



**ORANGE COUNTY CORRECTIONS COMPOUND
COMMUNICATIONS UPGRADE**

**BID DOCUMENTS
FOR
ORANGE COUNTY
CAPITAL PROJECTS
400 E. SOUTH STREET
ORLANDO, FLORIDA 32801**

BY

**MATERN PROFESSIONAL ENGINEERING, INC.
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JUNE 10, 2014

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BID DOCUMENTS
JUNE 10, 2014
MPE 2014-040

DIVISION 01 GENERAL REQUIREMENT

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DIVISION 27**COMMUNICATIONS**

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SECTION 01 11 00 - 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 01 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. Upgrade existing backbone, horizontal and structured cabling infrastructure for buildings D, E, and F.
 - 2. Relocate active network electronic components to respective control rooms for buildings D, E, and F.
 - 3. Provision of new spaces in control rooms with room for expansion for buildings D, E, and F.
 - 4. Provide new raceways, cabinets and associated items for relocation of data system to make it complete and functional.

1.04 CONTRACTOR RESPONSIBILITIES

- A. The contractor shall have all submittals approved by the Engineer and accepted by the Owner prior to the start of active construction.
- B. The contractor shall have all equipment and material onsite prior to the start of active construction.
- C. The contractor shall submit to the Owner prior to the project pre-construction meeting the following:
 - Schedule of Values
 - Construction Schedule
 - Submittal Schedule
 - Emergency Telephone List including subcontractors and suppliers
- D. The contractor shall field verify existing conditions of construction prior to start of active construction.
- E. The contractor shall coordinate with the Owner on the operation of the existing fire alarm system prior to the start of active construction. There shall be an action plan for the operation of the fire alarm system during construction submitted by the contractor to the Owner for acceptance. This action plan shall be in place prior to the start of active construction. Any false fire alarms that occur during construction and deemed by the

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Owner to be the fault of the contractor, the contractor shall pay all costs incurred from the local fire department for responding to a false alarm.

- F. The contractor is responsible for moving furniture and/or equipment if necessary to perform the work included in the contract. The contractor is responsible for placing the furniture and/or equipment back in its original location. The contractor is responsible for any damages to furniture, equipment, etc., which occur during construction. The contractor shall provide protection for floors, walls, furniture, equipment and any other items that may be subject to damage during the construction periods and will be required to repair or replace to original or better condition.
- G. The contractor shall coordinate with the Owner on the operation of the security alarm system prior to the start of active construction. The contractor shall submit an action plan for operation of the security alarm system during construction to the Owner for acceptance prior to start of active construction. This action plan shall be in place prior to the start of active construction. Any false security alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all cost incurred from the local police and/or sheriff department for responding to a false alarm.
- H. The contractor shall videotape or take pictures of pre-existing conditions of the interior and exterior of the building prior to the start of active construction. However, permission shall be ascertained for each area within the prison in which photos are taken. 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.
- I. The contractor shall at all times maintain daily cleanup of construction areas. Costs for work areas that are not cleaned by the contractor and cleaned by the Owner shall be charged back to the contractor via change order.
- J. The contractor shall provide a construction schedule to the Owner's Project Manager prior to the pre-construction meeting.
- K. The contractor shall update the construction schedule weekly and submit it to the Owner's Project Manager for review.
- L. The contractor shall submit written forms for any areas in which HVAC, or Power is required to be shutdown within the prison. Forms shall include the areas affected, duration of outages, and planned days in which shut down will occur. Forms shall be submitted and approved by Orange County Corrections project manager and submitted a minimum of 1 week prior to execution.

1.05 WORK SEQUENCE

- A. The facility shall remain occupied and operational while work is in progress. All work shall be fully coordinated in writing with Orange County corrections staff Center Staff prior to commencement of work.
- B. The contractor may work on the weekends at his or her discretion with prior written approval from Orange County Corrections. 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.

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- C. Orange County Corrections 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 coordinate which areas are acceptable to Corrections Staff for use during the life of the project. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portion of the project.
- B. General: Limited use of the premises to construction activities in areas indicated within the limit of the premises. The Contractor may only use portion(s) of the site for storage or work areas only with prior approval from Orange County Project Manager.
 - 1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
 - 2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
 - 3. Burial of Waste Materials: Do not dispose of organic and hazardous material on site, either by burial or by burning.
 - 4. Where appropriate, maintain the existing building in a watertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and 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 secure protection and safekeeping of material and equipment stored on premises. At no point shall tools or materials be unaccounted for within secure corrections areas.
 - 7. Contractor will move any stored material and equipment, which interfere with operations of the Owner or other contractors at no additional cost to Owner..
 - 8. Comply with Owner's requirements for ingress and egress procedures, prohibitions against firearms, procedures for transportation of workers, safety and fire prevention requirements and 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, inmates, or the general public during the entire construction period.
 - 11. Use of sound equipment (such as boom boxes, stereos, radios, etc.) is not

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allowed.

12. Contractor and their personnel shall abide to Orange Tobacco free policy while on any Orange County property. This policy shall apply to building, parking lots, parks, break areas and worksites. Tobacco is defined as tobacco products, including but not limited to: Cigars, cigarettes, pipes, chewing tobacco and snuff. Failure to abide by the policy may result in civil penalties levied under Chapter 386, Florida Statutes and/or Contract enforcement remedies.
13. Conduct that is disrespectful, abusive or otherwise objectionable to the Owners' employees, inmates, 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 Orange County Corrections. All contractor's staff background checks will be sent to Orange County Corrections project manager for approval.
- C. For security purposes and to maintain privacy, please submit a FDLE Background Checks via e-mail the subject line of the email must contain the following ***EXEMPT***
- D. Orange County Corrections will inform the contractor of their Background Check results. Upon Background Check approval, the contractor's staff shall arrange an appointment with corrections 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. Business activity is considered to be Orange County office/administrative staff located in or adjacent to construction/renovation site.

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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).

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END OF SECTION

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SECTION 01 25 00 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling 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 01 33 00 Submittal Procedures.

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.

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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.

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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.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 01 Section 01 33 00 Submittal Procedures for requirements for the Contractor's Construction Schedule.
 - 2. Division 01 Section 01 29 00 Payment Procedures for administrative procedures governing applications for payment.
 - 3. Division 01 Section 01 25 00 Substitution Procedures 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

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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

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SECTION 01 29 00 – PAYMENT PROCEDURES

PART I - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 01 33 00 Submittal Procedures.

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

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- (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.

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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

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

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

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

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

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for project coordination including, but not necessarily limited to:
 - 1. Coordination
 - 2. Administrative and supervisory personnel
 - 3. General installation provisions
 - 4. Cleaning and protection
- B. Progress meetings, coordination meetings and Pre-installation conferences are included in Section 01 31 19 Project Meetings.
- C. Requirements for the Contractor's Construction Schedule are included in Section 01 33 00 Submittal Procedures.

1.03 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specification that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required: notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

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- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Schedules
 - 2. Installation and removal of temporary facilities
 - 3. Delivery and processing of submittals
 - 4. Progress meetings
 - 5. Project close-out activities
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment (if any) involved in performance of, but not actually incorporated in, the Work.
- E. Lack of coordination as specified in this and other sections of the contract documents are grounds for assessment of back charges and/or termination in order to remediate the situation.

1.04 SUBMITTALS

- A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the interrelationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with requirements contained in Section 01300 Submittals.
 - 4. Refer to Division-23 Section "Basic Mechanical Requirements," and Division-26 Section Common Work Results for Electrical 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

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3.01 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to Project Manager for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Project Manager for final decision.

3.02 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as directed by the Project Manager and as frequently as necessary to ensure its integrity and safety through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

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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

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SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-Construction Conference
 - 2. Pre-Installation Conference
 - 3. Coordination Meetings
 - 4. Progress Meetings
- B. Construction schedules are specified in Section 01 33 00 Submittal Procedures.

1.03 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than 20 days after execution of the agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attends: The County's Representative, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule
 - 2. Critical Work sequencing and/coordinating
 - 3. Designation of responsible personnel
 - 4. Procedures for processing field decisions and Change Orders
 - 5. Procedures for processing Applications for Payment
 - 6. Distribution of Contract Documents
 - 7. Submittal of Shop Drawings, Product Data and Samples
 - 8. Preparation of record documents
 - 9. Use of the Premises
 - 10. Office, Work and storage areas
 - 11. Equipment deliveries and priorities
 - 12. Safety procedures
 - 13. First aid
 - 14. Security

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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

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- 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

ORANGE COUNTY CORRECTIONS COMPOUND
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SECTION 01 32 33 - CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including Contractual Conditions and other Division-01 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 Section 01 33 00 Submittal Procedures for general requirements for submitting photographs. Permission must be obtained for any area within Corrections compound in which photos will be obtained.
- 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.

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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

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SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

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

- B. Administrative Submittals: Refer to other Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

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

- C. The Schedule of Values submittal is included in Section 01 29 00 Payment Procedures.

1.03 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.

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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. Orange County Corrections Compound Communication Upgrades.
 - b. Date.
 - c. Matern Professional Engineering
130 Candace Drive
Maitland Florida 32751
 - 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., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.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.

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- E. Contractor shall be responsible for cost of third review and additional reviews of rejected submittals, shop drawings, etc. Costs for third review shall be reimbursed to the County by deducting the cost from the Contractor's monthly progress payments. Costs to be determined by applying the consultant's 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.

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- 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 01 29 00 Payment Procedures 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

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- 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 01 32 33 Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.

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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.

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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

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- 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

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 26, 27, 28 sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.03 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
 - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching is to be performed.
 - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 - 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
 - 7. Approval by the Engineer to proceed with cutting and patching does not waive the Engineer's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.04 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements.
 - a. Foundation construction
 - b. Bearing and retaining walls
 - c. Structural concrete
 - d. Structural steel
 - e. Lintels
 - f. Timber and primary wood framing
 - g. Structural decking
 - h. Miscellaneous structural metals
 - i. Stair systems
 - j. Exterior curtain wall construction
 - k. Equipment supports
 - l. Piping, ductwork, vessels and equipment
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Refer to Division 26 and 27 sections regarding Fire Rated Penetrations.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.
 - a. Shoring, bracing and sheeting
 - b. Primary operational systems and equipment
 - c. Air or smoke barriers
 - d. Water, moisture, or vapor barriers
 - e. Membranes and flashings
 - f. Fire protection systems
 - g. Noise and vibration control elements and systems
 - h. Control systems
 - i. Communication systems
 - j. Conveying systems
 - k. Electrical wiring systems
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.
 - 1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and

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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

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- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
 - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.
 - 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

3.04 CLEANING

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

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

END OF SECTION

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SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.01 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.
- 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 is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.
 - 2. Advise Owner of pending insurance change-over requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - 5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the County's Project Manager will either proceed with inspection or advise the Contractor of unfilled

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

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

1.04 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.

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- 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-Built 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,

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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 completed 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

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- 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-built 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-Built: 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 standard divisions. Bookmarks will be needed for the appropriate divisions.
 - 4. Operations and Maintenance Manual: Specify the division name only in the bookmarks. 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

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- A. General: General cleaning during construction is required by the General Conditions.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
 - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.
- C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
 - 1. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

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SECTION 01 78 00 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contractor Documents, including manufacturers standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
 - 2. General closeout requirements are included in Section 01 77 00 Closeout Procedures.
 - 3. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in this document.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.03 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.
- B. Reinstatement of Warranty. When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
 - . Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligation, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

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- 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 Divisions 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

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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

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SECTION 01 80 00 - ORANGE COUNTY BCC STANDARDS SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 WEB SERVERS

- A. Web and Data Placement
 - 1. A database server shall not reside in the same hardware platform as a web server.
- B. Anonymous Accounts
 - 1. Web server anonymous accounts shall only have read and execute permissions to folders/files within the web server directories. Change and delete permissions to folders/files that are directly accessible via a web browser shall not be granted to web server anonymous accounts.

1.3 DMZ

- A. Web Server Platforms
 - 1. Microsoft Internet Information Server (IIS) version 5.0 or higher shall be the only platform within the DMZ to run as a Web or FTP server.
- B. Services and Protocols
 - 1. Traffic using the following protocols from the DMZ to the internal network shall not be allowed: Kerberos, NetBIOS, Microsoft- DS, Microsoft's Well Known Ports, LDAP, RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.
- C. Encrypted Data
 - 1. Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: Name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information. The OCGBCC DMZ shall not have access to data containing bank information. The OCGBCC DMZ shall not have access to social security information.
- D. Data Access
 - 1. The OCGBCC DMZ shall have read only access to live data, if such data is also used by applications residing in the internal OCGBCC network.

1.4 ANTIVIRUS

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

1.5 MICROSOFT SECURITY PATCHES

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

1.6 DESKTOP COMPUTING STANDARDS

- A. AUTHORIZED PRODUCTS

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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

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- 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.

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- 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.

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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

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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

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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)

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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.

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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

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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.

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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

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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,

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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

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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.

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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

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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

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SQL database calls.

5. Enforcement

- a) Any server found within the OCGBCC DMZ that does not meet 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 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.
 - 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

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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.

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- 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

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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.

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(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

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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

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SECTION 02 07 00 - DEMOLITION AND ALTERATIONS

PART 1 - GENERAL

1.1 SCOPE OF SECTION

- A. Cut, demolish and remove existing work associated with the renovation. Cut and remove existing work as indicated or necessary to fit new work to existing that is to remain. Where practical, salvage existing items that may be reused or are indicated for reuse or to be turned over to Owner.

1.2 REFERENCE STANDARDS

- A. The latest edition of publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- 1. ASTM E 84 Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- 2. NFPA 241 Safeguarding Construction, Alteration and Demolition Operations

- B. Unknown Conditions: Work shall not include Contractor's identification, detection, abatement, encapsulation or removal of asbestos or similar hazardous substance(s). In the course of performing this work, if such material/product is encountered, discontinue work and remove workers from the project until such material/product and hazards connected therewith are abated, encapsulated or removed, or it is determined that no hazard exists. An extension of time will be granted for delay resulting from such condition and correction.

- C. Structural Members: Do not cut any building structure without written authorization of the Engineer. Any structural members intentionally cut without proper authorization or accidentally cut shall be restored to their original integrity and condition.

- 1. Do not cut or drill existing concrete pre cast slabs. Use existing chases and openings at floor slabs.

1.3 PROTECTION

- A. Safety: Before commencing any work, provide warning signs, lights, barricades, fences, rails and other safety devices. Exercise caution when working adjacent to spaces occupied by Owner's personnel.
- B. Temporary Work: Do not commence demolition until temporary shoring, bracing, partitions, exits and other support and protective measures have been properly installed.
- C. Temporary Partitions and Closures: Where new existing openings are created and where work is in occupied spaces or existing equipment, provide physical separation and protect from dust and moisture with partitions and closures. Maintain partitions in place until new work has been completed and provide protection from the weather and dust. Before and during removal, clean all surfaces with a vacuum cleaner (to avoid dispersion of dust).

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- D. Portable Coverings: For minor interior alterations, where acceptable to Engineer, flame-proofed drop cloths may be used. Plastic sheet or film shall not be used for any purpose for interior work.
- E. Air filters: During Demolition provide portable air filters as part of dust control.
- F. Wet mop concrete floors slab to control dust.
- G. Vacuum space every day at the completion of the work.

1.4 SECURITY

- A. Establish procedures and execute operations to provide continuous security. Provide temporary protection for openings and at other locations as may be appropriate during construction. Deny entrance of unauthorized persons into work area.

1.5 HOUSEKEEPING

- A. Collect debris, rubbish and trash resulting from operations at designated places. Sprinkle dusty debris with water. Handle in a controlled manner. Do not accumulate waste unnecessarily; remove promptly from premises; generally daily. Sweep and vacuum floors in work areas as frequently as necessary to maintain premises in acceptable condition for continuous, uninterrupted operation by Owner.

1.6 OCCUPIED SPACES

- A. Since the building will maintain operations, coordination will be required with building staff and owners representative to coordinate time of demolition to minimize disturbance occupants.

PART 2 - MATERIALS

2.1 LUMBER

- A. Wood and plywood used in building temporary partitions shall be fire-retardant treated to provide flame spread rating, per ASTM E 84, or maximum of twenty-five (25).

2.2 TAPE

- A. Kraft paper two (2) inches wide with pressure sensitive adhesive one side. Shear strength (peel adhesion); 60-oz. per inch width. Acceptable: Fastape.

2.3 TEMPORARY CLOSURES

- A. In addition to the requirements of Division 0, flame-proofed drop cloths (not flammable plastic), UL labeled, flame spread maximum fifteen (15). Where daylight would be beneficial for workmanship and reduce need of artificial illumination, translucent polyvinyl chloride film reinforced in diamond pattern with 33 nylon threads per foot. Acceptable: "Griffolyn" T-55-FR, Reed Industries, Box 248, Houston, Texas 77233, phone 800/231-6074.

PART 3 - EXECUTION

3.1 RELOCATION AND REMOVAL

- A. Temporarily remove or suitably relocate designated equipment, utilities or services to

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clear the work, or to properly function in the complete installation. Where services or utilities are removed, suitable cap or terminate according to applicable ordinances and requirements of governing authorities and/or per other sections of specifications and drawings. Where such items interfere with the work and specific instructions are not included on the drawings, they shall be adequately protected and further instructions requested from the Engineer. Existing construction that does not interfere with new work and will be concealed may remain in place unless indicated to be removed.

3.2 PORTABLE COVERINGS

- A. For interior alterations, where acceptable to Engineer, flame-proofed drop cloths may be used. Flammable plastic sheet or film shall not be used within the building.

3.3 DEMOLITION

- A. Plan of Operations: Establish procedures for safe removal of parts by methods that will not transmit excessive vibrations to or eccentric loads on building structure, create a nuisance, damage existing work that will remain, nor endanger either workmen, public, occupants nor adjacent work.
- B. Supervision: Cut and demolish under supervision of a competent foreman, capable of identifying hazardous conditions and authorized to promptly take corrective action to eliminate them.
- C. Precaution: Exercise care to avoid unnecessary damage to work that shall remain or stored for reinstallation.
- D. Hole Cutting: Neatly cut holes where necessary. Keep area and debris covered to minimize creation of dust. Use care and adjust hole locations as required to minimize necessary cutting.
- E. Finishes and Exposed Work: Cut to true and straight lines to permit satisfactory refinishing or connection to new work. Remove items to nearest full piece that is to remain.

3.4 OWNERSHIP OF MATERIALS

- A. Salvaged materials that are to be relocated or remain the property of the Owner shall be carefully removed and stored on the site for reuse or disposition specified. Other materials become the property of Contractor and shall be removed and disposed of off the site.

3.5 SALVAGE OPERATIONS

- A. Salvage existing materials/products identified to be reused or turned over to Owner. Carefully remove, collect, protect, repair, clean or restore to first class condition, relocate and reinstall where and as indicated. After cleaning and repairing salvaged items to be furnished to Owner, place in location on premises designated by Owner's representative.

3.6 REMOVAL

- A. Remove materials/products/equipment which are not to be reused in the work in an orderly and careful manner so as not to endanger or damage adjacent work which is to remain. When removing nails by claw hammer, place a small piece of wood under the hammer head to keep claws at right angle to the nail and prevent damage to the surface.

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3.7 DISPOSAL

- A. Haul rubbish, debris and unusable material away from the site promptly and dispose of legally. Burning on site is prohibited.

3.8 CLEANING

- A. Clean surfaces as described in specifications.

3.9 CONCRETE

- A. Exercise due caution in cutting and patching, chipping or general concreting so as not to deface that portion of the existing structure which is to remain. Should any such impairment occur, immediately clean or restore to original condition at no cost to Owner.
- B. Do not cut or core existing, concrete slabs, columns, joist and beams.
- C. Patch all existing slab penetrations caused by demolition of mechanical and plumbing with rated and UL listed seal assembly.

3.10 UTILITIES AND RELATED EQUIPMENT, PLUMBING, AND ELECTRICAL WORK

- A. Protect existing utilities, storm, waste, water, fire protection, conduit racks, refrigerant pipes and raceways as indicated and as uncovered by the work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Engineer. If electrical, communications, fire protection and systems lines are encountered and not shown on drawings, contact the Engineer prior to the start of the work.

