Section of the Specifications.

B. Provide all labor, materials, and equipment necessary to properly install all motor starters or to modify existing motor starters to Thermomagnetic breakers feeding AFD/VFD replaced during this renovation.. Provide motor starters for all new motors to be wired, where starters are not elsewhere specified under work of that division which provides the motored equipment.

C. Unless specifically noted otherwise manual motor starters shall be furnished and installed under this Section of the Specifications.

D. Disconnect switches for 120V fractional hp exhaust fans to be provided by Division 15 Contractor at exhaust fan. Any other required disconnect switch to be provided and installed by Division 16 Contractor.

E. Motor control center and modification shall be provided under this section.

F. Provide and install 75 degree rated lugs on all non-unitary mechanical equipment such as pumps, air handling units and individual motor units/equipment. Coordinate with Division 15 Contractor prior to bid.

G. Where a disconnect switch is mounted between an adjustable frequency drive and the motor, the disconnect must have a late make, early break auxiliary contact. This contact shall be wired into the AFD control circuit so that the control circuit is disconnected before the power circuit is broken

1.4 CONTROL ITEMS

A. Unless specifically noted otherwise, all control, alarm and interlock wiring required for proper operation of equipment furnished by any other contractor and the required raceways shall be furnished and installed under the division where the equipment is specified.

B. Where required by Electrical Drawings, Division 15 Specification, and/or Mechanical Drawings, this Contractor shall connect power feeder to mechanical equipment via control devices furnished by Division 15 Contractor (i.e. starters, line voltage, t'stats, line voltage switch, control relays, etc.).

C. Provide and install power circuits to all control devices requiring them (i.e. 120V dampers, control panels, control devices, etc.) whether shown on Drawings or not. Coordinate

requirements of all Divisions and/or Sections of these Specifications prior to bid.

1.5 SUBMITTALS

A. Shop Drawings and Product Data:

1. Shop Drawings, Motor Control Centers:

a) Layouts showing concrete pad dimensions, conduit entrance and available space, bus duct connections, electrical ratings, nameplate nomenclature, and single-line diagrams indicating connections and controls with numbered terminals.

b) Shop Drawings shall clearly indicate:

1. Frame sizes and Interrupting Capacity of each starter/motor circuit protector unit and total assembly.

2. Horsepower ratings at rated voltage of starter/motor circuit protector unit.

3. Type of labels and labeling for every device and what it feeds.

4. Nameplate giving name of project; Architect, Engineer and Contractor.

5. Bus bar size, arrangement and spacing.

2. Shop Drawings, Individually mounted AC Manual Starter:

a) Shop Drawings shall clearly indicate:

1. Frame sizes and Interrupting Capacity of manual starter and/or disconnect unit.

2. Horsepower rating at rated voltage of manual starter and/or disconnect unit.

3. Electrical ratings.

4. Single line diagram for power and control connections with numbered terminals and all required accessories.

5. All required accessories.

3. Shop Drawings, Individually mounted AC Magnetic Starter:

a) Shop Drawings shall clearly indicate:

1. Frame sizes and interrupting capacity of starter and/or disconnect unit.

2. Horsepower rating at rated voltage of starter and/or disconnect unit.

3. Electrical ratings.

4. Single line diagram for power and control connections with numbered terminals and all required accessories.

5. All required accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Square D

B. Accepted Substitutions:

1. General Electric

2. Siemens/ITE

2.2 GENERAL

A. Motor starters shall be manual, magnetic, or combination type as denoted on the Drawings.

B. Pilot lights shall have long-life lamps rated 7500 hours minimum.

C. Enclosures shall be NEMA 1 for indoor locations and NEMA 3R for outdoor or wet locations except where indicated as NEMA 4.

D. Multi-speed or stop type controllers shall have thermal overload relays in each ungrounded conductor for each speed or step.

E. Where multi-speed motors are scheduled on the Drawings, the motor controls shall be compatible with the type motor and have adjustable time deceleration for transition from high to low speeds.

2.3 INDIVIDUALLY MOUNTED AC MANUAL STARTERS

A. Where manual motor starter switch is called for on Drawings, it shall be a combination across-the-line manual type starter with overloads and disconnect rated in accordance with NEMA standards, sizes and horsepower rating. Final rating of overloads shall be field set and recorded. Unit shall be mounted on NEMA 1 enclosures, unless otherwise noted.