3.11 DRYWALL

- A. Within the limits of the work, should any portion of existing drywall surfaces be deemed broken, scratched or unfastened, spackle with drywall compound, refasten or other wise repairs. Where indicated on the drawings for drywall to be removed remove the covering, base, drywall board, vapor barrier, insulation, metal furring and all fasteners.
- B. Within the limits of the work make repairs to drywall partitions. Match adjacent surfaces or as indicated on the drawing.
- C. Within the limits of tile work remove drywall ceiling and ceiling suspension system and supports, fasteners complete.

3.12 PATCHING

- A. Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish.
- B. Where patching occurs on rated partition or fireproofed structure repair to match existing UL rated system to match code required hourly rating for assembly.

3.13 FIRESTOPPING AND DRAFT STOPPING

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- A. Fire stop existing holes at all masonry walls, floor slab & GWB Partitions.
- B. Fire stop existing open ends of conduits:
- C. Fire stop all existing plumbing penetrations at existing rated walls and floors.
- D. Draft stop all penetrations into cavity of walls, ceilings, and attics. They include all penetrations created by new work or penetrations left by removal of existing proposed for replacement.

3.14. ACOUSTICAL LAY-IN CEILING

- A. Remove and re-install existing acoustical ceiling and suspension system as required by the work U.O.N. on the drawings. If any portion of the existing ceiling is damaged by the G.C. it shall be replaced to match existing.

END OF SECTION

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General conditions provisions of the contract including contractual conditions, and Division 01 specifications.

1.2 SUMMARY

- A. This Section includes sheet metal flashing and trim in the following categories:
 - 1. Copings.
 - 2. Metal flashing.
 - 3. Self-adhering flashing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- B. Shop Drawings: Of each item specified showing layout, profiles, methods of joining, and anchorage details.
- C. Samples: Of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
 - 1. 8-inch- square Samples of specified sheet materials to be exposed as finished surfaces.
 - 2. 12-inch- long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.
- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineers and Owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Quality Control Standard: Sheet Metal & Air Conditioning Contractor's National Association (SMACNA), latest edition, and the Florida Building Code.
- B. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to

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verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Engineer.
2. Notify Engineer one week in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Engineer's approval of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. When directed, demolish and remove mockups from Project site.
 - b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.6 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 ALUMINUM COPING:

- A. HICKMAN: Perma Snap 2 with product Florida Product approval # 7424

2.2 METALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
 1. Factory-Painted Aluminum Sheet: ASTM B209, 3003-H14, with a minimum thickness of 0.040 inch, unless otherwise indicated.
 2. Extruded Aluminum: ASTM B221, alloy 6063-T52, with a minimum thickness of 0.080 inch for primary legs of extrusions that are anodized, unless otherwise indicated.
- B. Stainless-Steel Sheet: ASTM A167, Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance; minimum 0.0187 inch thick, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
 1. Use S.S. 316 fasteners when connecting to P.T. Wood Nailers.

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- B. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."
- C. Self-Adhering Flashing/ Weather Barrier: Self-adhering rubberized asphalt membrane integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 40 mils thick.
 - 1. Product and Manufacturer – Basis of Design: Perm-A-Barrier Wall Flashing; Grace Construction Products.
 - a. Surface Conditioner: Type as recommended by the manufacturer for substrates indicated.
- D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

2.4 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- E. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Separate metal from noncompatible metal or corrosive substrates with self-adhering flashing material.
- H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for

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application but never less than thickness of metal being secured.

2.5 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:
 - 1. Aluminum: 0.050 inch thick.
- C. Copings: Fabricate from the following material:
 - 1. Aluminum: 0.050 inch thick.
- D. Base Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.01inch minimum thickness.
- E. Counterflashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.01inch minimum thickness.
- F. Flashing Receivers: Fabricate from the following material:
 - 1. Stainless Steel: 0.01inch minimum thickness.
- G. Equipment Support Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.0187 inch thick.
- H. Concealed Flashing and Thru-Wall Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.1084 inch thick; mill finish.

2.6 ALUMINUM FINISHES

- A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.
- B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA standards.
 - a. Colors: Custom to be selected by the Engineer to match existing building coping..

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.
 - 1. Install exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- B. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- E. Separations: Separate metal from noncompatible metal or corrosive substrates using self-adhering flashing material.
- F. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.
- G. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Seal flashing to equipment support member.

3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

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- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

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SECTION 07842 - FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes firestopping and smoke sealing for the following:
 - 1. Through penetrations of fire-resistance-rated construction, including both empty openings and openings containing cables, pipes, ducts, conduits, structural members, and other penetrating items.
 - 2. Membrane penetrations of fire-resistance-rated construction, including both empty openings and openings containing cables, pipes, ducts, conduits, structural members, and other penetrating items.
 - 3. Joints in fire-resistance-rated construction, including floor-to-floor, wall-to-wall, floor-to-wall, and head-of-wall joint systems.
 - 4. Openings of, and annular spaces of, through- and membrane-penetrations in smoke barriers and other compartmentalized areas.
 - 5. Construction, control and expansion joints of, and perimeters of, smoke barriers and other compartmentalized areas.

1.3 REFERENCES

- A. ASTM E814 - "Test Method for Fire Tests of Through-Penetration Fire Stops"
- B. UL 2079 - "Standard for Tests for Fire Resistance of Building Joint Systems"
- C. FM 4991 - "Standard for Approval of Firestop Contractors"

1.4 DEFINITIONS

- A. Firestopping: The combination of materials utilized to restore the integrity of an assembly identified with an hourly rating.
- B. Smoke sealing: The combination of materials utilized to restore the integrity of an assembly identified as a smoke barrier.
- C. Through-Penetration: The incident in which a penetrating item passes entirely through any assembly identified either with an hourly rating or as a smoke barrier; i.e., breaching both sides of the assembly.
- D. Membrane-Penetration: The incident in which a penetrating item passes into or exits from any assembly identified either with an hourly rating or as a smoke barrier; i.e., entering into or

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exiting from only one side of the assembly.

- E. Joint: The abutment of or gap between two or more assemblies. Either one or both of the assemblies may be identified either with an hourly rating or as a smoke barrier. The assemblies may be either parallel or perpendicular to each other. These include floor-to-floor, wall-to-wall, floor-to-wall, head-of-wall, or any other linear breach of the assembly(ies).

1.5 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases according to requirements indicated, and to restore integrity of assembly.
 - 1. For systems subject to movement, provide products that will remain flexible to allow for such movement without affecting the integrity of the system when exposed to movement.
 - 2. For systems exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
 - 3. For systems for items subject to binding, e.g., fire or smoke dampers, provide non-intumescent type products.
- B. F-Rated Penetration Firestop Systems: Provide penetration firestop systems with F ratings determined per ASTM E814, not less than that of the construction penetrated.
- C. T-Rated Penetration Firestop Systems: Provide penetration firestop systems with T ratings, in addition to F ratings, determined per ASTM E814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.
- D. Joint Firestop Systems: Provide joint firestop systems with fire-resistance ratings determined per UL 2079, not less than that of the construction in which the joint occurs. Where movement is required or can be anticipated, joint firestopping system must be listed as a dynamic joint, with movement capabilities equal to those of the in-service conditions.
- E. Materials offered for horizontal applications shall be capable of self-supporting any penetrating item and shall maintain their integrity when tested in horizontal applications.

1.6 SUBMITTALS

- A. Schedule identifying conditions to be firestopped and smokesealed. Include type of construction, orientation, type and size of penetrant, type and size of joint, and methods to accomplish firestopping and smoke sealing. One axis of schedule shall identify each assembly to be firestopped or smokesealed and its rating (i.e., 1-hour cmu wall). Second axis of schedule shall identify each penetrant or joint to be firestopped or smokesealed (i.e., 4" cast iron pipe – insulated). Intersection point between both axes of schedule shall identify design designations from qualified testing and inspecting agency proposed to accomplish firestopping and smoke sealing (i.e., C-AJ-5102).
- B. Product data and copies of listings or test reports. Cross-reference each to schedule. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular condition, submit illustration approved by manufacturer's fire protection engineer with modifications marked and signed engineering opinion letter stating basis for modifications.

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- C. Qualification data for firm and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, and dates (month/year); names and phone numbers of Architects and Owners; products installed at each listed project; and other information specified.
 - 1. Include letter from manufacturers of products specified, wherein manufacturer recognizes as trained or approved, or certifies, firm and persons for installation of that manufacturer's products.
 - 2. Copy of Factory Mutual's Approved Firestop Contractor certificate, if applicable.
- D. Identification label.
- E. Certification affidavit.

1.7 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics:
 - 1. Firestopping tests performed by a qualified nationally recognized independent testing and inspecting agency performing testing and follow-up inspection services for firestopping that is recognized by the Council of American Building Officials and is acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping identical to that tested per ASTM E814 under conditions where positive furnace pressure differential of at least 0.01" of water is maintained at a distance of 0.78" below the firestopping surrounding the penetrating items in the test assembly.
 - 3. Joint firestopping identical to that tested per UL 2079 under conditions where all components of each joint system, including splices, are exposed to a positive furnace pressure differential. For tests of floor-to-floor, floor-to-wall and head-of-wall joint systems, the average furnace pressure shall be measured at 12" below the exposed horizontal surface of the test assembly. For tests of wall-to-wall joint systems, the average furnace pressure shall be measured at the elevation of the midheight of the exposed vertical surface of the test assembly. After the initial ten (10) minutes of fire exposure, the furnace pressure for the respective joint systems shall not be less than 0.01" of water for an aggregate time period exceeding 10% of the fire exposure for fire tests of one (1) hour or less duration, 7.5% of the fire exposure for fire tests longer than one (1) hour but not longer than two (2) hours and 5% of the fire exposure for fire tests exceeding two (2) hours.
- B. References to specific design designations of firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed alternate systems equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.
- C. Installer Qualifications: A single-experienced Installer who is trained, certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements and who has specialized in installing firestopping systems similar in material, design, and extent to those indicated for this Project. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer. All firestopping and smoke sealing products, regardless of the Section in which their use is specified or drawing on which their use is indicated, are to be installed by a single installer.

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- D. Technical Advice: Provide technical advice from material manufacturer's lab and technical department on materials and assemblies as required. For through- or membrane-penetrations and assemblies proposed but not yet tested provide an Engineering Opinion, in writing on manufacturer's letterhead signed by a qualified person and bearing his title, with copies to the Architect. Engineering Opinions shall be based on approval tests from recognized independent testing agency.
- E. Pre-Installation Conference: Prior to preparation for and installation of materials to be used as firestops and smoke seals convene a pre-installation conference at project site with the Contractor, installer, affected subcontractor(s), material supplier(s), and Architect. Review Contract Document requirements, submittals, status of coordinating work, availability of materials and installation facilities, proposed installation schedule, safety and handling requirements, requirements for inspections and testing or certifications, proposed installation procedures and protection requirements for construction period extending beyond installation. Record discussion; furnish copy of recorded discussions to each participant.
- F. Field-Constructed Mockup: Prior to installing firestopping and smoke sealing, erect mockups for each different system to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.
1. Locate mockups on site in locations indicated or, if not indicated, as directed by Architect.
 2. Identify mockups as specified under the "Field Quality Control" article.
 3. Notify Architect one (1) week in advance of the dates and times when mockups will be erected.
 4. Obtain Architect's acceptance of mockups before start of final unit of Work.
 5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.
 - a. When directed, demolish and remove mockups from Project site.
 - b. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.
- G. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that systems are installed per specified requirements. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate systems.

1.8 CERTIFICATIONS

- A. Contractor shall provide the following notarized affidavit jointly signed by corporate officers, with titles noted, of both the Contractor and installer:
- "We the undersigned certify that firestops and smoke seals have been installed in accordance with Contract Document requirements and manufacturer's instructions, and that materials used meet firestopping and smoke sealing requirements of the Contract Documents".
- B. Manufacturer shall provide the following certification, executed by the appropriate person, with title and department noted:
- "Products provided by (manufacturer) for the (name of project) are composed of the same ingredients and formulation or are of the same components and identical construction as products that have been tested by (the testing agency) for various fire

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resistive and other performance ratings, and when properly applied or installed in accordance with (manufacturer) instructions will perform in a manner consistent with results obtained in the tests conducted by (the testing agency)".

1.9 SEQUENCING AND SCHEDULING

- A. Schedule installation of penetration firestopping and smoke sealing after completion of penetrant installation but prior to covering or concealing of openings. Schedule installation of joint firestopping and smoke sealing after completion of adjacent assemblies, but prior to covering or concealing of joints.
- B. Do not cover up those firestopping and smoke sealing installations that will become concealed behind other construction until authorities having jurisdiction have examined each installation.

1.10 PRECEDENCE

- A. Order of precedences: Firestopping, smoke sealing, acoustical/sound rating, other requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A/D Fire Protection Systems, Inc.
 - 2. Bio Fireshield / The Rectorseal Corp.
 - 3. Hilti, Inc.
 - 4. Grace / International Protective Coatings Corp.
 - 5. Isolatek International
 - 6. Nelson Firestop Products / O - Z Gedney
 - 7. NMP Corp.
 - 8. Specified Technologies, Inc.
 - 9. Thermal Ceramics
 - 10. 3M Fire Protection Products
 - 11. Tremco, Inc.
 - 12. Unifrax

2.2 MATERIALS

- A. Firestopping and Smoke sealing: Provide systems composed of components that are compatible with each other, the substrates forming openings or joints, and the items, if any, penetrating the system under conditions of service and application, as demonstrated by system manufacturer based on testing and field experience. Provide systems of one or more of the following types:
 - 1. Ceramic-Fiber Mastic Coating and Sealant: Single-component formulation of ceramic fibers and inorganic binders.

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2. Collar: Factory-manufactured device consisting of a metal-restricting collar housing a molded intumescent insert.
 3. Endothermic Latex Compound Sealant: Single-component, endothermic, latex formulation.
 4. Intumescent Latex Mastic Sealant: Single-component, intumescent, latex formulation.
 5. Intumescent Polyurethane Foam Block: Pliable softfoam-shaped block, intumescent formulation.
 6. Intumescent Putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
 7. Intumescent Wrap Strip: Flexible elastomeric strip, intumescent. May be used in conjunction with a surface-mounted restricting collar.
 8. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogenous mortar.
 9. Pillow/Bag: Re-usable, heat-expanding pillow/bag composed of a glass-fiber cloth or plastic case filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
 10. Silicone Sealant: Single-component, moisture-curing, silicone-based, neutral-curing elastomeric sealant, self-leveling and non-sag as appropriate.
- B. Identification: Provide pressure-sensitive, self-adhesive, preprinted vinyl identification labels for firestopping and smoke sealing systems, minimum 2" by 3". Identification shall include:
1. Condition:
 - a. For penetration firestops, "Rated Penetration Firestop System - Do Not Disturb."
 - b. For joint firestops, "Rated Joint Firestop System - Do Not Disturb."
 - c. For smoke seals, "Smoke Seal System - Do Not Disturb."
 - d. For all, "Notify Building Management of any damage."
 2. System designation issued by the qualified testing and inspecting agency, and the name of the qualified testing and inspecting agency.
 3. System manufacturer's name.
 4. Contractor's name, address, and phone number.
 5. Installer's name, address, and phone number.
 6. Date of installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordination: Sequence work to avoid need for removal of firestopping and smoke sealing by work of other trades.
- B. Preparation: Clean out openings and joints immediately prior to installing firestopping and smoke sealing. Prime substrates where recommended by manufacturer.
- C. Install forming/damming materials and other accessories of types required to support firestopping during application and in the position needed to produce the cross-sectional shapes and depths required to restore fire-resistance-rated construction. After installing firestopping and smoke sealing, remove combustible forming materials and other accessories not listed as permanent components of system.

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- D. Install firestopping by proven techniques to restore fire-resistance-rated construction.
- E. Install materials in both fire-rated and smoke barrier assemblies with sufficient pressure to properly fill and seal openings to ensure an effective cold smoke seal.

3.2 FIELD QUALITY CONTROL

- A. After installation, identify firestopping and smoke sealing systems at locations where each is installed. Attach labels permanently to surfaces of adjacent construction on both sides of each system installation where labels will be visible to anyone seeking to disturb the installation or adjacent construction.
- B. Inspect completed firestopping and smoke sealing for compliance with requirements, and issue written letter to Architect and Owner stating such.
- C. Do not proceed to cover or enclose firestopping and smoke sealing with other construction until reports of examinations are issued.
- D. Where deficiencies are found, repair or replace firestopping and smoke sealing so that it complies with requirements.

3.3 CLEANING AND PROTECTION

- A. Clean off excess materials adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of systems and of products in which opening and joint occurs.
- B. Protect firestopping and smoke sealing during and after installation from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping and smoke sealing immediately and install new materials to produce systems complying with specified requirements.

3.4 PENETRATION AND JOINT FIRESTOP SCHEDULE

- A. A combination of multiple details may be necessary to address a specific job condition, such as multiple or differing penetrants through a single opening or a head-of-wall joint with a penetration of the wall or horizontal assembly.
- B. The following basic system references are not intended to be exhaustive or exclusive. System numbers are from UL for convenience only.
- C. Blank Opening:
 - 1. CMU: CAJ0004, CAJ0009, CAJ0011, CAJ0012, CAJ0014, CAJ0015, CAJ0033, CAJ0040, CAJ0041, CAJ0043, CAJ0050, CAJ0051, CAJ0053, CAJ0054, CAJ0055, CBJ0009
 - 2. GWB: WL0001, WL0005
- D. Metallic Pipe, Conduit, or Tubing:

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1. CMU: CAJ1001, CAJ1003, CAJ1031, CAJ1044, CAJ1079, CAJ1205, CAJ1213, CAJ1224, CAJ1226, CAJ1234, CAJ1235, CAJ1262
2. GWB: WL1001, WL1029, WL1030, WL1049, WL1054, WL1085, WL1089, WL1090, WL1091, WL1094, WL1105, WL1113, WL1115

E. Flexible Metal Conduit:

1. CMU: CAJ1052, CAJ1079, CAJ1176, CAJ1242
2. GWB: WL1017, WL1046, WL1049

F. Metal Pipe, Conduit, or Tubing with Cables:

1. CMU: CAJ3015, CAJ3016, CAJ3089, CAJ3093, CAJ3128, CAJ8001, CAJ8046
2. GWB: WL3005, WL3025, WL3032, WL3065, WL3088, WL8008

G. Non-Metallic Pipe, Conduit, or Tubing – Plastics:

1. CMU: CAJ2001, CAJ2082, CAJ2088, CAJ2109, CAJ2124, CAJ2149, CAJ2163, CAJ2171, FA2024, WJ2040
2. GWB: WL2002, WL2038, WL2059, WL2070, WL2071, WL2078, WL2083, WL2133

H. Non-Metallic Pipe, Conduit, or Tubing – Glass:

1. CMU: CAJ1032, CAJ2079, CAJ2118, CAJ2144
2. GWB: WL2112, WL2114

I. Electrical Cables – No Sleeve:

1. CMU: CAJ3003, CAJ3016, CAJ3030, CAJ3035, CAJ3043, CAJ3068, CAJ3083, CAJ3095, CAJ3103, CAJ3116
2. GWB: WL3011, WL3026, WL3030, WL3044, WL3060, WL3064, WL3065, WL3076, WL3087

J. Electrical Cables – Metal Sleeve:

1. CMU: CAJ3002, CAJ3030, CAJ3095, CAJ3116, CAJ3128, WJ3030
2. GWB: WL3005, WL3025, WL3032, WL3065, WL3072, WL3088, WL3106

K. Electrical Cables – Non-Metallic Sleeve:

1. CMU: CAJ2162, CAJ2163, CAJ3030, CBJ3003
2. GWB: Submit

L. Insulated Metallic Pipe, Conduit, or Tubing:

1. CMU: CAJ5001, CAJ5058, CAJ5080, CAJ5082, CAJ5088, CAJ5089, CAJ5091, CAJ5099, CBJ5008
2. GWB: WL5014, WL5029, WL5033, WL5039, WL5040, WL5050, WL5060, WL5065, WL5066, WL8007

M. Insulated Non-Metallic Pipe, Conduit, or Tubing – Plastics:

1. CMU: CAJ5022, CAJ5042, CAJ5106
2. GWB: WL2002, WL5054

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- N. Insulated Non-Metallic Pipe, Conduit, or Tubing – Glass:
 - 1. CMU: CAJ5103
 - 2. GWB: WL5051

- O. Miscellaneous Electrical Penetrants:
 - 1. CMU: CAJ6011, CAJ8001, CAJ8055
 - 2. GWB: WL8002, WL8003, CLIV, UL Report 94NK15324

- P. Miscellaneous Mechanical Penetrants:
 - 1. CMU: CAJ7005, CAJ7008, CAJ7009, CAJ7010, CAJ7013, CAJ7016, CAJ7027, CAJ7030, CAJ7036, WJ7001, WJ7002, WJ7003
 - 2. GWB: WL7003, WL7006, WL7007, WL7008, WL7009, WL7010, WL7011, WL7022

- Q. Multiple Mixed Penetrants:
 - 1. CMU: CAJ1140, CAJ3123, CAJ4010, CAJ8001, CAJ8012, CAJ8013, CAJ8042, CAJ8046, CAJ8049, CAJ8052, CAJ8053, CAJ8055, CAJ8056, CAJ8057, CAJ8059, WJ8004
 - 2. GWB: CAJ8003, WL1031, WL1127, WL4017, WL8002, WL8003, WL8004, WL8007, WL8008, WL8010, WL8013

- R. Head-of-Wall Joints, Dynamic:
 - 1. Concrete/Masonry – Concrete: HWD0006, HWD0007, HWD0008, HWD0017, HWD0022, HWD1001
 - 2. Frame – Concrete: HWD0003, HWD0010, HWD0011, HWD0015, HWD0016, HWD0019, HWD0020

END OF SECTION

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SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through the fire-resistance-rated assemblies, including both new and existing empty openings and new and existing openings containing penetrating items.
- B. Firestopping shall be designed and constructed in accordance with the Florida Building Code, Florida Fire Code and Uniform Fire Safety Standards as adopted by the State Fire Marshall and latest addendums

1.3 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
 - 1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
 - 2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 - 3. Fire-resistance-rated roof assemblies.
 - 4. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 5. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - Penetrations located outside wall cavities.
 - Penetrations located outside fire-resistive shaft enclosures.
 - Penetrations located in construction containing fire-protection-rated openings.
 - Penetrating items larger than 4-inch (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.
 - 6. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 - 7. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

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8. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
9. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
10. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

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- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

UL in "Fire Resistance Directory."
- E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

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- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Hilti Construction Chemicals, Inc.
Nelson Firestop Products.
3M Fire Protection Products.

2.2 FIRESTOPPING

- A. General: Where UL-classified systems are indicated, they refer to the alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- C. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - Slag-/rock-wool-fiber insulation.
 - Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - Fire-rated form board.
 - Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

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2.3 FILL MATERIALS

- A. General: Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- I. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- K. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 - 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing

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containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
 - 2. Install fill materials for firestop systems by proven techniques to produce the following results:

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3. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
4. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
5. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: The Contractor shall engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
- B. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5 IDENTIFICATION

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Labels shall be installed above ceilings and in concealed spaces. Include the following information on labels:
 1. The words: "FIRE AND SMOKE BARRIER PROTECT ALL OPENINGS".
Contractor's name, address, and phone number.
Through-penetration firestop system designation of applicable testing and inspecting agency.
Date of installation.
Through-penetration firestop system manufacturer's name.
Installer's name.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION

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SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Acoustical joint sealants.

1.2 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required, provide samples with joint sealants in 1/2"-wide joints formed between two (2) 6"-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- G. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results for "Product Test Reports" paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E548.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

1.4 PROJECT CONDITIONS

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- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.
- C. Multi-Component, Non-Sag, Neutral-Curing Silicone Sealant:
 - 1. Products:
 - a. Dow Corning Corporation; 756 H.P.
 - b. Other approved equivalent.
 - 2. Type and Grade: M (multi-component) and P (pourable)
 - 3. Class: 50
 - 4. Use Related to Exposure: NT (non-traffic)
 - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O
 - a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-

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performance coating, galvanized steel, brick, and ceramic tile.

D. Single-Component, Neutral-Curing Silicone Sealant:

1. Products:
 - a. Dow Corning Corporation; 799
 - b. GE Silicones; UltraGlaze SSG4000
 - c. GE Silicones; UltraGlaze SSG4000AC
 - d. Polymeric Systems, Inc.; PSI-631
 - e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus
 - f. Tremco; Proglaze SG
 - g. Tremco; Spectrem 2
 - h. Tremco; Tremsil 600
2. Type and Grade: S (single-component) and NS (non-sag)
3. Class: 25
4. Use Related to Exposure: NT (non-traffic)
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O
 - a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and ceramic tile.

2.3 JOINT-SEALANT BACKING

- A. Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330. Provide any type approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, non-absorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 °F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Non-Porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent non-porous surfaces in any way, and formulated to

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promote optimum adhesion of sealants to joint substrates.

- C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean non-porous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Non-porous joint substrates include the following:
 - a. Metal.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or joint-sealant-substrate tests prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.

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2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Non-Sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.
- G. Installation of Preformed Tapes: Install according to manufacturer's written instructions.
- H. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8". Hold edge of sealant bead 1/4" inside masking tape.
 3. Within ten (10) minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
- I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. EXAMINATION / INSPECTION

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

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2. Inspect tested joints and report on the following:
 - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants-filled joint cavities and are free from voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
3. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements. Costs for retests and resultant required work will be paid for by Contractor.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

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SECTION 09 55 10 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division 01 Specification sections apply to work of this section.

1.2 SCOPE

- A. Selectively remove existing acoustical ceiling tile and suspension system as required by the communications work and store for reinstallation. Provide new acoustical ceiling tile and suspension system as required to replace all damaged ceiling tile and suspension system which cannot be reused and reinstalled.
- B. Replace components as required or if damaged by the work.

1.3 SUBMITTALS

- A. Product Data: Provide 6 copies of manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.

1.4 JOB CONDITIONS

- A. Space Enclosure: Do not install interior acoustical ceilings until wet-work in space completed and nominally dry, and until work above ceilings completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 CEILING UNITS

A. Acoustical Panels:

1. General:

- a.) Provide lay-in panels with fissured textured to match existing ceiling tile. Material
Fiber Acoustical Panels:

2. Products/Manufacturer:

- a.) Armstrong 1728A 2x2 lay in, Armstrong 1729A 2x4 lay in or approved equal.

2.2 CEILING SUSPENSION MATERIALS

A. General:

- 1. Comply with ASTM C-635 for dimensional tolerances, coatings and finishes, as applicable to type of suspension system required for type of ceiling units indicated. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, soffits, fans and partition system (if any).

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2. Structural Class: Intermediate-duty system. Individual component deflection shall not exceed 1/360 of the span.
 3. Hanger Wires: Galvanized carbon steel, ASTM A-641, soft temper, prestretched, yield-stress load of at least 3 times design load, but not less than 9-gauge. install wire hangar at each corner of grid at light fixtures.
 4. Type of System: Indirect-hung suspension system. Provide under the work of this Section, supplemental framing as required for proper spacing of hanger wires and other items suspended such as fans, and electric fixtures.
- B. System Manufacturer:
1. To match existing.
- C. Edge Moldings: Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish unless otherwise indicated.
- D. Exposed Suspension System: Manufacturer's standard exposed runners, cross-runners and accessories, of types and profiles indicated, with exposed cross runners coped to lay flush with main runners.
- E. Finish of Exposed Members: Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system, including moldings, trim, and accessories. Finish to match existing.
- F. Finish: Provide hot-dipped galvanized finish (G-30 minimum on all ceiling suspension components. Exposed surfaces of suspension system component will receive a white baked on enamel paint. Color to match existing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.
- B. When removing the system exercise care so as not to damage system.
- C. Coordinate with Owner's representative for an interior air-conditioned space for storage of all removed components.

3.2 INSTALLATION

A. General

1. Install materials in accordance with manufacturer's printed instructions, and comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.
2. Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.

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3. Install tile with pattern running in one direction.
 4. Install suspension systems to comply with ASTM C-636, with hangers supported only from building structural members or supplemental framing supported by building structural members. Locate hangers near each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".
 5. Secure wire hangers by looping and wire-tying, either directly to structures or supplemental framing.
 6. Install edge moldings to type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
 7. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.
 8. Install acoustical panels in coordination with suspension system instructions, with edges concealed by support of suspension members.
 9. Scribe and cut panels to fit accurately at borders and at penetrations.
 10. Do not use or install pop rivets in tracks.
 11. Do not staple tracks to wall.
 12. Install four support hangers at each corner of light fixtures and HVAC grille and diffusers.
 13. Store material in HVAC space to acclimate following the manufacturer's instruction for temperature and humidity.
- 3.2 ADJUST AND CLEAN
- A. Clean exposed surfaces of acoustical ceilings including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
 - B. Replace damaged tiles or suspension system to match existing.

END OF SECTION

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SECTION 09 90 00 - PAINTING

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 the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of painting Work shown on Drawings and as herein specified. The Owner requires sole source responsibility for cleaning and preparation of all surfaces prior to priming and painting.
- B. The Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated. Surface preparation and priming shall be included in the bid.
- C. Paint architectural structural exposed steel to match existing.
- D. Touch up paint existing metal wall panels, trim and flashing to match existing paint and color.
- E. "Paint" as used herein, means all coating systems materials, including primers, emulsions, enamels, stains, sealants and fillers, and other applied materials, whether used as primer, intermediate or finish coats and the preparation of the surfaces prior to the application of the coat systems.
- F. Paint exposed surfaces, whether or not colors are designated in "schedules", except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar material or areas. If color or finish is not designated, Architect will select these standard colors on the schedule for material systems specified.
- G. The following categories of Work are not included as part of field-applied finish Work, or are included in other sections of these specifications:
 - 1. Shop priming: This is only for new materials, unless otherwise specified, shop priming of ferrous metal items is included under various sections for new structural steel, new miscellaneous metal, new hollow metal work, and similar items.
 - 2. Mechanical and electrical work: Painting of mechanical and electrical work in unoccupied and concealed space is not required.
 - 3. Pre-finished items: Unless otherwise indicated, do not include painting when factory-finishing is specified.
 - 4. Concealed surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas.
 - 5. Finished metal surfaces: Metal surfaces of anodized aluminum and similar finished materials will not require finish painting, unless otherwise indicated.

1.3 SUBMITTALS

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- A. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material proposed for use.
- B. Do not order any materials until final color selection has been accepted by the Owner.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to job site in original, new, and un-opened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Name and title of materials.
 - 2. Manufacturer's name.
 - 3. Color name and number.

PART 2 - PRODUCTS

2.1 COLORS AND FINISHES

- A. Manufacturer listed is for color only and the basis for matching color selection to other paint manufacturers specifically called out for a surface. All colors to be selected by the Architect, or as indicated on drawings and specifications.
 - 1. Interior drywall and block walls: Color to match existing.
 - 2. Exposed steel structure: Paint color to match color of existing wall panel.

2.2 MATERIAL QUALITY

- A. Provide best quality grade of various types of coatings as regularly manufactured by PRATT & LAMBERT; DULUX PAINTS; PITTSBURGH PAINTS; GLIDDEN; SHERWIN WILLIAMS; DURON. Materials not displaying manufacturer's identification as a standard best-grade product will not be acceptable.
- B. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer and use only within recommended limits.
- C. Paint Systems: Provide the following paint systems for various substrate as indicated:

2.3 Exterior Paint Systems: Manufacturer listed name and system establishes baseline for quality standard for the paint system required. Other paint manufacturer's products may be submitted for review by the Architect. The Contractor will submit all information to the Architect to determine whether proposed substitution meets the baseline quality requirements.

2.4 Interior Paint Systems: Manufacturer listed name and system establishes baseline for quality standard for the paint system required. Other paint manufacturer's products may be submitted for review by the Architect. The Contractor will submit all information to the Architect to determine whether proposed substitution meets the baseline quality requirements.

- A. Exposed Steel Structure: Pratt & Lambert, Spec #41.1, gloss finish, alkyd type, one (1) coat Effecto Primer plus two (2) coats Effecto, or accepted equal.
- B. Interior Drywall Surfaces: Pratt & Lambert, Spec #114.4, semi-gloss finish, latex enamel type, two (2) coats Alcolate, or accepted equal.

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- C. Interior CMU Surfaces: Pratt & Lambert, Spec #118.4, satin finish, latex type, one (1) coat primafill plus two (2) coats Aqua Satin Enamel, or accepted equal.
- D. Exposed Stainless Steel:: Pratt & Lambert, Spec #41.1, gloss finish, alkyd type, one (1) coat Effecto Primer plus two (2) coats Effecto, or accepted equal.
- E. Exposed Steel: Pratt & Lambert, Spec #41.1, gloss finish, alkyd type, one (1) coat Effecto Primer plus two (2) coats Effecto, or accepted equal.
- F. Steel Primer: Federal Specification TT-P-636D, color and finish to match existing.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Applicator must examine areas and conditions under which painting work is to be applied, and notify Contractor in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
- B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, un-cured masonry joints repaired, and un-cured concrete allow manufacturer's recommendation for cure or as listed on the drawings and these specification or any conditions otherwise detrimental to formation of a durable paint film.

3.2 SURFACE PREPARATION

- A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions as herein specified and shown on drawings for each particular substrate condition.
- B. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
- C. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
- D. Cementitious Materials: Prepare cementitious surfaces of concrete, concrete block, and cement plaster to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

3.3 TEST & SURFACE PREPARATION

- A. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content or alkalinity exceeds that permitted in manufacturer's printed directions and

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recommendations. Submit two (2) copies of alkalinity test and recommendation for Owner and Architect record.

- B. Determine paint origin on existing metal panels. Notify Architect if paint is not original factory-applied paint.
- C. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop coated of oil, grease, dirt, loose mill scale, and other foreign substances as noted on Drawings.
- D. Touch-up shop applied prime coats wherever damaged or bare where required by other sections of these specifications. Clean and touch-up with same type of shop primer.
- E. Galvanized Surfaces: Clean free of oil and surface contaminants. Treat surfaces for painting and priming follow paint manufacturer recommendations for treatment and priming of galvanized surfaces.

3.4 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign material, and residue.
- B. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.5 APPLICATION

- A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Apply additional coats when undercoats stain or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
- C. Paint surfaces behind moveable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture similar exposed surfaces.
- D. Finish exterior doors on tops, bottoms, and side edges same as exterior faces, unless otherwise indicated. Sand lightly between each succeeding enamel or varnish coat. Omit first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated.
- E. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pre-treated, or otherwise prepared for painting by painter as soon as practicable after preparation and before subsequent surface deterioration.
- F. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

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- G. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.
- H. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed and on the exterior of the building. Use paint primer and paint type that is compatible with the material being painted.
- I. Prime Coats: Apply prime coat of material that is required to be painted or finished, and that has not been primer coated by others.
- J. Recoat primed and sealed surfaces, where there is evidence of suction spots or unsealed areas of first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- K. Pigmented (Opaque) Finishes: Completely cover to provide an opaque smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

3.6 CLEAN-UP AND PROTECTION

- A. Clean-Up: During progress of Work, remove from site discarded paint materials, rubbish, cans, and rags at end of each work day. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. Protection: Protect work and equipment of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect. Protect all existing exterior landscaping or other adjacent property from damage from paint and the Work.
- C. Cover floors of spaces scheduled for exposed concrete finish or other floor sealers with temporary protective cover.
- D. Cover existing materials and finishes and protect from damage.
- E. Provide "wet paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations. At the completion of work of other trades, touch-up, and restore all damaged or defaced painted surfaces.

END OF SECTION

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SECTION 26 01 00 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 OPERATION AND MAINTENANCE MANUALS

- A. O& M Manuals shall consist of a minimum of one hard cover view type 3-ring binder sized to hold 8 1/2 inch x 11 inch sheets for Electrical and Systems. Refer to Division 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 inch, maximum spline size to be 3 inch. Provide additional binders if 3 inch size is not sufficient to properly hold submittals.
 2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for O & M Manuals at the end of this section. Description sheet is to be white with black letters, minimum of 11 inches high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e. Operation and Maintenance for Electrical (Power and Lighting).
- B. O & M Data:
1. Manufacturers' operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e. surge suppression - switchboard MDPA).
 2. Include troubleshooting instructions, list of special tools required, theory of operation, manufacturer's care and cleaning, preventative maintenance instructions, wiring diagrams, and point-to-point schematics.
- C. O & M Manuals to include but are not limited to:
1. Completed forms and information per Division 01, General Requirements, and this section of the specifications. Reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
 - a) Table of Contents
 - b) Project Information Sheet
 - c) Reinforced Separation Sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule
 - d) Check Out Memo
 - e) Conductor Insulation Resistance Test
 - f) DC High Voltage Cable Test Report
 - g) Ground Test Information
 - h) Motor Test Information
 - i) Voltage and Amperage Readings (Tabulated Data)

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- j) Progress and Record Drawing Certification
 - k) Spare Parts Certification Memo
2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 3. Product Data: Product data and/or Catalog sheets shall be a copy of the final and accepted submittal submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 4. Warranties/Guarantees: Provide copy of warranties/guarantees. Original warranties/guarantees are to be incorporated into separate project warranty book with warranties/guarantees provided for other sections and divisions of the specifications and submitted for Architectural/Owner acceptance.
 5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section.
 6. Wiring diagrams, schematic, etc. inserted in proper order, for:
 - a) Control devices, controls.
 - b) UPS systems.
 - c) Panelboards.
 - d) Each and every part of Division 27 and Division 28 sections of these Specifications.
 7. For Sections 26
 - a) Product data and/or catalog sheets on all equipment applicable to this project.
 - b) Equipment supplier list for each section's equipment.
 - c) 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
 - d) Ground fault wiring devices; in addition to above provide:
 1. Wiring diagram.
 - e) Grounding; in addition to above provide:
 1. Test results on each ground rod.
 2. Ground Test Information Form
 8. Sections 27, 28
 - 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.

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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 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)

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PROJECT INFORMATION SHEET

Project Name: _____

Project Number: _____

Substantial Completion Date: _____

Certificate of final Completion Date: _____

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

Brief Description of Project Scope:

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CHECK OUT MEMO

Check Out Memo shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name _____

Type of Equipment Checked _____

Equipment Number _____

Manufacturer of Equipment _____

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

- The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.
- The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below.*
- Written operating and maintenance information has been presented and reviewed in detail with the Contractor.
- Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

MANUFACTURER'S REPRESENTATIVE – PRINT NAME

ADDRESS

TELEPHONE, FAX, E-MAIL

MANUFACTURER'S REPRESENTATIVE – SIGNATURE AND TITLE

DATE CHECKED

WITNESSED BY:

CONTRACTOR'S REPRESENTATIVE – SIGNATURE AND TITLE

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

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CONDUCTOR INSULATION RESISTANCE TEST

PROJECT NAME _____

CONDUCTOR FROM _____ TO _____

SIZE _____

INSULATION TYPE _____

INSULATION VOLTAGE RATING _____

DATE _____ TIME _____

WEATHER CONDITIONS _____

TEST VOLTAGE (DC) _____

RANGE _____

MEGGER INSTRUMENT/SERIAL NUMBER _____

TESTING METHODOLOGY _____

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

PHASE A TO GROUND _____

PHASE B TO GROUND _____

PHASE C TO GROUND _____

NEUTRAL TO GROUND _____

ISOLATED GROUND TO GROUND _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

OWNER'S REPRESENTATIVE _____

DATE: _____

ENGINEER'S REPRESENTATIVE: _____

DATE: _____

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DC HIGH VOLTAGE CABLE TEST

Project Name _____

Location _____

Description _____

Rated Voltage _____

TEST DATA

Set Leakage @ Test Voltage _____ ma Variac _____

Pri. Voltage _____

Sphere Gap _____ Inches

Duct Temp. _____ Ambient Temp. _____ Weather _____

Cable Status _____ 1 hour prior to test

Phase or Conductor	<u>A</u>	<u>B</u>	<u>C</u>	Remarks
Starting Time	_____	_____	_____	
	MA	MA	MA	

- 0
- 15 sec.
- 30 sec.
- 45 sec.
- 1 min.
- 2 min.
- 3 min.
- 4 min.
- 5 min.