B. Manual motor starter switch shall include green "run" pilot light, and shall be surface or flush mounted as noted on Drawings.

2.4 INDIVIDUALLY MOUNTED AC MAGNETIC STARTERS

A. Combination Starter and Disconnect:

1. Where combination starter and disconnect switch is called for on Drawings, it shall be a combination across-the-line magnetic type starter with motor circuit protection (magnetic only breaker) disconnect, rated in accordance with NEMA standards, sizes and horsepower rating. Final magnetic setting of MCP shall be field set and recorded with unit shall be mounted on NEMA 1 enclosures, unless otherwise noted.

B. Individual Starter Without Disconnect:

1. Where individually mounted starter is called for on Drawings, it shall be across-the-line magnetic type rated in accordance with NEMA standards, sizes, and horsepower ratings. Unit shall be mounted on NEMA 1 enclosure, unless otherwise noted.

C. Starters:

1. Motor starter, unless otherwise noted, shall be across-the-line magnetic type rated in accordance with NEMA standards, sizes, and horsepower ratings. Starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable from front without removing starter from enclosure. Overload relays shall be provided in each phase, and shall be melted alloy or bimetallic type. Thermal units shall be of the one-piece construction and interchangeable.

2. Starters shall be equipped with minimum of two (normally open) auxiliary contacts in addition to the normally open auxiliary seal-in interlock and shall be suitable for the addition of at least two additional external electrical interlocks, one normally open and one normally closed. All starters shall have red "run" pilot light, "Hand-Off-Auto" selector switch, and nameplate. Control voltage shall be as required. Starters shall contain fused control transformers to provide correct control voltage.

3. Starter for all 3-phase motors shall include 3-phase power monitor as manufactured by Time Mark Corporation (Model #A258B for 480V, 3 phase system) (Model #258B for 208V/240V, 3 phase system) (Model #B258B for 120V system) providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage of (340-480VAC) (160-240VAC) (85-125VAC).

2.5 MOTOR CONTROL CENTER

A. General:

1. Description:

a) Where shown on Drawings, furnish and install motor control centers in NEMA 1 enclosures as herein specified. The control centers shall be supplied from a 3-phase, 3-wire 60 cycle power system as shown. UL label shall be provided on each section indicating compliance with UL Standard 845.

B. Internal Control Wiring:

1. Each control wiring conductor shall have labels on each end of termination. Terminations shall be made to screw terminal strips. All points of terminal strips are to be labeled to match conductor labeling.

C. Units Combination Disconnect/Starters In MCC:

1. Units shall be a combination across-the-line magnetic type starter with motor circuit protection (magnetic only breaker) disconnect, rated in accordance with NEMA standards, sizes and horsepower rating. Final magnetic setting of MCP shall be field set and recorded with unit shall be mounted on NEMA 1 enclosures, unless otherwise noted.

2. Starters:

a) Motor starter, unless otherwise noted, shall be across-the-line magnetic type rated in accordance with NEMA standards, sizes and horsepower ratings. Starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable from front without removing starter from enclosure. Overload relays shall be provided in each phase, and shall be melted alloy or bimetallic type. Thermal units shall be of the one-piece construction and interchangeable.

b) Starters shall be equipped with minimum of two (normally open auxiliary contacts), in addition to the normally open auxiliary seal-in interlock and shall be suitable for the addition of at least two additional external electrical interlocks, one normally open and one normally closed. All starters shall have red "run" pilot light, "Hand-Off-Auto" selector switch, and nameplate. Control voltage shall be as required. Starters shall contain fused control transformers to provide correct control voltage.

c) Starter for all motors sized 1 hp or larger shall include 3-phase power monitor as manufactured by Time Mark Corporation (Model #A258B for 480V, 3 phase system) (Model #258B for 208V/240V, 3 phase system) (Model #B258B for 120V system) providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage of (340-480V AC) (160-240VAC) (85-125VAC).

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine area to receive motor-control units to assure adequate clearance for motor control unit installation.