Final Test Voltage _____

Time Finish: _____

KV DC after 1 min.

Test Procedure _____ Number of Terminals _____

Joints _____

Witnessed By: _____ Performed By: _____

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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 _____

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MOTOR TEST INFORMATION

PROJECT NAME: _____

DESCRIPTION OF MOTOR: _____

NAME OF CHECKER: _____

DATE CHECKED: _____

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

Manufacturer _____

Model Number _____

Serial Number _____

RPM _____

Frame Size _____

Code Letter _____

Horsepower _____

Nameplate Voltage and Phase _____

Nameplate Amps _____

Actual Voltage _____

Actual Amps _____

Starter Manufacturer _____

Starter Size _____

Heater Size, Catalog No. and Amp Rating _____

Manufacturer of Dual-Element Fuse _____

Amp Rating of Fuse _____

Power Factor _____

CONTRACTOR'S REPRESENTATIVE: _____

DATE: _____

SIGNATURE OF CHECKER: _____

DATE: _____

OWNER'S AUTHORIZED REPRESENTATIVE: _____

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VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME _____

SWITCHGEAR/PANELBOARD _____

FULL LOAD AMPERAGE READINGS:

DATE _____

TIME _____

PHASE A _____
 B _____
 C _____
 N _____
 GROUND _____

FULL LOAD VOLTAGE READINGS:

DATE _____

TIME _____

PHASE A TO N _____ A TO B _____
 B TO N _____ A TO C _____
 C TO N _____ B TO C _____

VOLTAGE AT THE END OF THE LONGEST BRANCH _____

TYPE OF LOAD _____

NO LOAD VOLTAGE READINGS:

DATE _____

TIME _____

PHASE A TO N _____ A TO B _____
 B TO N _____ A TO C _____
 C TO N _____ B TO C _____

ENGINEER'S REPRESENTATIVE _____

DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE _____

DATE _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

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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-Built" record of the work as actually installed. One copy will be turned over to the Owner at the instruction in Operation Conference. The duplicate copy is for the Engineer's files.

General Contractor

:

By: _____
Authorized Signature And Title

Date

Subcontractor

By: _____
Authorized Signature And Title

Date

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SPARE PARTS / MAINTENANCE STOCK CERTIFICATION

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

Project Name: _____

Type/Name of Spare Parts/Attic Stock: _____

Specification Reference: _____

Quantity of Spare Parts/Attic Stock: _____

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

Contractor/CM

Authorized Signature, Title

Date: _____

Subcontractor

Authorized Signature, Title

Date: _____

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

Department

Authorized Signature, Title

Date: _____

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

MANUAL COVER (face)

PROJECT NAME ADDRESS
MPE NO.
ELECTRICAL OPERATION AND MAINTENANCE MANUAL
DATE (substantial completion date)

PROJECT NAME ADDRESS
MPE NO.
SYSTEMS OPERATION AND MAINTENANCE MANUAL
DATE (substantial completion date)

MANUAL COVER (Spine)

MPE NO
E L E C T R I C A L
OPERATION AND MAINTENANCE MANUAL
DATE

MPE NO.
S Y S T E M S
OPERATION AND MAINTENANCE MANUAL
DATE

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SECTION 26 01 03 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for 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.
- B. Provide all materials necessary for work.

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

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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 Premise Distribution System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from the Owner 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.

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

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SECTION 26 01 05 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes testing and documentation of existing electrical systems.
- B. Test the essential features of the following existing electrical systems:
 - 1. Intercommunication equipment.
 - 2. Controls and alarms.
 - 3. Outlets: Convenience.
 - 4. Building grounding systems.
- C. 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.
- D. Document the existing conditions and operation of the existing electrical systems prior to any work.
- E. Contractor is responsible for all non-working systems and their components unless non-working status is verified prior to work on system.

1.3 REFERENCES

- A. IEEE Recommended Practices

1.4 DESCRIPTION

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. 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.
 - 2. Ground System:
 - a) Test ground system at each permanent building and at each modular unit/building.
 - 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

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- 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 the value required by this Specification, Contractor is to bring this to the attention of both the Engineer and Owner in writing 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 26 08 03 Demonstration of Completed Electrical Systems.

3.2 INVESTIGATION/TESTING FORMS

- A. Submit Existing Facilities Investigation Form (included at the end of this Section) and advise Owner/Engineer of all deficiencies in system(s) prior to work. All systems will be assumed to be fully operational if Form is not received by Engineer prior to work on system.
- B. Submit five copies of 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

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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 26 01 05 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.

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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 _____

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

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. This section includes Basic Electrical Requirements specifically applicable to Divisions 26, 27 28 Sections.

1.3 DESCRIPTION OF WORK

- A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.
- B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.
- C. The Division 26 Sections refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.
- D. Only trained and qualified personnel shall be used by the Contractor to perform work. The Contractor shall not perform work which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.
- E. Refer to other Division 26 Sections for additional work requirements.
- F. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required for complete and properly operating systems..
- G. Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment.
- H. The Contractor shall provide and install panic hardware on all electrical room doors where the electrical room houses equipment rated 1200 amps or more per NEC Article 110.26. All electrical room doors shall open in the direction of egress.

1.4 WORK SEQUENCE

- A. Install work in stages and/or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with Owner and Architect/Engineer.

1.5 CODES, FEES, AND STANDARDS

- A. Conform to all applicable requirements of Section Reference Standards and Regulatory Requirements.
- B. Obtain permits and request inspections from authority having jurisdiction and applicable utility

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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

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and equipment which are required to remain active for the facility to be fully functional.

- H. All items removed and not re-used shall be immediately turned over to Owner as they are made available by renovation. Remove items from job site and deliver to Owner's storage location(s) as directed by project manager. Discard complete items which Owner elects to refuse.
- I. Investigate site thoroughly and reroute all conduit and wiring in area of construction in order to maintain continuity of existing circuitry. Existing conduits indicated in Contract Documents indicate approximate locations only. Contractor shall verify and coordinate existing site conduits and pipes prior to any excavation on site. Bids shall include hand digging and all required rerouting in areas of existing conduits or pipes.
- J. Work is in connection with existing buildings which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. **The Owner will require all work to take place between 7PM and 4 AM throughout the entire length of the project.** Notify Owner 24 hours in advance of any shut-down of existing systems. Perform work during non-general office operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.
- K. Bid shall include all removal and relocation of all piping, fixtures or other items required for completion of alterations and new construction.
- L. See Section Minor Electrical Demolition for Remodeling for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

- A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.
- B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc which is the most expensive and costly to implement.
- C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.
- D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.
- E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.
- F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.

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- G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.
- H. Where the requirements of another division, section, or part of these specifications exceed the requirements of this division those requirements shall govern.

1.9 MATERIALS AND EQUIPMENT

- A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.
- B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with Section Substitutions and requirements.
- C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.
- D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.
- E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 26 methods and materials unless specifically noted otherwise.
- F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.
- G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.
- H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.
- I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.
- J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.

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- K. Where tamperproof screws are specified or required, Phillips head or Allen head devices shall not be accepted. For each type used, provide Owner with three tools. Owner will designate the specific hardware design to correspond with existing devices elsewhere in the building, to limit special tool requirements.
- L. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

1.10 MISCELLANEOUS CIRCUITS REQUIRED

- A. Provide 120 volt, 20 amp circuit to post indicator valves (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all required electrical. Coordinate final location and electrical requirements with valve installer after bid and provide all required electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- B. Provide 120 volt, 20 amp circuit to fire protection system panel and bell (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- C. Provide 120 volt, 20 amp circuit to intercom system panel (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with intercom system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- D. Provide 120 volt, 20 amp circuit to all fire alarm panels, remote panels, etc (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire alarm system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- E. Provide 120 volt, 20 amp circuit to fire and smoke dampers (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- F. Provide 120 volt, 20 amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide

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all electrical

1.11 CARBON MONOXIDE ALARMS

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

1.12 SMOKE ALARMS

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

1.13 SUPERVISION OF THE WORK

- A. Reference the General Conditions for additional requirements.
- B. The Contractor shall provide experienced, qualified, and responsible supervision for work. A competent foreman shall be in charge of the work in progress at all times. If, in the judgement of the A/E, the foreman is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the A/E. Once a satisfactory foreman has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the A/E.
- C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have, as a minimum, an active Journeyman's Electrical License in the State of Florida.
- D. Superintendent shall possess a valid registered communications distribution designer (RCDD) license and a Florida low voltage license, providing copies of both prior to any work taking place..

1.14 COORDINATION

- A. Provide all required coordination and supervision where work connects to or is affected by work of other trades, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
 - 1. Door Hardware
 - 2. Roll-up doors
 - 3. Fire Shutters
 - 4. Roll-Up Grilles
 - 5. Elevators

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6. Escalators
 7. Sliding Doors
 8. Mechanical Division of the Specifications
 9. Interior Design Drawings
 10. Pool/Spa Equipment
 11. Fountains
 12. Landscape Architect Drawings
 13. Lifts
 14. Laundry Equipment
 15. Kitchen Equipment
 16. Conveyors
 17. Flight Information Display Systems
 18. Baggage Information Display Systems
 19. Millwork Design Drawings and Shop Drawings
- B. Contractor shall obtain set of Contract Documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Division 26 Sections or not.
- C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.
- D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.
- E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
- G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design.
- H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.
- I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and

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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.

1.15 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.

1.16 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).

1.17 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.

1.18 CUTTING AND PATCHING

- A. New Construction:
 - 1. Reference Division 1 - General Requirements.
 - 2. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.
 - 3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed finished surface.
- B. Existing Construction:
 - 1. See Section Minor Electrical Demolition for Remodeling for additional requirements.

1.19 TRENCHING

- A. Trench excavations in excess of 5 feet deep shall comply with OSHA Standard 29 C.F.R.s. 1926. 650 Subpart P.
- B. Trench excavations in excess of 5 feet deep shall comply with OSHA Standard 29 C.F.R.s. 1926. 650 Subpart P. Contractor shall complete form as referenced in Section Instructions to Bidders.

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1.20 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.

1.21 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.

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- D. The changes and alterations shall be transferred to CAD (AutoCAD Release 2006 or higher). Obtain CAD disk of the construction documents by the A/E, from the A/E. Generate/update the CAD disks to include all changes, additions, etc. on the accepted marked up prints. Label each drawing "As-Built" and date. Submit as-built CAD disk and reproducible of the as-builts.
- E. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit set prior to request for final payment and/or request for final observation.
- F. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

1.22 "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.

1.23 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.

1.24 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.

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1.25 SUBSTANTIAL COMPLETION

- A. The Contractor shall be fully responsible for contacting all applicable parties (Engineer of record) 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.

1.26 PROHIBITION OF ASBESTOS AND PCB

- A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.
- B. Prior to the final review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under Division 26 contain no asbestos or PCB's. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB's. This statement shall be signed and dated by a duly authorized agent of the manufacturer.

PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

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SECTION 26 05 07 - SUBMITTALS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 26, 27, 28 Sections.
- B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

- A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addenda, Contractor represents that he:
 - 1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.
 - 2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
 - 3. Waives all claims for additional costs related to substitution which may subsequently become apparent.
 - 4. Will provide the same warranties for the substitution as for the product specified.
 - 5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
 - 6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.
- B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

1.4 SUBMITTALS

- A. Submittals shall consist of a minimum of one view type 3-ring binder, white, sized to hold 8-1/2" x 11" sheets for "ELECTRICAL SUBMITTALS" (Power and Lighting).
 - 1. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).
 - 2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for Submittals included at end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting.

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- 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. Lightning protection system
 2. Special built light fixtures
 3. Each section of fire alarm, television, etc..
 4. Premise Distribution System
 5. UPS systems
 6. Emergency generator systems
 7. Special and/or modified equipment
 8. Main switchboard(s)
 9. U.L. listed fire and smoke stopping assemblies for each applicable penetration
 - k) See specific sections of Specifications for further requirements.
 6. Product Data: Technical data is required for all items as called for in the Specifications

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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 than 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.
- D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.
- E. Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.
- F. Shop Drawings: For custom fabricated items and systems shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.
- G. Shop Drawing Review Notation.

<u>Action</u>	<u>Description</u>
1. No Exception Noted	No exceptions taken. Resubmittal not required.
2. Rejected	Not in compliance with Contract Documents. Resubmit.

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- | | | |
|----|------------------------|--|
| 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

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PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

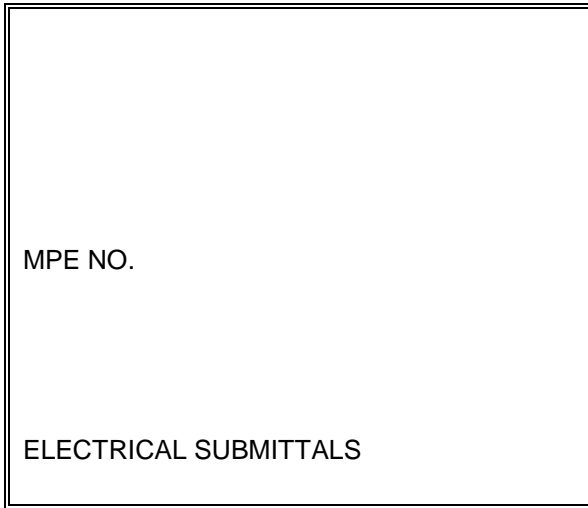
Matern Professional Engineering, Inc.
130 Candace Drive
Maitland, Florida 32751
Telephone No.: (407) 740-5020
Fax No.: (407) 740-0365

GENERAL CONTRACTOR:

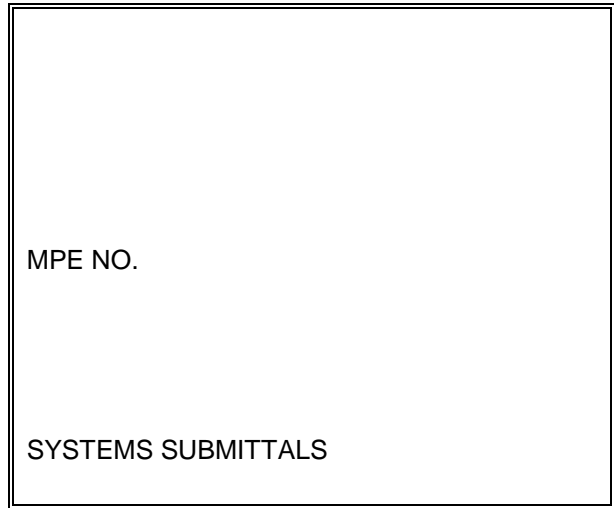
SUBCONTRACTOR:

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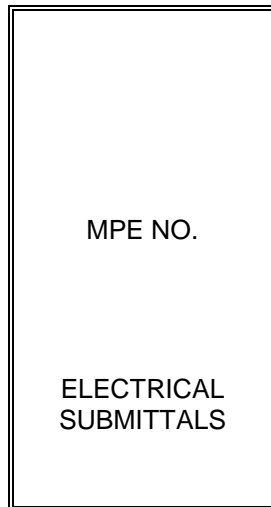
BINDER EXAMPLES FOR SUBMITTALS
Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder



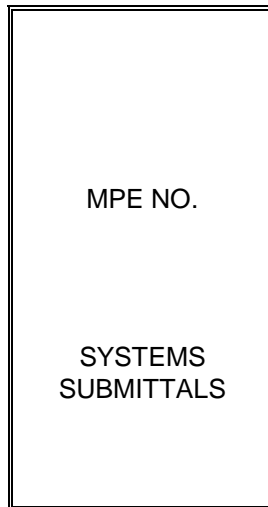
(Size To 8-1/2" x 11")



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



(Size To 11")



(Size To 11")

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SECTION 26 05 08 - SUBSTITUTIONS

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 specifies general, administrative and procedural requirements for substitutions for Divisions 26, 27 28 above and beyond the requirements of Division 1 General Requirements and any Supplemental requirements/conditions.
- B. Request for substitutions must be submitted no later than 10 days prior to bid due date.
- C. Request for substitution will not be considered after bid due date.

1.3 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: Products, materials, equipment, finishes, and methods of construction are considered substitutions if they meet any one of the following conditions:
 - 1. Does not meet all the requirements of these specifications under Part 1 - General or Part 2 - Products for any section included in Divisions 26, 27 28.
 - 2. Is a different design which accomplishes the same result as that design specified in Division 26 Sections.
 - 3. Is of similar or different design that:
 - a) Requires more space.
 - b) Requires more power.
 - c) Requires changes in other elements of the work such as (but not limited to) architectural, mechanical, structural, or other electrical work.
 - d) Affects the construction schedule.
 - 4. Is listed in these specifications on the Contract Documents or in any addenda as an accepted substitution.

1.4 REQUEST FOR SUBSTITUTION SUBMITTALS (10 Days Prior to Bid Due Date)

- A. A separate request for substitutions shall be submitted for each product, material, etc. that is defined as a substitution.
- B. Submittal must consist of written request for substitution with data as required below. Request must be very specific as to what specified item, request for substitution is submitted for.
- C. Each request for substitution submittal for each product, etc. shall include:
 - 1. Name of material or equipment for which it is to be substituted.
 - 2. Drawings, product data, performance data and/or other information necessary for the engineer to determine that the equipment meets all specifications and requirements.
 - 3. Proof that pole lighting fixture and pole meet applicable wind loading requirements. Pole lighting fixtures must be submitted showing proof that they comply with the applicable wind loading requirements for location of this project.

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4. Compliance Statement. Each request shall include the following compliance statement typed on letterhead of submitting company:
 - a) Submittal complies with all aspects/requirements of Contract Documents. (Yes or No). If no, state deviance.
 - b) Submittal complies with all applicable codes. (Yes or No). If no, state deviance.
 - c) Submittal complies with all other elements of the work and does not require any other changes. (Yes or No). If No, state required change.
 - d) Meets or exceeds the performance of specified product. (Yes or No). If no, state required change.

1.5 REQUEST FOR SUBSTITUTION SUBMITTALS (AFTER BID)

- A. Substitution requests submitted after bid will not be reviewed.
- B. Submittals for items noted as an Accepted Substitution on Contract Drawings, these specifications, or listed in an addenda, shall be submitted as required in Section Submittals.

1.6 CONSIDERATION AND ACCEPTANCE

- A. Request for substitutions will not be considered if:
 1. Submittal does not comply with all requirements as noted above or contain all information required above.
 2. If submittal does not contain Compliance Statement, fully filled out.
 3. If Compliance Statement contains a 'no' or 'N'.
 4. Submittals are submitted beyond time limitations noted above.
- B. Samples.
 1. Sample may be required to be submitted, if deemed necessary by the A/E to determine if the substitution meets specifications.
 2. Where required by A/E on an individual basis, samples may be required after written notice of acceptance and approval has been made of each substitution.
 3. The A/E reserves the right to reject sample and consequently the substitution should the sample not meet the requirement of the contract documents.
- C. Substitutions will be considered on basis of design, concept of the Work, and overall conformance with information given in Contract Documents, including but not limited to:
 1. Design criteria, which shall be equal or superior to the specified item.
 2. Finishes, which shall be identical or superior to finishes of specified product.
 3. Lenses or louvers, which shall be identical size, thickness and type material specified.
 4. Physical size and dimension which are identical or within design criteria limitations as determined by the Engineer.
 5. Photometric data, which shall be identical or superior in quantity and quality.
 6. Trim detail and mechanical qualities, which shall be identical or within design criteria limitations as determined by the Engineer.
- D. The Engineer's decision on acceptance or rejection of substitutions will be final.
- E. Substitution requests, if accepted will be included in an addenda.
- F. Approval of a substituted item or listing a substituted item as an accepted substitution, does

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not modify or act as a waiver in any way, the requirements of the contract documents. See Section Submittals for additional requirements on accepted substitution submittals, equipment, etc.