B. Start work only after unsatisfactory conditions are corrected.

C. Check that concrete pads are level and free of irregularities for motor control centers.

3.2 INSTALLATION

A. Install motor control units in accordance with manufacturer's written instructions and NEC.

B. All starters and their respective 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. Starters shall be installed with their turning axis of their handles approximately 5'-0" above finished floor. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.

C. Starters shall be mounted where shown on the Drawings. Where the starter also provides the code-required disconnecting means for a load, the starter shall be located within sight of the load and as close as feasible.

D. Provide fusing for all fusible switches.

E. Provide properly sized heater elements for every starter overload relay. The element shall be sized using the nameplate full load running current of the actual equipment supplied to the job.

F. Provide a heater element selection chart on the inside of each starter door.

G. Provide spare pilot light lamps to the Owner. Provide two of each type and size load.

H. Provide nameplate for each control units.

I. Provide and install 75 degree rated lugs on all non-unitary mechanical equipment such as pumps, air handling units and individual motor units/equipment. Coordinate with Division 15 Contractor prior to bid.

J. Coordinate conductor terminations on all equipment connections. Replace all 60 degree lugs/connections with 75 degree lug/connection.

3.3 ADJUSTMENT AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

C. Tighten bus connections and mechanical fasteners.

3.4 IDENTIFICATION

A. Refer to Section 16195 Identification for Electrical Systems.

B. Provide engraved plastic nameplates under the provisions of Section 16195 Identification for Electrical Systems.

C. Provide labels and identification as required by the NEC.

D. Nameplate shall show panel name, voltage and name of panel that feeds each motor starter device, and UL short circuit rating.

E. Each motor starter device shall have engraved nameplate describing load/equipment being fed by device.

F. All circuit identifications/nameplates shall be checked to verify accuracy of the description of the load and/or equipment being fed.

END OF SECTION

SECTION 16691
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 1 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 1363 Standard for Safety Relocatable Power Taps
7. UL 1449 3rd Edition Standard for Safety for Surge Protective Devices

1.4 DESCRIPTION

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 VAC and 480 VAC three phase.

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

C. Provide surge protective devices for the following equipment:

1. On each main electrical service panel added under this project.
2. On distribution and branch panels as called for on Drawings or in these Specifications.
3. All electronic communications equipment installed as per all Sections of 16700 including, but not limited to, fire alarm, intercom, security, television, premise distribution, and sound systems.
4. All or any electronic equipment installed under Division 16 including electronic time clocks, controls systems, etc.
5. All or any electronic equipment installed under Division 15 including: electronic time clocks, halon systems, control systems, building management systems, etc.
6. Additional locations as required by NFPA 780.
7. At point of use locations (receptacles, plug-in units) as required.
8. On all automatic transfer switches (ATS).
9. On all step-down or step-up transformers and voltage regulators as identified in the project

drawings.

10. On input to each UPS system.

1.5 SUBMITTALS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 16012 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.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O & M) data as called for in Section 16098 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.

1.7 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.

1.8 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.

1.9 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.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES.

A. General: Provide service entrance surge protective devices on each main electrical service panel at each building and/or structure. Surge protective devices shall meet or exceed the following (in addition to requirements under ‘General’ above):

1. Surge protective devices shall be tested per UL 1449 requirements to determine voltage protection rating (VPR).

2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 10 kA, Cat. C3 test criteria.

3. Enclosure:

a) UL listed

b) Fire retardant

c) NEMA rating as required for each location.

d) Switchboard and/or Surface mounted as shown/called for on drawings for each location.

2.3 SECOND LEVEL SURGE PROTECTIVE DEVICES .

A. General. Provide second level surge protective devices on each second level of the distribution system including sub panels. Surge protective devices shall meet or exceed the following (in addition to requirements under 'General' above):

1. Surge protective devices shall be tested as per UL 1449 requirements to determine voltage protection ratings (VPR – 3 kA).

2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 3 kA, Cat. B3 test criteria.

3. Enclosure:

a) UL listed.

b) Fire retardant.

c) NEMA 1, 2, 3R, 3S, 12, or 13 as required for each location.

d) Flush, Switchboard and/or Surface] mounted as required/shown/called for on drawings for each location.