- G. The naming of any manufacturer as an accepted substitution does not imply automatic approval as a substitution. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for systems that meet or exceed these specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 26 05 09 - REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	ASME International American Society of Mechanical Engineers International
ASTM	ASTM International American Society for Testing and Materials International
BOR	Board of Regents
BICSI	BICSI, Inc.
BOCC	Board of County Commissioners St Johns County
CRSI	Concrete Reinforcing Steel Institute
DCA-ADAIA	Department of Community Affairs - Florida Americans with Disabilities Accessibility Implementation Act
DCA-ADAAG	Department of Community Affairs - Florida Americans with Disabilities Act Accessibility Guidelines
DCA-ARM	Department of Community Affairs - Accessibility Requirements Manual
DER Rule 17-761	Department of Environmental Regulation, Chapter 17-761 on Underground Storage Tank Systems

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

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

1.4 REGULATORY REQUIREMENTS

- A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc.. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.
1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority Having Jurisdiction):
 - a) Americans with Disabilities Act of 1990, as amended
 - b) ADA Standards for Accessible Design, 2010
 - c) American National Standards Institute

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- 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
- y) Safety Code for Existing Elevators and Escalators
- 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

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SECTION 26 05 10 - 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 26 27 28 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
 - A.C. Alternating Current
 - ADD # Addendum #
 - A/E Architect/Engineer (or Engineer when Architect not applicable)
 - AFF Above Finished Floor
 - AFG Above Finished Grade
 - AHU Air Handler Unit
 - AIC Amps Interrupting Capacity
 - AL Aluminum
 - ALT Alternate
 - AMP Ampere
 - ANSI American National Standards Institute
 - AWG American Wire Gauge
 - @ At
 - B.C. Bare Copper
 - BIDS Baggage Information Display System
 - BLDG Building
 - BRKR Breaker
 - BTU British Thermal Unit
 - BTUH BTU Per Hour
 - C. Conduit
 - C.B. Circuit Breaker
 - CBM Certified Ballast Manufacturers
 - cd Candela
 - CFM Cubic Feet per Minute
 - CKT. Circuit
 - CKT BRKR Circuit Breaker
 - C/L Center Line
 - Clg. Ceiling
 - Comp. Compressor

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Conn. Connection
Cond. Condenser
Cont. Continuous
C.R.I. Color Rendering Index
C.T. Current Transformer
CU. Copper
C.U. Compressor Condenser Unit
C.W. Cold Water
D.B. Direct Burial
D.C. Direct Current
Disc. Disconnect
DN. Down
DPST Double Pole Single Throw
DWG Drawing
E.C. Electrical Contractor (or General Contractor)
ELEV. Elevator
EMT Electrical Metallic Tubing
Equip. Equipment
EST Estimate
FAAP Fire Alarm Annunciator Panel
FACP Fire Alarm Control Panel
FARP Fire Alarm Remote Panel
FATC Fire Alarm Terminal Cabinet
FCCP Fire Alarm Command Center Panel
FHC Fire Hose Cabinet
FIDS Flight Information Display System
FLA Full Load Amperes
FT. Feet
FLR Floor
F.C. 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
H.S. Heat Strip
IMC Intermediate Metallic Conduit
Incand. Incandescent
in. Inches
J.B. Junction Box
KVA KiloVolt Ampere
KW Kilowatts
KWH Kilowatt Hour
K Kelvin

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

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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
U.L. 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
W Wire
W.P. Weatherproof
XFMR Transformer
Y Wye
Yd. Yard
Yr. Year
3R Rainproof
4X Stainless Steel Dusttight, Watertight

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 26 05 19 - BUILDING WIRE AND CABLE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for provision and installation of building wire and cable.
- B. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete and operating system for the following:
 - 1. Building wire and cable.
 - 2. Wiring connectors and connections.
- C. No aluminum wiring shall be permitted.
- D. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM/kcmil).

1.3 REFERENCES:

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

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

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

1.6 QUALIFICATIONS

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

1.7 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 COORDINATION

- A. Determine required separation between cable and other work.
- B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

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2.1 BUILDING WIRE AND CABLE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: ANSI/NFPA 70, Type THHN/THWN and XHHW.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install products in accordance with manufacturer's instructions.
- B. Conductors #10 AWG or #12 AWG shall be 600 volt type THWN/THHN unless noted otherwise, rated 90 degrees C. dry, 75 degrees C. wet.
- C. Conductors #8 AWG and larger shall be Type THWN-2/THHN unless noted otherwise, rated 90 degrees C, wet or dry.
- D. Use solid conductor for feeders and branch circuits 10 AWG and smaller (except for control circuits).
- E. Use conductor no smaller than 12 AWG for power and lighting circuits.
- F. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- G. All conductors shall be installed in raceway.
- H. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit, unless noted otherwise on the Drawings or in these Specifications.
- I. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).
- J. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.
- K. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

3.2 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire has been completed.

3.3 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.4 WIRING METHODS

- A. Use only building wire type (THHN/THWN for #10 and #12 and THHN/THWN-2 for #8 and larger) insulation in raceway, unless noted otherwise.
- B. Wiring in vicinity of heat producing equipment: Use only XHHW insulation in raceway.
- C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required to meet the UL listing of the fixture; however, in no case shall the temperature rating be less than 90 degrees Centigrade. Remove incorrect insulation types in new work.

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3.5 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 26 05 53 Identification for Electrical Systems.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.
- C. Identify neutrals with its associated circuit number(s).

3.6 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents and Section 26 08 13 Tests and Performance Verification.
- B. Inspect wire for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.

3.7 VERTICAL RISERS

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

3.8 PULLING

- A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.
- B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.
- C. Use only powdered soapstone or other pulling lubricant acceptable to the Architect/Engineer. Compound or lubricant shall not cause the conductor or insulation to deteriorate.
- D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.
- E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.
- F. Where communications type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

3.9 CONTROL AND SIGNAL CIRCUITS

- A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW or THWN-THHN as permitted by NFPA 70, within voltage drop limits, increased to #12 AWG as necessary for proper operation.
- B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volt rated, PVC insulated, except where specifically noted otherwise in the Contract Documents.
- C. Conductor insulation for fire alarm systems shall be as accepted by Code Inspection Authority only. Wire acceptance by the Architect/Engineer shall not supersede this final acceptance for conditions of this specific project.
- D. Install circuit conductors in conduit.
- E. Circuit conductors to be stranded.

3.10 COLOR CODING

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- A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.
- B. Unless otherwise accepted or required by Architect/Engineer to match existing, color-code shall be as follows:
Neutrals: 120/208V system white; 277/480V system natural grey
Ground Wire: green, bare
Isolated Ground Wire: green with yellow stripes
120/208V: Phase A black, Phase B red, Phase C blue
277/480V: Phase A brown, Phase B orange, Phase C yellow.
- C. All switchlegs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above.

3.11 TAPS/SPLICES/CONNECTORS/TERMINATIONS

- A. Clean conductor surfaces before installing lugs and connectors.
- B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- C. Power and lighting conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).
- D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum. Pull conductors through to equipment, terminal cabinets, and devices.
- E. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.
- F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.
- G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the Contractor to provide sleeve type vertical cable supports in vertical raceway installations, provided in pullboxes at proper vertical spacings.
- H. A calibrated torque wrench shall be used for all bolt tightening.
- I. Interior Locations:
 - 1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.
- J. Exterior Locations:
 - 1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.
 - 2. All taps and splices shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be

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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

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SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes
 - 1. Grounding electrodes and conductors.
 - 2. Equipment grounding conductors.
 - 3. Bonding.
 - 4. Counterpoise System.
 - 5. Ground Ring.
- 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.

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3. Ground wells.
 4. Ground bus bars and associated components.
 5. Ground ring conductor.
 6. Counterpoise conductor.
 7. Exothermic welding materials and molds.
 8. 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 Tests and Performance Verification of Electrical System.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 5/8".
- 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 and equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:
 1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.
 2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.
 3. Piping Clamps: Burndy GAR-TC Series with two hole compression terminal or T&B equal.
 4. Grounding Screw and Pigtail: Raco No. 983 or equal.
 5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.
- C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

2.3 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.

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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 #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.

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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 each main service electrode system 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, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
 - b) Lightning Protection system ground locations shall not exceed 5 ohms for the Franklin system measured at ground electrode.
 - 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 CONDUCTORS

- 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 CONDUCTOR

- A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.
- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

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- 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 Buildings:
 - 1. Contractor shall verify that each building's electrical service is properly grounded as required by the NEC.
 - 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.

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6. Ground ring.
 7. Site distribution counterpoise ground system.
 8. Lightning protection system.
- 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 building. 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

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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 Conductor."
 - 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 GENERATOR GROUNDING

- A. Separately derived systems (i.e. systems where generator neutral is not solidly interconnected to service supplied system neutral such as 4-pole switched neutral transfer switch systems).
 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 generator neutral/ground to grounding electrodes 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 with connection to other electrodes specified in NEC 250.
 - c) Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or mote 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 generator 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.
- B. Non separately derived systems (i.e. systems where generator neutral is solidly interconnected

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to service supplied system neutral such as 3-pole non-switched neutral transfer switch systems).

1. Ground per NEC 250 and these specifications.
 2. Do not bond neutral to transformer frame/enclosure or the equipment grounding conductors of the derived system.
 3. Connect generator frame/enclosures 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 other electrodes 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 generator 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.
- C. Provide additional ground electrodes as required to achieve specified ground resistance.
- D. 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.
- E. Complete installation shall exceed the minimum requirements of NEC 250.
- F. Equipment ground conductors shall be provided in addition to above grounding. See "Equipment Grounding Conductors."

3.8 LIGHTNING PROTECTION SYSTEMS

- A. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.
- B. Bond lightning protection system grounds to electrical service system ground, all piping entering or leaving all buildings, and counterpoise system ground where provided.
- C. See Section 26 41 13 Lightning Protection System.

3.9 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

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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 ft. 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.

3.10 ROOF MOUNTED EQUIPMENT

- A. Bond all roof mounted electrical equipment to lightning protection system (when provided) per NFPA 780.
- B. Where lightning protection system is not provided, ground/bond all roof mounted electrical equipment to building steel and to two or more 30' ground rods at no less than 30' spacing driven vertically to a minimum depth of 30' plus 1' below grade.
 - 1. Bond the two or more ground rods together with a Class I or Class II as required per NFPA 780 lightning protection main copper conductor.
 - 2. Provide additional rod electrodes as required to achieve specified ground resistance.
 - 3. Complete installation shall exceed the minimum requirements of NFPA 780.

3.11 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.
- C. Pole Light Fixtures:
 - 1. Metal Pole Light Fixtures:

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- a) Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
- b) Conductor shall be bonded to metal pole via UL Listed ground clamp suitable for use. Locate ground lug opposite to handhole (or adjacent if visible through handhole).
2. Concrete or Non-Metallic Pole:
 - a) Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
 - b) Conductor shall be extended from grounding electrode to top of pole and terminate at the top of pole in a Class I or Class II copper lightning protection air terminal.
 - c) Each metal part of light fixture assembly, bracket, ballast cabinet, disconnect, transformer, etc. that is mounted to pole shall be bonded to down conductor.
3. Fixtures located on elevated roadway ramps shall be specially provided with a connection to lightning counterpoise grounding system, properly installed.
4. Grounding electrode(s) at each pole shall be connected (bonded) to site distribution counterpoise system.
5. Grounding Electrodes:
 - a) Two or more 30' ground rods at no less than 30' spacing shall be driven vertically to a minimum depth of 30' plus 1' below grade.
 - b) Bond the two or more ground rod electrodes together with a Class I or Class II lightning protection main copper conductor.
 - c) Provide additional rod electrodes as required to achieve specified ground resistance.
 - d) The two or more grounding rod electrodes shall be installed at each light pole.
6. Installation shall exceed minimum requirements of NFPA 780.

3.12 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

- A. One 30' 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.

3.13 HAZARDOUS LOCATIONS

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

3.14 GROUND RING

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- A. Provide complete underground building perimeter ground ring system, completely encircling each building.
- B. Conductor shall be minimum of Class II lightning protection copper conductor (bare).
- C. Install at not less than 2-1/2' depth into earth.
- D. Install ground rods (minimum 30' long) every 150' section of ground ring conductor.
- E. Bond ground ring to building foundation steel every 150' around building perimeter, bond to any and all electrical and piping systems that cross the ground ring system, bond to lightning protection down conductors and to any lightning or other earth grounding electrodes that may be present on the premises.
- F. Bond to building service and counterpoise ground systems.

3.15 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/l beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.
- C. Grounding conductors shall: be installed to permit the shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.
- D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.
- E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.
- F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
- I. Grounding provisions shall include double locknuts on all heavywall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.

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- 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 26 Contractor). Provide size and length of rod to meet NEC requirements.

3.16 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 Systems Sections.
- 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).

3.17 COUNTERPOISE SYSTEM

- A. Install counterpoise and ground over all sections of underground ductbanks, conduits, or cables outside (exterior) to building.
- B. No. 2 bare stranded copper counterpoise shall be run 6" above all underground duct banks, conduits and cables outside (exterior) to building.
- C. Provide one counterpoise conductor for ductbanks (or conduit groupings) 12" wide or less. Provide two counterpoise conductors above outside edge of ductbank (or conduit groupings) over 12" wide.
- D. Counterpoise shall run to building and be grounded at each building to the main building electrical service ground rod electrode (exterior to building). Counterpoise shall be bonded to ground rod at all light poles, pullboxes, manholes, handholes and at each building. Provide and install appropriate ground rod every 150' length of counterpoise conductor (see "Grounding Electrodes.") Counterpoise conductor shall not be run into interior of building. Route counterpoise underground around exterior perimeter of building to main service ground rod installation.

3.18 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

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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.

3.19 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 26 08 13 Tests and Performance Verification.

3.20 INTERFACE WITH OTHER PRODUCTS

- A. Interface with site grounding system.
- B. Interface with lightning protection system installed under Section 26 41 13 Lightning Protection System.
- C. Interface with communications system installed under systems sections series specification sections.

3.21 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

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SECTION 26 05 29 - HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Conduit and equipment supports.
 - 2. Anchors and fasteners.
- B. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pullboxes and other equipment furnished under this Division.

1.3 REFERENCES

- A. NECA National Electrical Contractors Association
- B. ANSI/NFPA 70 National Electrical Code

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

PART 2- PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA National Electrical Installation Standards.
- C. Do not fasten supports to pipes, ducts, mechanical equipment or conduit.
- D. Do not use spring steel clips and clamps.
- E. Obtain permission from A/E before using powder-actuated anchors.
- F. Obtain permission from A/E before drilling or cutting structural members.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1" off wall.

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- 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

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SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for electrical conduit.
- B. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
 - 1. Rigid Metal Conduit (RMC) NEC 344
 - 2. Aluminum Rigid Metal Conduit (RMC) NEC 344
 - 3. Rigid Metal Conduit PVC Coated (RMC-PVC Coated) NEC 344
 - 4. Intermediate Metal Conduit (IMC) NEC 342
 - 5. Flexible Metal Conduit (FMC) NEC 348
 - 6. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
 - 7. Electrical Metallic Tubing (EMT) NEC 358
 - 8. Rigid Polyvinyl Chloride Conduit (Type PVC) NEC 352
 - 9. Fittings and Conduit Bodies
 - 10. Electrical Nonmetallic Tubing (ENT) NEC 362
 - 11. Flexible Nonmetallic Conduit.

1.3 REFERENCES

- A. ANSI C80.1 Electrical Rigid Steel Conduit, Zinc Coated
- B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated
- C. ANSI C80.5 Electrical Rigid Aluminum Conduit
- D. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- E. ANSI/NFPA 70 National Electrical Code
- F. NECA Standard Practice of Good Workmanship in Electrical Contracting
- G. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- H. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
- I. 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

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- 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, and other federal codes where applicable.

2.2 MINIMUM TRADE SIZE

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

2.3 RIGID METAL CONDUIT

- A. Comply with:
 - 1. ANSI C80.1.
 - 2. UL 6.

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- 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 ALUMINUM RIGID METALLIC CONDUIT
- A. Comply With:
 - 1. ANSI C80.5.
 - 2. UL 6.
 - 3. NEC 344.
 - B. Conduit Material:
 - 1. Aluminum.
 - C. Fittings:
 - 1. Threaded.
 - 2. Aluminum.
 - 3. Insulated bushings on terminations.
 - D. Conduit Bodies:
 - 1. Comply with ANSI/NEMA FB 1.
 - 2. Threaded hubs.
 - 3. Aluminum.
- 2.5 INTERMEDIATE METAL CONDUIT
- A. Comply with:
 - 1. UL Standard 1242.
 - 2. ANSI C80.3.
 - 3. 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
- 2.6 RIGID METAL CONDUIT PVC COATED
- A. Comply with:
 - 1. UL 6.
 - 2. ANSI C80.1.

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3. NEC 344.
 4. NEMA RN1.
- B. Conduit material: Hot-dipped galvanized rigid steel with external PVC coating, 40 mil thick.
- C. Fittings:
1. Threaded.
 2. Insulated bushings on terminations.
 3. Zinc plated or hot-dipped galvanized malleable iron or steel with external PVC coating, 40 mil thick.
- D. Conduit Bodies:
1. Comply With:
 - a) ANSI/NEMA FB 1.
 - b) Threaded hubs.
 2. Zinc plated or hot-dipped galvanized malleable iron with external PVC coating 40 mil thick.

2.7 FLEXIBLE METAL CONDUIT

- A. Comply With:
1. NEC 348.
 2. ANSI/UL 1.
- B. Conduit Material:
1. Steel, interlocked.
- C. Fittings:
1. ANSI/NEMA FB 1.
 2. ANSI/UL 514B.
 3. Die Cast
 4. Malleable iron, zinc plated.
 5. Threaded rigid and IMC conduit to flexible conduit coupling.
 6. Direct flexible conduit bearing set screw type not acceptable.

2.8 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Comply with:
1. NEC 350.
 2. ANSI/UL 360.
- B. Conduit material:
1. Flexible hot-dipped galvanized steel core, interlocked.
 2. Continuous copper ground built into core up to 1-1/4" size.
 3. Extruded polyvinyl gray jacket.
- C. Fittings:
1. Threaded for IMC/rigid conduit connections.
 2. Accepted for hazardous locations where so installed.
 3. Provide sealing washer in wet/damp locations.
 4. Compression type.
 5. ANSI/NEMA FB 1.
 6. ANSI/UL 514B.
 7. Die Cast
 8. Zinc plated malleable iron or steel.

2.9 ELECTRICAL METALLIC TUBING

- A. Comply with:
1. UL 797.
 2. ANSI C80.3.

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3. NEC 358.
 4. ANSI/UL 797.
- B. Conduit material: Galvanized steel tubing.
- C. Fittings:
1. ANSI/NEMA FB 1.
 2. Set screw.
 3. Die Cast
 4. Zinc plated malleable iron or steel.
 5. Concrete tight.

2.10 RIGID POLYVINYL CHLORIDE CONDUIT

- A. Comply with:
1. NEMA TC 2.
 2. UL 651.
 3. NEC 352.
- B. Conduit material:
1. Shall be high impact PVC, tensile strength 55 PSI, flexural strength 11000 PSI.
- C. Fittings:
1. Comply with:
 - a) NEMA TC 3.
 - b) UL 514.
- D. General:
1. UL listed and identified.
 2. Conform to all national, state and local codes.
 3. Manufacturer shall have 5 years experience in manufacturing PVC conduits.

2.11 ELECTRICAL NON-METALLIC TUBING (ENT)

2.12 FLEXIBLE NON-METALLIC CONDUIT

2.13 EXPANSION FITTINGS

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

PART 3 - EXECUTION

3.1 LOCATION REQUIREMENTS

- A. Underground Installations:
1. Use rigid non-metallic conduit (PVC) only unless local Authority Having Jurisdiction or applicable codes/utility requirements, etc. require rigid steel conduit.
 2. Use galvanized rigid conduit, or PVC encased in steel-reinforced concrete.
 3. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.