B. Non-Modular Design with remote monitoring.

1. Remote Monitoring. Provide complete with:

a) Normally open and normally closed dry contacts for remote annunciation of unit status for interfacing with building management system.

b) Remote monitoring unit (remote annunciator) complete with cable to provide audible and visual indication of any fault that may occur in the suppressor. Location to be as directed by Owner/Engineer.

2. Status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure. The LED status indicators shall be located on the front cover to redundantly indicate module or unit failure.

3. Minimum Surge Capacity:

a) 100 kA per phase.

4. Voltage protection rating (VPR) and maximum continuous operating voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

100 kA Unit	L-L	L-N	L-G	N-G	MCOV	In
120/208 V, 3ph, 4W, wye					150V	
UL 1449	1000V	700V	700V	600V		20 kA
277/480 V, 3ph, 4W, wye					320V	
UL 1449	2000V	1200V	1200V	1200V		20 kA

5. Short Circuit Current Rating: 100,000 amps.

6. Manufacturers:
    a) 100 kA Units:
        1. Advanced Protection Technologies Series TE/***XDS/10 for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.
        2. LEA International SP100 Plus Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
        3. Atlantic Scientific Zone Sentinel Series for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes.

2.4 Exterior Lighting Poles Circuits.

A. Provide surge arrester in pole handhole.

B. Surge arrester shall be UL listed as a Type 1 surge arrester.

2.5 Service Surge Arrester.

A. Service Surge arrester shall be UL listed as Type 1 surge arrester and as required to comply with Local Authority Having Jurisdiction and UL 96A requirements.

B. This suppressor shall be connected on the line side of service to each building and where required to meet UL 96A.

C. 50 kA per phase rating.

D. Minimum short circuit current rating: 200,000 amps

E. Enclosure:
    1. NEMA 4X polycarbonate

F. Manufacturers:
    1. Advanced Protection Technologies SPDEE Series for applied voltage
    2. Atlantic Scientific Zone Defender Curve Series for applied voltage

2.6 Point of Use Location (120 Volt).

A. UL 1449 Listed.

B. 20 Amp, 120V rated. All components must be 20 Amp rated.

C. Surge protection devices shall be tested per IEEE, C62.41 for Categories A and B.

D. Normal mode (L - N), and common mode (L+N-G) protection.

E. Internal fusing.

F. Hybrid design.

G. Indicators for normal operation and failure indication.

H. Enclosure:
    1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.

I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3 kA, 8 x 20 µs): 350V @ 120V.

J. Maximum Surge Capacity: 26,000 Amps.

K. Maximum continuous operating voltage: 115 percent of line voltage.

L. Provide hardwire connection or add 20-amp receptacle device to hardwired devices to match equipment being protected and maintain UL Listing. Device shall be a feed-through design. Parallel connected devices are not acceptable.

M. Manufacturers:

1. Leviton 51020-WM

2.7 Power Plug-in Units

A. UL 1449 Listed.

B. 15 Amp, 120V rated. All components must be 15 Amp rated.

C. Surge protection devices shall be tested per IEEE, C62.41.2 for Categories A and B.

D. Normal mode (L - N), and common mode (L+N-G) protection.

E. Internal fusing. Resettable circuit breaker.

F. Hybrid design.

G. Operational indicator lamp.

H. Enclosure:

1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.

I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3KA, 8 x 20 µs): 350V @ 120V.

J. Maximum Surge Capacity: 13,000 Amps.

K. Maximum continuous operating voltage: 115 percent of line voltage.

L. Manufacturers:

1. Control Concepts SP Series

2. Leviton

3. Wiremold

PART 3 – EXECUTION

3.1 GENERAL

A. Provide, install and connect surge protective devices at first piece of electrical equipment (panel, switchboard, ATS, etc.) that the electrical service encounters as it enters the facility.

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

C. Provide, install and connect surge protective devices at each Automatic Transfer Switch (ATS) and Uninterruptible Power Supply (UPS) in project whether shown on drawings or not.

D. Provide, install and connect surge protective devices in pole near hand hole of all exterior lighting poles whether shown on Drawings or not.

E. Provide, install, and connect surge protective devices at location where Section 16700 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.

F. Provide surge protective devices at panel feeding exterior site lighting circuits[for each circuit] [for each panel feeding site lighting].

3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Surge protective devices for other than Section 16700 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 Sections 16700 to 16900 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 then 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