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4. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with NEC 300.5 except the minimum cover for any conduit shall be 2'. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.
 5. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.
 6. PVC runs over 150' in length shall utilize rigid steel 90 degree elbows at each riser and at each change in direction. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC 250.80 and NEC 300.5.
 7. All underground service lateral raceways shall be protected as required by NEC 300.5, including requirements for installation of warning tape.
- B. In Slab Above or on Grade:
1. Use coated rigid steel conduit, coated intermediate metal conduit (if accepted) or rigid non-metallic conduit.
 2. Coating of metallic conduit to be black asphaltic or PVC.
- C. Penetration of Slab:
1. Exposed Location:
 - a) Where penetrating a floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 2. Concealed Location:
 - a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 48" above finished floor.
 - b) Where penetrating a floor in location other than that above use a black mastic coated or PVC coated galvanized rigid steel conduit.
- D. Outdoor Location:
1. Above Grade:
 - a) Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 - b) In general all exterior conduit runs shall be rigid conduit (with PVC coating if within 10 miles of ocean or gulf) and threaded connectors as specified elsewhere.
 - c) Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.
 - d) Exterior conduits not on roof and not subject to damage (i.e. 6' above grade/floor or higher) may be rigid non-metallic PVC conduit as specified elsewhere. (Schedule 40 for low voltage Class II wiring, Schedule 80 for power wiring.)
 - e) Exterior conduits from grade level to 6' above grade may be rigid non-metallic Schedule 40 PVC for low voltage Class II wiring provided rigid metal conduit is used at transition from below grade to 12" above grade (due to weed eater damage, etc.).
 2. Metal Canopies:
 - a) Conduit runs except for canopy lighting raceways are not to be run on (top or bottom) of metal canopies roof systems. All new conduit shown on or at these areas shall be run underground.
 3. Roofs:
 - a) Conduit is not to be installed on roofs, without written authorization by A/E for specific conditions.
 - b) When accepted by written authorization conduit shall comply with the following:
 1. Be PVC coated rigid galvanized metal conduit.

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2. All fittings, etc. are to be PVC coated.
 3. Conduit shall be supported above roof at least 6" using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
 4. Supports to be fastened to roof using roofing adhesive or means as accepted by roofing contractor.
- E. Interior Dry Locations:
1. Concealed: Use rigid metal conduit or aluminum conduit, intermediate metal conduit, electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" AFF except where prohibited by the NEC (Places of Assembly, etc.).
 2. Exposed: Use rigid metal conduit or aluminum conduit, intermediate metal conduit, electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.
 3. Concealed or Exposed Flexible Conduit:
 - a) Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not longer than 6' in length with a ground conductor installed in the conduit or an equipment ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Exposed flexible steel conduit or seal tight flexible steel conduit shall not exceed 2' in length, unless written authorization by A/E for specific conditions is granted.
- F. Interior Wet and Damp Locations:
1. Use rigid galvanized steel or intermediate metal conduit.
- G. Concrete Columns or Poured in-place Concrete Wall Locations:
1. Use rigid non-metallic conduit. Penetration shall be by accepted metal raceway (i.e. metal conduit as required elsewhere in these specifications).
- H. Locations Near 400Hz Distribution Systems:
1. Metal ferrous conduit or support equipment is not to be installed within 6" of any 400 Hz distribution system conduit or wire. Increase distance if so required by 400 Hz system manufacturer.
- 3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT
- A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.
1. Accepted pipe vise.
 2. Roller/bade type cutter or band saw.
 3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.
- B. Hangers shall be installed 8' apart.
- C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.
- 3.3 ADDITIONAL REQUIREMENTS FOR EMT
- A. Electrical metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.
- B. All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted

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reamer.

3.4 ADDITIONAL REQUIREMENTS FOR ALUMINUM CONDUIT

- A. May be used only for 400 Hz electrical distribution system.

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

- A. Shall be properly grounded.
- B. Shall be installed with accepted fittings.

3.6 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.

3.7 SUPPORTS

- A. Arrange supports to prevent misalignment during wiring installation.
- B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24", increase distance as required) provide space on each for 25 percent additional conduits.
- D. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29 Hangers and Supports.
- E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach conduit to ceiling support wires.
- G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.
- H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.8 EXPANSION FITTINGS

- A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses

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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'.

3.9 GROUNDING

- A. All raceways shall have a copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC codes.
- B. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings.
- C. Grounding conductors run with exterior/ underground feeders shall be bare only.
- D. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by accepted ground bushings.
- E. See other sections of these specifications for additional requirements.
- F. Grounding conductors (including lightning protection down conductors) run in metal conduit shall be bonded to metal conduit at both ends.

3.10 FIRE AND SMOKE STOPPING

- A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.
- B. Install conduit to preserve fire resistance rating of partitions and other elements.
- C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.
- D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in compliance with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in compliance with ASTM E119. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

3.11 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.

3.12 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.

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- D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.
- E. Route conduit in and under slab from point-to-point.
- F. Do not cross conduits in slab.
- G. Maintain adequate clearance between conduit and piping.
- H. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- I. Cut conduit square using saw or pipecutter; de-burr cut ends.
- J. Bring conduit to shoulder of fittings; fasten securely.
- K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- L. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2" size.
- M. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- N. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC 300, whether shown on Drawings or not.
- O. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the Specifications. Pullcord must be fastened to prevent accidental removal. A phenolic or brass nameplate shall be attached to each end indicating the location of both ends of conduit as follows: THIS END = "LOCATION," OTHER END = "LOCATION."
- P. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Q. Ground and bond conduit under provisions of Section 26 05 26 Grounding and Bonding.
- R. Identify conduit under provisions of Section 26 05 53 Identification for Electrical Systems.
- S. Install all conduits concealed from view unless specifically shown otherwise on drawings
- T. Rigid steel box connections shall be made with double locknuts and bushings.
- U. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- V. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- W. All raceways shall be run from outlet to outlet as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.
- X. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade. Marker shall be 6" round x 6" deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.
- Y. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."

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- 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

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SECTION 26 05 34 - OUTLET BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes wall and ceiling outlet boxes (and/or small junction/pullboxes).
- B. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.

1.3 REFERENCES

- A. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
- B. ANSI/NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- C. ANSI/NFPA 70 National Electrical Code
- D. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Submit catalog cut sheets/product data on:
 - 1. Surface cast boxes.
- B. For pullboxes and junction boxes not covered in Section 26 05 35 Pull and Junction Boxes. Submit product data showing dimensions, covers, and construction.

1.6 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of outlets in offices and work areas prior to rough-in.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All boxes and fittings shall be labeled by Underwriters Laboratories.
- B. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- C. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.
- D. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size

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and number of conduits connecting thereto.

- E. Handy boxes shall not be used.
- F. Outlet boxes to be one-piece.
- G. 4" x 4" boxes and 4 11/16" x 4 11/16" boxes used as junction boxes shall be one piece.

2.2 SHEET METAL OUTLET BOXES: ANSI/NEMA OS 1, GALVANIZED STEEL

- A. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2" male fixture studs where required.
- B. Concrete Ceiling Boxes: Concrete type.
- C. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices. T&B, Steel City, Raco or accepted substitution.
- D. Ceiling outlet boxes shall be 4" octagonal or 4" square X 1 1/2" deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.
- E. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be 4" square X 1 1/2" deep. For recessing in exposed masonry, provide one piece 4" square x 1-1/2" deep wall boxes with appropriate 4" square cut tile wall covers Steel City series #52-C-49/52-C-52 or accepted substitution. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.

2.3 CAST BOXES NEMA FB 1:

- A. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices; Appleton, Crouse Hinds or accepted substitution. Trim rings shall also be of one-piece construction.
- B. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast metal suited to each application with threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitably configured, gasket, and corrosion-proof fasteners.
- C. Boxes to be Type FD unless otherwise noted on drawings.
- D. Freestanding cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
- D. Install boxes to preserve fire resistance rating of partitions and other elements.
- E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- F. Use flush mounting outlet boxes in finished areas.
- G. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation.

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- Provide minimum 24" separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
 - I. Use stamped steel bridges to fasten flush mounting outlet box between studs.
 - J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
 - K. Support all outlet boxes from structure with minimum of one 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two all-thread rod hangers, minimum.
 - L. Do not fasten boxes to ceiling support wires.
 - M. Support boxes independently of conduit.
 - N. Use gang box where more than one device is mounted together. Do not use sectional box.
 - O. Use gang box with plaster ring for single device outlets.
 - P. Use cast outlet box in exterior locations and wet locations.
 - Q. Comply with applicable portions of the NECA National Electrical Installation Standards.
 - R. Install outlets in the locations shown on the Drawings; however prior to rough-in, the Owner shall have the right to make slight changes in locations to reflect room furniture layouts.
 - S. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.
 - T. The Contractor shall relocate electrical boxes as required so that once installed, electrical devices will be symmetrically located with respect to the room layout.
 - U. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.
 - V. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.
 - W. As a minimum, provide pull boxes in all raceways over 150' long. The pull box shall be located near the midpoint of the raceway length.
 - X. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
 - Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
 - Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
 - AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
 - BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of

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finish wall surface.

- CC. Outlet boxes mounted in metal stud walls are to be supported to studs with two screws inside of outlet box to a horizontal stud brace between vertical studs, or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall is finished.
- DD. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.
- EE. Mount Height.
 - 1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural Drawings and Shop Drawings for installing:

Switches	4'-0" AFF to top
Receptacles	1'-4" AFF to bottom
Lighting Panels	6'-6" AFF to centerline of highest breaker/fuse
Phone outlets	1'-4" AFF to bottom
Intercom Call-in button/handsets	4'-0" AFF to top
Fire Alarm Pull Stations	4'-0" AFF to top
Fire Alarm Strobe Lights	80" AFF to bottom
Thermostats	4'-0" AFF to top
Space Sensors	4'-0" AFF to top
 - 2. Bottoms of outlets above countertops or base cabinets shall be minimum 2" above countertop or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural Drawings, prior to rough-in, regardless of height shown on Division 26 Drawings.
 - 3. Height of wall-mounted fixtures shall be as shown on the Drawings or as required by Architectural Drawings and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.
- FF. Special Purpose Outlets.
 - 1. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.
- GG. Outlets in Fire/Smoke and Smoke Partitions/Walls.
 - 1. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other accepted materials. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for products furnished under all Sections of these specifications.
- B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.

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- 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

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SECTION 26 05 35 - PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install pull and junction boxes as shown on drawings or as required by the NEC.
- B. Provide and install pull and junction boxes wherever required for a complete and operating distribution system whether shown on drawings or not.
- C. Where outlet boxes are used for pull and/or junction boxes, they shall meet the requirements of Section 26 05 34 Outlet Boxes.

1.3 REFERENCES

- A. ANSI/NEMA FB 1 Fittings and Supports for Conduit and Cable Assemblies
- B. ANSI/NEMA OS 1 Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- C. ANSI/NEMA OS 2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- D. ANSI/NFPA 70 National Electrical Code
- E. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Submit actual shop drawings of all pull boxes showing:
 - 1. Covers.
 - 2. Dimensions - inside and out.
 - 3. Rating of concrete or gauge of metal.
 - 4. Manufacturer.

1.6 PROJECT RECORD DOCUMENTS

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

1.7 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of pull and junction boxes prior to rough-in.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose and to maintain required access.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Dimensions of pull and junction boxes shall meet dimensions shown on Drawings or dimensions

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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

- 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.

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- M. Pull and junction boxes used for Systems Divisions 27, 28 larger than 25 square inches shall be hinged cover type.
- N. Do not fasten boxes to ceiling support wires.
- O. Support boxes independently of conduit.
- P. Large Pull Boxes:
 - 1. Boxes larger than 100 cubic inches in volume or 12" in any dimension.:
 - a) Interior dry locations per NEC with screw covers.
 - b) Other locations use hinged enclosure under provisions of Section 26 27 16 Cabinets and Enclosures.
- Q. Outdoor Locations: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations and sizes of required access doors with applicable sections in these Specifications.
- B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

3.3 ADJUSTING

- A. Install knockout closure in unused box opening.

END OF SECTION

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SECTION 26 05 36 - CABLE TRAYS

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. Cable trays and accessories.
 - a) Factory-assembled, metal center hung and wall mounted ladder-type cable tray system for distribution and support of cables, installed in place.
 - b) Cable tray shall include all supporting devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, and accessories required for complete installation.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code
- B. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- C. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- D. NEMA FG 1 - Fiberglass Cable Tray Systems
- E. NEMA VE 1 - Metal Cable Tray Systems

1.3 SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.
- B. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.
- C. Product Data: Submit data for fittings and accessories.
- D. Manufacturer's Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section Common Work Results.
- B. Record actual routing of cable tray and locations of supports.

1.5 QUALIFICATIONS

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

1.6 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 MANUFACTURERS

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- A. Mono-Systems, Inc. Model B1113-0323 (center hung), B6113-0322 (wall hung).
- B. Substitutions: Under provisions of Section Substitutions.

2.2 LADDER-TYPE CABLE TRAY

- A. Description: NEMA VE 1, Class 20C ladder type tray.
- B. Material: Aluminum.
- C. Finish: ASTM A 123, hot dipped galvanized after fabrication
- D. Inside Width: 12inches
- E. Inside Depth: 3 inches
- F. Straight Section Rung Spacing: 12 inches on center.
- G. Inside Radius of Fittings: 12 inches
- H. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- I. Covers: ventilated cover.

2.3 CENTER HUNG TYPE CABLE TRAY

- A. Materials
 - 1. Cable trays shall be ventilated ladder type construction with widths and depths as indicated on the drawings or specified herein. The ladder tray shall be center supported or wall mounted.
 - 2. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors and grounding straps.
- B. Center Supported Ladder Tray
 - 1. Tray shall be constructed of a center rectangular aluminum tube which forms a spine to which square/rectangular/triangular cross rungs are attached on 6 inch centers. The cross rungs shall be bent up at their ends to a height of 3 inches to form a center supported, open sided, ladder like assembly. The tray must not have side rails. Width inside to be 12". Rungs shall emanate at right angles from the bottom of the spine
- C. Wall Mounted Ladder Tray - Wall Rack
 - 1. Single Tier Wall Tray (Wall Rack) shall be constructed of a rectangular aluminum tube which forms a spine to which cross rungs are attached on 6 inch centers. These cross rungs shall be attached to emanate from one side of the spine and shall be bent up at their ends to a height of 3 inches to form an open sided ladder like assembly. The tray must not have side rails. Inside width shall be 9". Rungs shall emanate at right angles from the bottom of the spine. Tray shall be mounted by fastening the spine directly to the wall in accordance with the manufacturer's specifications.
- D. Wall Mounted Ladder Tray - Wall Rack Double Tier
 - 1. Double Tier Wall Tray (Wall Rack Double Tier) shall be constructed of a rectangular aluminum tube which forms a spine to which cross rungs are attached on centers. These cross rungs shall emanate from one side (top of the spine only) and also vertically from the bottom of the spine to form two tiers of cable tray, one above the other and shall be bent up at their ends to form an open sided ladderlike assembly. The tray must not have side rails. Tray shall be mounted by fastening the spine directly to the wall in accordance with the manufacturer's specifications.
- E. Fittings

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1. Splice Connectors - Sections of tray and all other fittings shall be joined by using a two bolt, 4 inch (100 mm) long rectangular splice connector which telescopes into the spine of the tray. Splice connectors shall allow for thermal expansion/contraction of the tray system. The splice connectors shall be provided with a vertical hole to accept 1/2 inch (12mm) threaded rod which is used to support the tray in an overhead application.
2. Quick Tees - Horizontal and Vertical, quick connect items shall be used for all 90 degree elbows, tees and crosses by clamping to the spine without the need for drilling or cutting this component.
3. Angle Connectors - Horizontal and Vertical, shall be used for angles of 90 degrees to 30 degrees and fasten into spine in the same manner as the above splice connector.
4. Tray Inserts and Tray Covers as well as other accessories shall effect a complete rigid mechanical tray installation of compatible material and design.

F. Construction

1. The ladder tray shall be constructed of 6063-T6 aluminum alloy and shall utilize a center spine being 1.5 inches (38 mm) wide x 2.75 inches (70 mm) high, and square/rectangular/triangular cross section rungs a minimum of .50 (12 mm) (L-Series, .40 inches (10 mm) thick. Rungs must be staked into place, not screwed or welded. All fittings and accessories to also be 6063-T6 aluminum.

G. Supports

1. For Center Supported Ladder Tray; tray shall be supported on maximum 12 foot centers (3.6 meter) (or by local requirements) by a single .50 inches (12mm) threaded rod which passes through the vertical hole in the splice connector and fastens directly to the stressed central spine by one .50 inch (12mm) nut and washer on the top and bottom of the spine. When shorter spans are needed, then a 5/8 inch diameter hole should be drilled through top and bottom walls of the spine, at support points only, and a single .50 inch (12mm) threaded rod should be inserted also using a .50 inch (12mm) nut and washer on top and bottom of spine.
2. For Wall Mounted Ladder Tray - Single Tier and Double Tier; wall spacers must be used at each support point. A minimum of three wall spacers and fasteners should be used per 12 foot (3.6 meters) section. No brackets shall be needed to mount this tray to the wall.

2.4 TROUGH-TYPE CABLE TRAY

- A. Description: NEMA VE 1, Class 20C trough type tray.
- B. Material: Aluminum.
- C. Finish: ASTM A 123, hot dipped galvanized after fabrication
- D. Inside Width: 12 inches
- E. Inside Depth: 3 inches
- F. Inside Radius of Fittings: 12 inches.
- G. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- H. Covers: ventilated cover.

2.5 SOLID-BOTTOM-TYPE CABLE TRAY

- A. Description: NEMA VE 1, Class 20C solid bottom cable tray.
- B. Material: Aluminum.

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- C. Finish: ASTM A 123, hot dipped galvanized after fabrication
- D. Inside Width: 12 inches
- E. Inside Depth: 3 inches.
- F. Inside Radius of Fittings: 12 inches
- G. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- H. Covers: ventilated cover.

2.6 CHANNEL-TYPE CABLE TRAY

- A. Description: NEMA VE 1, Class 20C ventilated bottom channel type cable tray.
- B. Material: Aluminum.
- C. Finish: ASTM A 123, hot dipped galvanized after fabrication.
- D. Inside Width: 3 inches
- E. Outside Depth: 1-3/4 inches
- F. Inside Radius of Fittings: 12 inches
- G. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- H. Covers: Flanged, ventilated cover.

2.7 WARNING SIGNS

- A. Engraved Nameplates: 1/2 inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install metallic cable tray in accordance with NEMA VE 1.
- C. Support trays in accordance with Section Supporting Devices. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 3 ft maximum.
- D. Use expansion connectors where required.
- E. Ground and bond cable tray under provisions of Section Grounding and Bonding.
 - 1. Provide continuity between tray components.
 - 2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
 - 3. Provide 2 AWG bare [copper] [aluminum] equipment grounding conductor through entire length of tray; bond to each component.
 - 4. Connections to tray may be made using mechanical or exothermic connectors.
- F. Install warning signs at 50 ft centers along cable tray, located to be visible.

END OF SECTION

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SECTION 26 05 37 - SURFACE RACEWAYS

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. Surface metal raceways.
 - 2. Multi-outlet assemblies.
 - 3. Wireways.
 - 4. Wall duct.

1.2 REFERENCES

- A. NECA (National Electrical Contractor's Association) Standard of Installation.
- B. NEMA WD 6 - Wiring Device Configurations.

1.3 SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.
- B. Submit Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.
- C. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

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

1.6 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 SURFACE METAL RACEWAY WITH DUPLEX RECEPTACLES AND (WHERE APPLICABLE) COMMUNICATION SYSTEMS OUTLET

- A. Manufacturers:
 - 1. Single Duct:
 - a) Wiremold #G3000 Series or approved equal.
 - 2. Twin Duct:
 - a) Wiremold #G-4000 Series or approved equal.

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- B. Description:
 - 1. Single, double, or triple metal raceway system with cover, devices and device covers.
 - 2. Two-piece construction (base and snap-on cap).
- C. Size:
 - 1. Single: 2.83 sq. in., 1 5/8" x 2 1/8".
 - 2. Double: (2) 2.83 sq. in., 1 5/8" x 4 1/4".
- D. Finish: Gray enamel base. Paint as directed by architect.
- E. Fittings: Provide all fittings as required for a complete and enclosed system, including but not limited to:
 - 1. Wall box connector (for flush end feeder).
 - 2. End feed (for surface conduit connections).
 - 3. Panel connector (for connecting to panels, cabinets, etc.)
 - 4. End blanks.
 - 5. T's, couplings, elbows, bridges, etc.
- F. Device and Device Covers:
 - 1. Provide and install power receptacles as noted on drawings complete with covers.
 - 2. Provide and install cover with grommetted hole for communication systems outlets shown on drawings.
- G. Wiring Devices:
 - 1. Power receptacles are to be minimum 20 amp, 120V spec. grade equal or superior to that specified in wiring device section (gray).

2.2 SURFACE METAL RACEWAY

- A. Manufacturers:
 - 1. Wiremold Model 200, 500 or 700 as required for conductors.
 - 2. Substitutions: Under provisions of Section Substitutions.
- B. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- C. Size: As required to house wires and match connecting equipment.
- D. Finish: [Ivory] Gray enamel unless otherwise noted on drawings, paint as directed by Architect.
- E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, complete as required for a complete enclosed installation.
- F. Boxes shall be a minimum of 2-3/4" deep.

2.3 MULTIOUTLET ASSEMBLY (SINGLE RECEPTACLES)

- A. Manufacturers:
 - 1. 20 AMP single receptacles.
 - a) Wiremold Model V24GB Series or approved equal.
 - 2. 15 AMP single receptacles.
 - a) Wiremold 2000 Series or approved equal.

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3. Where required due to number of conductors required or wiring device called for, assembly shall be increased in size to:
 - a) Wiremold 2100 Series or approved equal.
4. Where shown to have duplex receptacles provide system as specified above.
- B. Multioutlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multioutlet assembly.
- C. Size: Length as indicated on Drawings.
- D. Receptacles: NEMA WD 6, 15 AMP or 20 AMP, single receptacle as indicated.
- E. Receptacle Spacing: As indicated.
- F. Receptacle Color: Gray.
- G. Channel Finish: Gray enamel unless otherwise noted on drawings. (Paint as directed by architect.)
- H. Fittings: Furnish manufacturer's standard couplings, elbows, outlet and device boxes, and connectors.
- I. Where more than one circuit is feeding multioutlet assembly, receptacles are to be wired alternately.
- J. Where shown receptacles and wiring shall be isolated ground type.

2.4 WIREWAY

- A. Manufacturers:
 1. Hoffman.
 2. Square "D"
 3. Electrical Enclosures
 4. Substitutions: Under provisions of Section Substitutions.
- B. Description: General purpose, Oiltight and dusttight or Raintight type wireway as indicated on drawings. If not indicated provide type required to meet applicable codes.
- C. Knockouts: Manufacturer's standard.
- D. Size: As indicated on Drawings, or larger as required by the N.E.C.
- E. Cover: Hinged cover with full gasketing for raintight and oiltight types.
- F. Connector: Slip-in for general purpose and raintight types and flanged for oiltight types.
- G. Fittings: Lay-in type with removable top, bottom, and side; captive screws for general purpose, and drip shield for raintight type, and removable top for oiltight type.
- H. Finish: Rust inhibiting primer coating with gray enamel finish.

2.5 WALL DUCT

- A. Manufacturers:
 1. Square "D".
 2. Walker
 3. Substitutions: Under provisions of Section Substitutions.
- B. Description: Sheet metal wall duct suitable for installation of cables; with flush covers and accessories as indicated.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- D. Wireway Supports: Provide steel channel as specified in Section Supporting Devices.
- E. Close ends of wireway and unused conduit openings.
- F. Ground and bond raceway and wireway under provisions of Section Grounding and Bonding.
- G. Install only in locations deemed accessible by the N.E.C. and local authority. Provide all access panels, etc., as required to maintain required access.

END OF SECTION

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SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install all equipment, labor and material for a complete identification system including but not limited to:
 - 1. Nameplates and labels.
 - 2. Wire and cable markers.
 - 3. Conduit markers.
- B. Identify all new and existing conduit, boxes, equipment, etc. as specified herein.

1.3 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code
- B. Americans with Disabilities Act

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

PART 2- PRODUCTS

2.1 NAMEPLATES

- A. Nameplates shall be laminated phenolic plastic, chamfered edges.
 - 1. 120/208 Volt System:
 - a) Black front and back, white core, lettering etched through outer covering, white engraved letters on black background.
 - 2. 277/480 Volt System:
 - a) Orange with white letters.
 - 3. Emergency System:
 - a) Red with white letters.
 - 4. Emergency Power:
 - a) Red front and back, white core, lettering etched through outer covering, white engraved letters on red background.
- B. Letter Size:
 - 1. 1/8" letters for identifying individual equipment and loads.
 - 2. 1/4" letters for identifying grouped equipment and loads.
- C. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the Drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards, switchboards, motor

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control centers, disconnects and enclosed breakers shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire." In addition, provide phenolic label in panel to describe where the panel is fed from and location. For example, "Fed From MDP-1:3:5 Electrical Room #E101 Level 1." Nameplates for equipment listed below shall describe particular equipment name and associated panel/circuit, if applicable. The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and pushbutton station nameplates for that machine.

- D. The following items shall be equipped with nameplates:
 - 1. All motors, motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches, transformers, panelboards, circuit breakers (i.e., all 2-pole, 3-pole circuit breakers), contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical, and electrical systems (Systems Divisions 27, 28), junction and pull boxes (larger than 4-11/16"), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number, if applicable.
- E. All Electrical system panels, transfer switches, motor control centers, disconnect switches, motor controllers, etc. shall be labeled as per branch, i.e.: "Panel ABC Emergency-Life Safety Branch" (similar for emergency legally required standby branch, or emergency optional standby branch).

2.2 WIRE MARKERS

- A. Description: Cloth, tape, split sleeve or tubing type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings including neutral conductor.
 - 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

2.3 CONDUIT/JUNCTION BOX COLOR CODE

- A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:

<u>COLOR CODE FOR JUNCTION BOXES</u>	<u>KRYLON PAINT NUMBER</u>
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
Security/CCTV	Saddle Tan K03554 (<u>FOR VCSB ONLY</u>)

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Telephone	Clover Green K02012
Grounding	Fluorescent Green K03106
<u>COLOR CODE FOR JUNCTION BOXES</u>	<u>KRYLON PAINT NUMBER</u>
Fire Alarm	Cherry Red K02101
Normal Power 277/480 volt	Leather Brown K02501
Normal Power 120/208 volt	Glossy Black K01601
Fiber Optics	True Blue K01701
Intercom	Light Blue S01540
TV	Zinger Pink S01150
BAS	Cameo White K04129
Security/CCTV	John Deere Green K01817
Grounding	Fluorescent Green K03106

- B. Conduit (not subject to public view) longer than 20' shall be painted with above color paint band 20' on center. Paint band shall be 4" in length applied around entire conduit. Where conduits are parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniform. Paint boxes and raceways prior to installation, or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.
- C. Junction boxes and conduits located in public areas (i.e. areas that can be seen by the public) shall be painted to match surface attached to. Provide written request to A/E for interpretation of public areas in question.

2.4 CONDUIT/JUNCTION BOX MARKER

- A. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately describe its associated panel and circuit reference number(s) within (i.e. ELRW-2, 4, 6), or systems within (i.e. fire alarm, intercom, etc.). Identification shall be neatly written by means of black permanent marker. Paint one-half of cover plate with appropriate color above, and one-half with associated panel/circuit or system as described above. Junction box cover plates located in public areas shall be identified with small phenolic labels securely attached. Label colors to be determined by A/E. Large pull/junction boxes (8" x 8" or larger) shall be color identified by painting the corners of box cover plate with specified colors at 45 degree angles; phenolic labels as specified herein.
- B. Identify conduit not installed in public areas with corresponding panel/circuit numbers or corresponding system type as described above. Spacing 20 ft. on center adjacent to color identification bands.

2.5 UNDERGROUND WARNING TAPE

- A. Description: Minimum 6" wide plastic tape, detectable type, with suitable warning legend describing buried lines. Systems conduit shall have orange colored tape. Power/lighting conduit shall have red colored tape.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel pop rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Nameplates installed inside on dead front cover shall be self-adhesive tape. Do not drill or install

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- screws in dead front.
- E. Identify new 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

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SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide all labor, materials, and equipment necessary to properly and completely install panelboards as scheduled on the drawings and as required by this Section.

1.3 REFERENCES

- A. NECA National Electrical Installation Standards
- B. NEMA PB 1 Panelboards
- C. NEMA PB 1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- D. NFPA 70 National Electrical Code
- E. UL 50 Enclosures for Electrical Equipment
- F. UL 67 Panelboards
- G. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with NECA National Electrical Installation Standards.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

1.6 SUBMITTALS

- A. Product data shall be submitted on:
 - 1. Panel.
 - 2. Cabinet.
 - 3. Bus.
 - 4. Dimensions.
 - 5. Construction.
- B. Shop drawing shall be submitted for each and every panel for this project, each and every panel drawing shall clearly indicate the following information:
 - 1. UL label.
 - 2. Each circuit breaker amperage rating, circuit number and position/location in panel.
 - 3. Electrical characteristics of panel.
 - 4. Mains rating.
 - 5. Main device rating.
 - 6. Mounting.
 - 7. Dimension, width, depth, height.
 - 8. Bus material.
 - 9. Interrupting capacity of minimum rated breaker.
 - 10. Panel type.

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11. Series AIC rating with upstream breakers.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit record documents to record actual locations of products, indicate actual branch circuit arrangement.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit Maintenance Data: Include spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by manufacturer.

1.10 MAINTENANCE MATERIALS

- A. Provide two of each panelboard key.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle panelboards and enclosures carefully to prevent damage.
- B. Store equipment indoors and protect from weather.
- C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work. This time shall be established by a CPM provided by the Contractor and accepted by the supervising authorities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Square D.
- B. Manufacturers (including accepted substitutions) must provide equipment equal to or superior than the basis of design used on this project.
 - 1. Panels or circuit breakers with an AIC rating less than that shown on the drawings will not be approved.
 - 2. Where basis of design panelboard can accept a certain type, frame, and/or AIC rated breaker, the accepted substitution manufacturer must also be able to accept all equal breaker type, frame, and/or AIC rating.

2.2 GENERAL

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1, circuit breaker type, dead front UL 67.
- B. Panelboard Bus: Copper ratings as indicated. Provide copper ground bus in each panelboard. Provide isolated full size neutral bus where neutral is applicable. Provide non-linear load panelboards as specified on drawings. Non-linear panelboards shall have 200 percent rated neutral busbar.
- C. Short Circuit Rating:
 - 1. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:
 - a) Individual CB AIC rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.

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- b) Panel series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.
 - c) Circuit breaker types are not shown or called for. The Contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given, including providing current limiting breakers where required to achieve all ratings given.
2. Short Circuit Rating Label:
- a) Panelboards shall be labeled with a UL short-circuit rating.
 - b) Series ratings shall not be used to achieve short circuit ratings (for equipment on life safety or equipment branch).
 - c) When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:
 - 1. Size and type of upstream device.
 - 2. Branch devices that can be used.
 - 3. UL series short-circuit rating.
- D. Enclosure:
- 1. Enclosures shall be at least 20" wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
 - 2. Enclosures shall be provided with blank ends.
 - 3. Where indicated on the drawings, branch circuit panelboards shall be column width type.
 - 4. Regulatory requirements:
 - a) NEMA PB 1, Type 1, Type 3R, or Type 4X as indicated on Drawings. Use only Type 3R or Type 4X for units to be installed outdoors. Use only Type 4X in interior wet locations and designated wash-down areas. For the purposes of this specification, a wash-down area is defined as any area that is directly washed or rinsed with any form of water hose.
 - 5. Cabinet Box: Depth 6", width 20" minimum, constructed of code gauge steel, galvanized or bonderized to prevent rust.
- E. Cabinet Front: Flush or surface (as indicated on Drawings) cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard baked enamel finish for interior panels. Exterior panels to be painted with rust inhibit primer painted over on all surfaces with epoxy paint.
- F. Panels and breakers shall be rated for voltage and class of service to which applied.
- G. Spaces:
- 1. Space provisions or spaces for future breakers shall be located at the bottom of the panel and be fully bused complete with all necessary mounting hardware less the breaker.
- H. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

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2.3 MAINS

- A. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on Drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.
- B. Regardless of what is shown on Drawings, provide the following minimum requirements:
 - 1. Main circuit breaker on each panel serving building main if required by applicable codes.
 - 2. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).
- C. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.
- D. Main circuit breaker is not to be mounted as branch breaker or subfeeder breaker.

2.4 CIRCUIT BREAKERS

- A. General
 - 1. Molded Case Circuit Breakers: Plug-in type for 250V or less, bolt-in type for 250V or less bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
 - 2. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
- B. Main Breakers:
 - 1. Main breakers shall be individually mounted separate from branch breakers.
 - 2. Covered by a metal plate, except for operating handle.
 - 3. Connection from the load's side to the panel bus shall be bus bar. Insulated wire not permitted.
- C. Branch Breakers:
 - 1. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.
 - 2. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.
 - 3. Multi-pole breakers shall have common internal trip. No handle ties between single pole breakers are acceptable for this project.
 - 4. Multi-wire branch circuit breakers shall have multi-pole breakers as required by the NEC. Handle ties between breaker handles are not acceptable.
 - 5. Single pole 15 and 20 ampere circuit breakers shall be rated for switching duty and shall be labeled as "SWD."
 - 6. AIC rating shall be as called for in paragraph 2.2 General.
 - 7. Ground Fault Circuit Interrupters (GFCI):
 - a) Provide UL Class (5 milliamp sensitivity) ground fault circuit protection on 120 VAC

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branch circuits for exterior location receptacles and for interior locations where required by NEC. (These may not be indicated on Panel Schedule.) This protection shall be an integral part of the branch circuit breaker, which also provides overload, and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. Provide separate neutral for circuits on GFCI breakers whether indicated on drawings or otherwise.

- 8. Breakers feeding heating and air-conditioning equipment shall be rated HACR type breaker.
- 9. Breakers feeding high intensity discharge lamps systems shall be HID rated.
- D. All breakers are to have lugs sized to match conductors called for on drawings.

2.5 SERVICE ENTRANCE EQUIPMENT

- A. Panelboards used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA National Electrical Installation Standards, the applicable requirements of the National Electrical Code, and recognized industry practices.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 26 05 29 Hangers and Supports.
- C. Height: 6' to top of panelboard; install panelboards taller than 6' with bottom no more than 4" above housekeeping curb.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names on inside of door. Room names shall be actual names or numbers used, not necessarily shown on the drawings. Progress drawings shall show same arrangements as the directory. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates under the provisions of Section 26 05 53 Identification for Electrical Systems.
- G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 4 empty 1". Identify each as "SPARE".
- H. Proper working clearances shall be maintained at every panelboard location. The working space in front of a panelboard shall be as a minimum, 30" wide extending 3', 3.5', or 4' (per NEC 110.26) out perpendicular to the panelboard.
- I. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Enclosures shall be installed so that the top is 6'-6" above finished floor. Where the size of the enclosure is such that the top cannot be installed at 6'-6", the top of the enclosure shall be kept as low as possible.
- J. Clean the interior of each panelboard before installing conductors. At all times, keep the interior trim and exterior surfaces of the panelboard free of rust and debris. Repaint finishes if

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necessary.

- K. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be laced and arranged in orderly manner.
- L. Collect all keys upon delivery of panelboard. Store keys on one ring to be kept by project superintendent. Forward key ring with keys to Owner upon Substantial Completion.
- M. Provide a separate neutral conductor for each GFI breaker. These shall not be combined to serve more than 1 circuit, even where on different phases. Increase plan indications of conductors for neutral wires required, as necessary.

3.2 IDENTIFICATION

- A. Refer to Section 26 05 53 Identification for Electrical Systems for products and content.
- B. Provide engraved plastic nameplates under the provisions of Section 26 05 53 Identification for Electrical Systems.
- C. Nameplate shall state panel name and voltage of this panel, name of panel that feeds this respective panel, and UL short-circuit rating of this panel.
- D. Provide labels and identification as required by the NEC.
- E. All circuit identifications and directories shall be checked to verify accuracy of the description of the load and/or equipment being fed

3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
- D. Feeder conductors shall be checked by accepted means to establish the absence of shorts to ground, insulation value, etc., and the result recorded and submitted to the Engineer.
- E. All circuits shall be operated to establish a good working order and checked for shorts.
- F. All panel directory circuit numbers shall be checked to verify accuracy of the number.
- G. Where and when requested by Engineer provide:
 - 1. Inspection of equipment by authorized equipment manufacturer's technician complete with submittal of statement of findings by technician, and providing any adjustments deemed necessary for a complete and operating system.
 - 2. Ground, voltage, and/or load readings complete with submittal on legible form with applicable data.

END OF SECTION

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SECTION 26 43 00 - SURGE PROTECTIVE DEVICES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for surge protective devices.

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

- A. Equipment Certification: Surge protective devices shall be listed by Underwriters Laboratories shall bear the UL seal and be marked in accordance with referenced standard. Surge protective devices shall be UL listed and labeled for intended use.
- B. Surge protective devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 70 and NFPA 780).
- C. Comply with all standards and guides as listed under "References" above.

1.5 DESIGN REQUIREMENTS

- A. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on Drawings or specified in this Section for systems with voltages between 120 VAC and 208VAC, 480VAC (single phase or 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 at each building.
 2. On distribution and branch panels as called for on Drawings or in these Specifications.
 3. All electronic communications equipment installed under Divisions 27 and 28 including, but not limited to, fire alarm, intercom, security, television, premise distribution, and sound systems.

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4. All or any electronic equipment installed under Division 27 including electronic time clocks, controls systems, etc.
5. All or any electronic equipment installed under Division 23 including: electronic time clocks, halon systems, control systems, building management systems, etc.
6. Site lighting pole light circuits.
7. Additional locations as required by NFPA 780.
8. At point of use locations (receptacles, plug-in units) as required.
9. On all automatic transfer switches (ATS).
10. On all step-down or step-up transformers and voltage regulators as identified in the project drawings.
11. On input to each UPS system.

1.6 SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.
- B. Submit Product Data for each type of surge protective device:
 1. Dimensions.
 2. Means of mounting.
 3. Compliance with UL Standards referenced.
 4. Compliance with IEEE Standards referenced.
 5. Design type (Hybrid, MOV).
 6. Internal fusing.
 7. Recommended overcurrent protection.
 8. Size of wire leads.
 9. Visual failure indicator.
 10. Warranty.
 11. Performance data showing compliance with performance as specified herein.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance (O & M) data as called for in Section 26 01 00 Operation and Maintenance Manuals.
- B. O & M data to include:
 1. All accepted shop drawings, product data, and/or cutsheets.
 2. Installation, connection, and maintenance information on each type of surge suppression.
 3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.

1.8 QUALITY ASSURANCE

- A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.
- B. The surge protective device manufacturer shall offer technical assistance through support by a

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factory representative and local stocking distributor. Factory representatives are to accept installation prior to Substantial Completion.

1.9 COORDINATION/PROJECT CONDITIONS

- A. Verify proper grounding is in place.
- B. Verify proper clearances, space, etc. is available for surge protective devices.
- C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge protective device.

1.10 WARRANTY

- A. All surge protective devices shall be warranted to be free from defects in materials and workmanship for a period of five years.
- B. Any surge protective device which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.

1.11 DEFINITIONS/ABBREVIATIONS

- A. VPR: UL Voltage Protection Rating
- B. MCOV: Maximum Continuous Operating Voltage
- C. SCCR: Short Circuit Current Rating
- D. IN: Nominal

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.

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3. Enclosure:
 - a) UL listed
 - b) Fire retardant
 - c) NEMA rated as required for each location.
 - d) Flush, Switchboard and/or Surface mounted as shown/called for on drawings for each location.

B. Modular Design:

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.
2. Replaceable module design. The panel mounted surge protective device shall be designed with replaceable modules for purposes of in-service replacement.
3. The surge protective device shall be designed with redundant back-up surge protection in the event of a module failure.
4. Module status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.
5. Unit status indicators shall be provided to indicate the status of the complete surge protective device. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure.
6. Minimum Surge Capacity:
 - a) 300 kA per phase.
7. Voltage Protection Rating (VPR) and Maximum Continuous Operating Voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

300 kA Unit	L-L	L-N	L-G	N-G	MCOV	In
120/208 V, 3ph, 4W, wye					150V	
UL 1449	1000V	700V	600V	600V		20 kA
277/480 V, 3ph, 4W, wye					320V	
UL 1449	1800V	1200V	1000V	1000V		20 kA

8. Minimum Short Circuit Current Rating:
 - a) 200,000 amps.
9. Manufacturers:
 - a) 300 kA Units.
 1. Advanced Protection Technologies Series TE/***/XAS/30 for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes, or approved equal.
 2. Atlantic Scientific ZoneMaster 340 All-Mode Series for applied voltage in enclosure as required on drawings, as specified above, and/or as required by applicable codes, or approved equal.

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C. Non-Modular Design:

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.
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.
3. Unit status indicators shall be provided to indicate the status of the complete suppressor unit. The LED status indicators shall be located on the front cover to redundantly indicate module or unit failure.
4. Minimum Surge Capacity:
 - a) 240,000 amps. per phase.
5. Voltage Protection Ratings (VPR) and Maximum Continuous Operating Voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

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

6. Short Circuit Current Rating:
 - a) 100,000 amps.
7. Manufacturers
 - a) 240 kA Units
 1. LEA International PV400 Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes.
 2. Advanced Protection Technologies TE/xxXAS/25 Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes, or approved equal.
 3. Atlantic Scientific ZoneMaster 240 All Mode Series for applied voltage in enclosure as required on Drawings, as specified above, and/or as required by applicable codes, or approved equal.

2.3 SECOND LEVEL SURGE PROTECTIVE DEVICES AND UPS/ATS SYSTEMS.

- A. General. Provide second level surge protective devices on each second level of the distribution system (including sub panels) and on all major electronic equipment including UPS Systems and ATS Systems. 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

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withstand 1000 test cycles at 3 kA, Cat. B3 test criteria.

3. Enclosure:
 - a) UL listed.
 - b) Fire retardant.
 - c) NEMA rated as required for each location.
 - d) Flush, Switchboard and/or Surface mounted as shown/called for on drawings for each location.
4. Non-Modular Design.
5. 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.
6. 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.
7. Minimum Surge Capacity:
 - a) 100 kA per phase.
8. 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

9. Short Circuit Current Rating: 100,000 amps.
10. 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 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.

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- 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 μ s): 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 or approved equal

2.5 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 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 (3 kA, 8 x 20 μ s): 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 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

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

3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Surge protective devices for other than Divisions 27 and 28 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.
- B. Surge protective devices for Divisions 27 and 28 equipment power source shall be coordinated with the individual specification section contractor. Locate in terminal cabinet with surge protective devices and bond together.
- C. Surge protective devices shall be close nipped to the device being protected in a position near the neutral bus which will minimize lead length between surge protective devices and the buses or control breaker to which the surge protective device connects. Suppressor leads shall not extend beyond the surge protective device manufacturer's recommended maximum lead length without specific acceptance of the Engineer.
- D. Location shown on Drawings is diagrammatic only. Provide flush mount trim for surge protective device units at flush mounted panelboards. Provide NEMA 4X enclosures for TVSS units in exterior locations.
- E. Surge protective devices shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.
- F. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and accepted connections unless otherwise noted. Referenced to a common earth ground.
- G. Surge protective devices shall be installed in a manner that allows simple replacement within short periods of downtime.
- H. Surge protective devices other than point of use type and those for exterior lighting poles shall be installed with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30 amp, 3 phase CB, 100,000 AIC for the surge protective device. At the distribution secondary and/or subpanels location, provide dedicated 20 amp or 30 amp, 3 phase CB, for the surge protective device. Label disconnect or CB "Surge Protector." Fused disconnects may be substituted for the CB, with the acceptance of the Engineer. Contractor to change rating of CBs noted above as required to properly provide system as recommended by manufacturer.

END OF SECTION

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SECTION 27 05 07 - SUBMITTALS FOR COMMUNICATIONS SYSTEMS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 27 Sections, in addition to Division 01 - General Requirements and any supplemental requirements/conditions.
- B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

- A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addenda, Contractor represents that he:
 - 1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.
 - 2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
 - 3. Waives all claims for additional costs related to substitution which may subsequently become apparent.
 - 4. Will provide the same warranties for the substitution as for the product specified.
 - 5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
 - 6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.
- B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

1.4 SUBMITTALS

- A. Submittals to include:
 - 1. 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.

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- 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. Lightning protection system
 - 2. Each section of fire alarm, television, etc..
 - 3. Special and/or modified equipment
 - 4. UL listed fire and smoke stopping assemblies for each applicable penetration
 - k) See specific sections of Specifications for further requirements.
2. 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:
 - 1. Project Addresses
 - 2. Index
 - 3. Separation Sheets
 - 4. Basic Materials
 - 5. Panelboards

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6. Light Fixtures
7. Long Lead Items
8. Systems Product Data

PART 2- PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

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SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable Codes as accepted by the Authorities having jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.
- B. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of Article 250 of the N.E.C. and State codes. Bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.
- C. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed with-in conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors that run with feeders in PVC conduit outside of building(s) shall be bare only.
- D. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to Article 250 of the NEC.
- E. Section Includes
 - 1. Grounding electrodes and conductors.
 - 2. Equipment grounding conductors.
 - 3. Bonding.
 - 4. Counterpoise System.
 - 5. Ground Ring.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Submit catalog cut sheet/product data on:
 - 1. Ground rods and couplings
 - 2. Mechanical connectors
 - 3. Ground wells
 - 4. Ground bus bars and associated components
 - 5. Ground ring conductor
 - 6. Counterpoise conductor
 - 7. Exothermic welding materials and molds
 - 8. Testing equipment and procedures

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- B. Product data shall prove compliance with Specifications, National Electrical Code manufacturer's specifications and written installation data.

1.4 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 Hangers and Supports

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 5/8 inch.
- C. Length: 30 feet (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 and equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:
 - 1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.
 - 2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.
 - 3. Piping Clamps: Burndy GAR-TC Series with two hole compression terminal or T&B equal.
 - 4. Grounding Screw and Pigtail: Raco No. 983 or equal.
 - 5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.
- C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

2.3 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).

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2.4 GROUNDING WELL COMPONENTS

A. Grass Non-Traffic Areas:

1. Well: Minimum 18-inch (600 mm) long sleeve with minimum 12-inch diameter.
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 inch long by 12 inch wide by 18 inches 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 inches on center spacing. Lugs to be manufactured by Burndy or T&B.
- C. Standoff supports to be 2" polyester as manufactured by Glastic #2015-4C.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.
- C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the N.E.C., the NFPA, and applicable standards of IEEE.
- D. Where there is a conflict between these specifications and the above applicable codes/standards, or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the code/standard requirements shall be complied with.
- E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

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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 each main service electrode system 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, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
 - b) Lightning Protection system ground locations shall not exceed 5 ohms measured at ground electrode.
 - 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 (2) or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two (2) 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 feet 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 foot below grade level and not less than 2 feet 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 CONDUCTOR

- A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.
- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor

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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 Buildings:
 - 1. Contractor shall verify that each building's electrical service is properly grounded as required by the NEC.
 - 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).

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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.
 6. Ground ring.
 7. Site distribution counterpoise ground system.
 8. Lightning protection system.
- 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 building. 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 ft. ground rods in a delta configuration at no less than 30 ft. spacing driven to a minimum depth of 30 ft. 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 NEC250.52 (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 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.

3.7 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

- A. One 30 ft. ground rod electrode shall be driven vertically to a minimum depth of 30 ft. plus 1 ft. 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.

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- 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 ft. or more slack ground cable on cover connection as required to facilitate removal of cover.

3.8 HAZARDOUS LOCATIONS

- A. Ground in hazardous locations shall be done in accordance with applicable portions of Articles 500, 501, 502, 503, 511 and 514 of the National Electrical Code.

3.9 GROUND RING

- A. Provide complete underground building perimeter ground ring system, completely encircling each building.
- B. Conductor shall be minimum of Class II lightning protection copper conductor (bare).
- C. Install at not less than 2-1/2 feet depth into earth.
- D. Install ground rods (minimum 30 ft. long) every 150 feet section of ground ring conductor.
- E. Bond ground ring to building foundation steel every 150 feet around building perimeter, bond to any and all electrical and piping systems that cross the ground ring system, bond to lightning protection down conductors and to any lightning or other earth grounding electrodes that may be present on the premises.
- F. Bond to building service and counterpoise ground systems.

3.10 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

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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 (10) full length rebars which contact the connected rebar (by Division 26 Contractor). Provide size and length of rod to meet NEC requirements.

3.11 GROUNDING BAR/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION

- A. Where indicated on the drawings, provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.
- B. Mount bolt tapping lugs with hex head bolts to bus bar at 2" o.c. spacing, one for each ground conductor.
- C. Mount bus bar to wall using 2" polyester molded insulator stand-off.
- D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by N.E.C. for service ground, etc.) in 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 Systems Sections.
- F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800-40(b).

3.12 COUNTERPOISE SYSTEM

- A. Install counterpoise and ground over all sections of underground ductbanks, conduits, or cables outside (exterior) to building.
- B. No. 2 bare stranded copper counterpoise shall be run six (6) inches above all underground duct banks, conduits and cables outside (exterior) to building.
- C. Provide one (1) counterpoise conductor for ductbanks (or conduit groupings) 12 inches wide or less. Provide two (2) counterpoise conductors above outside edge of ductbank (or conduit groupings) over 12 inches wide.

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- D. Counterpoise shall run to building and be grounded at each building to the main building electrical service ground rod electrode (exterior to building). Counterpoise shall be bonded to ground rod at all light poles, pullboxes, manholes, handholes and at each building. Provide and install appropriate ground rod every 150 ft. length of counterpoise conductor (see "GROUNDING ELECTRODES"). Counterpoise conductor shall not be run into interior of building. Route counterpoise underground around exterior perimeter of building to main service ground rod installation.

3.13 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.

3.14 TESTING AND REPORTS

- A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.
- B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.
- C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Architect/Engineer as called for in Section Tests and Performance Verification.

3.15 INTERFACE WITH OTHER PRODUCTS

- A. Interface with site grounding system.
- B. Interface with lightning protection system installed under Section Lightning Protection System.
- C. Interface with communications system installed under Systems Sections series specification sections.

3.16 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

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SECTION 27 05 29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

- A. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pullboxes and other equipment furnished under this Division.
- B. Section Includes:
 - 1. Conduit and equipment supports.
 - 2. Anchors and fasteners.

1.2 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- F. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) 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

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

END OF SECTION

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SECTION 27 05 33 - CONDUIT FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. 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. Rigid Aluminum Conduit
 3. Intermediate Metal Conduit (IMC) – NEC 342
 4. PVC Coated Rigid Metal Conduit (PVC) (RMC) – NEC 344
 5. Flexible Metal Conduit (FMC) – NEC 348
 6. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
 7. Electrical Metallic Tubing (EMT) – NEC 358
 8. Rigid Nonmetallic Conduit (PVC) (RNC) – NEC 352
 9. Fittings and Conduit Bodies
 10. Electrical Nonmetallic Tubing (ENT) – NEC 362
 11. Flexible nonmetallic conduit. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.
- B. A raceway shall be provided for all electrical power and lighting, and electrical systems unless specifically specified otherwise.

1.3 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit - Zinc Coated
B. ANSI C80.3 - Electrical Metallic Tubing - Zinc Coated
C. ANSI C80.5 - Aluminum Rigid Conduit (ARC)
D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
E. ANSI/NFPA 70 - National Electrical Code
F. NECA Standard Practices for Good Workmanship in Electrical Contracting
G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

1.4 DESIGN REQUIREMENTS

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

1.5 SUBMITTALS

- A. Submit 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

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- 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, manufacturer's specifications and written installation data.
- 1.6 PROJECT RECORD DOCUMENTS
- A. Submit record documents to accurately record actual routing of conduits larger than 1.25 inches.
- 1.7 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.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle Products to site.
 - B. Accept conduit on site. Inspect for damage.
 - C. Protect conduit from sun, rain, corrosion and entrance of debris by storing above grade. Provide appropriate covering.
 - D. Protect PVC conduit from sunlight.
- 1.9 PROJECT CONDITIONS
- A. Verify that field measurements are as shown on Drawings.
 - B. Verify routing and termination locations of conduit prior to rough-in.
 - C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All conduits shall bear UL label or 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, and other Federal codes where applicable.

2.2 MINIMUM TRADE SIZE

- A. Rigid conduit - 3/4".
- B. Non-metallic conduit - 3/4"c.
- C. E.M.T. - 3/4".
- D. Flexible and seal-tite metallic conduit - 1/2"C. (Maximum 6 ft. long).
- E. Homeruns - 3/4"c.
- F. Branches - 1/2"c.
- G. All types - 1/2"c.

2.3 RIGID METAL CONDUIT (RMC)

- A. Comply with:
 - 1. ANSI C80.1
 - 2. UL Spec - No. 6
 - 3. NEC 344
- B. Conduit material:

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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 RIGID ALUMINUM CONDUIT
- A. Comply with:
 1. ANSI C80.5
 2. UL 6
 3. NEC
 - B. Conduit material: Aluminum.
 - C. Fittings:
 1. Threaded.
 2. Aluminum.
 3. Insulated bushings on terminations.
 - D. Conduit bodies:
 1. Comply with ANSI/NEMA FB 1.
 2. Threaded hubs.
 3. Aluminum.
- 2.5 INTERMEDIATE METAL CONDUIT (IMC)
- 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.
- 2.6 PVC COATED RIGID METAL CONDUIT (PVC) (RMC)
- A. Comply with:
 1. UL 6
 2. ANSI C80.1
 3. NEC. 344
 4. NEMA RN1
 - B. Conduit material: Hot-dipped galvanized rigid steel with external PVC coating, 20 mil. thick.

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- C. Fittings:
 - 1. Threaded.
 - 2. Insulated bushings on terminations.
 - 3. Zinc plated or hot-dipped galvanized malleable iron or steel with external PVC coating, 20 mil. thick.
 - D. Conduit bodies:
 - 1. Comply with:
 - a) ANSI/NEMA FB 1
 - b) Threaded hubs
 - 2. Zinc plated or hot-dipped galvanized malleable iron with external PVC coating 20 mil thick.
- 2.7 FLEXIBLE METAL CONDUIT (FMC)
- A. Comply with:
 - 1. NEC 348
 - 2. ANSI/UL 1
 - B. Conduit material: Steel, interlocked.
 - C. Fittings:
 - 1. ANSI/NEMA FB 1
 - 2. ANSI/UL 514B
 - 3. Malleable iron, zinc plated.
 - 4. Threaded rigid and IMC conduit to flexible conduit coupling.
 - 5. Direct flexible conduit bearing set screw type not acceptable.
- 2.8 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)
- A. Comply with:
 - 1. NEC 350
 - 2. ANSI/UL 360
 - B. Conduit material:
 - 1. Flexible hot-dipped galvanized steel core, interlocked.
 - 2. Continuous copper ground built into core up to 1-1/4" size.
 - 3. Extruded polyvinyl gray jacket.
 - C. Fittings:
 - 1. Threaded for IMC/rigid conduit connections.
 - 2. Accepted for hazardous locations where so installed.
 - 3. Provide sealing washer in wet/damp locations.
 - 4. Compression type.
 - 5. ANSI/NEMA FB 1.
 - 6. ANSI/UL 5148.
 - 7. Zinc plated malleable iron or steel.
- 2.9 ELECTRICAL METALLIC TUBING (EMT)
- A. Comply with:
 - 1. UL 797
 - 2. ANSI C80.3
 - 3. NEC 358
 - 4. ANSI/UL797
 - B. Conduit material: Galvanized steel tubing.
 - C. Fittings:
 - 1. ANSI/NEMA FB 1
 - 2. Set screw

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

2.10 RIGID NONMETALLIC CONDUIT (PVC) (RNC)

- A. Comply with:
 1. NEMA TC-2
 2. UL 651
 3. NEC 352
- B. Conduit material:
 1. Shall be high impact PVC - tensile strength 55 PSI, flexural strength 11000 PSI.
- C. Fittings:
 1. Comply with: NEMA TC-3 and UL 514.
- D. General:
 1. Shall be UL listed and identified.
 2. Shall conform to all national, state and local codes.
 3. Manufacturer shall have five years experience in manufacturing PVC conduits.

2.11 EXPANSION FITTINGS

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

PART 3 - EXECUTION

3.1 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 Section 300-5 of the NEC except that the minimum cover for any conduit shall be two feet. 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 feet in length shall utilize rigid steel 90° 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 300.5.

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7. All underground service lateral raceways shall be protected as required by Section 300-5 of the NEC including requirements for installation of warning tape.
- B. In Slab Above or on Grade:
1. Use coated rigid steel conduit, coated intermediate metal conduit (if accepted) or rigid non-metallic conduit.
 2. Coating of metallic conduit to be black asphaltic or PVC.
- C. Penetration of Slab:
1. Exposed Location:
 - a) Where penetrating a floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 2. Concealed Location:
 - a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 48" above finished floor.
 - b) Where penetrating a floor in location other than that above use a black mastic coated or PVC coated galvanized rigid steel conduit.
- D. Outdoor Location:
1. Above Grade:
 - a) Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 - b) In general all exterior conduit runs shall be rigid conduit (with PVC coating if within 10 miles of ocean or gulf) and threaded connectors as specified elsewhere.
 - c) Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.
 - d) Exterior conduits not on roof and not subject to damage (i.e. 6 ft. 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 ft. 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 twelve (12) inches 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 inches using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
 4. Supports to be fastened to roof using roofing adhesive or means as accepted by roofing contractor.
- E. Interior Dry Locations:
1. Concealed: Use rigid metal conduit or aluminum conduit, intermediate metal conduit, electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" A.F.F. except where prohibited by the NEC (places of

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assembly, etc.).

2. Exposed: Use rigid metal conduit or aluminum conduit, intermediate metal conduit, electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.
3. Concealed or exposed flexible conduit:
 - a) Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not longer than six (6) feet 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 two (2) feet in length, unless written authorization by A/E for specific conditions is granted.
- F. Interior Wet and Damp Locations:
 1. Use rigid galvanized steel or intermediate metal conduit.
- G. Concrete Columns or Poured in-place Concrete Wall Locations:
 1. Use rigid non-metallic conduit. Penetration shall be by accepted metal raceway (i.e. metal conduit as required elsewhere in these specifications).
- H. Locations Near 400Hz Distribution Systems:
 1. Metal ferrous conduit or support equipment is not to be installed within 6" of any 400Hz distribution system conduit or wire. Increase distance if so required by 400Hz system manufacturer.

3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

- A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.
 1. Accepted pipe vise.
 2. Roller/bade type cutter or band saw.
 3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.
- B. Hangers shall be installed 8 ft. 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 ALUMINUM CONDUIT

- A. May be used only for 400Hz electrical distribution system.

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

- A. Shall be properly grounded.
- B. Shall be installed with accepted fittings.

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3.6 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.

3.7 SUPPORTS

- A. Arrange supports to prevent misalignment during wiring installation.
- B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24", increase distance as required) provide space on each for 25 percent additional conduits.
- D. Fasten conduit supports to building structure and surfaces under provisions of Section Supporting Devices.
- E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach conduit to ceiling support wires.
- G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.
- H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.8 EXPANSION FITTINGS

- A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- B. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than one hundred feet long and interval between expansion fittings in such runs shall not be greater than 100 feet.

3.9 GROUNDING

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- A. All raceways shall have a copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC codes.
- B. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings.
- C. Grounding conductors run with exterior/ underground feeders shall be bare only.
- D. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by accepted ground bushings.
- E. See other sections of these specifications for additional requirements.
- F. Grounding conductors (including lightning protection down conductors) run in metal conduit shall be bonded to metal conduit at both ends.

3.10 FIRE AND SMOKE STOPPING

- A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.
- B. Install conduit to preserve fire resistance rating of partitions and other elements.
- C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.
- D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in accord with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in accord with ASTM E119. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

3.11 VERTICAL RACEWAYS

- A. Cables in vertical raceways shall be supported as per NEC Article 300-19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless if shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with architect prior to installation. This includes empty raceways for future use.

3.12 GENERAL

- A. Install conduit in accordance with NECA "Standard of Installation." Contractor shall layout all work prior to rough-in.
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange conduit to maintain headroom and present neat appearance.
- D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.
- E. Route conduit in and under slab from point-to-point.
- F. Do not cross conduits in slab.
- G. Maintain adequate clearance between conduit and piping.
- H. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- I. Cut conduit square using saw or pipecutter; de-burr cut ends.

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- 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 inch (50 mm) 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 Article 300, whether shown on drawings or not.
- O. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the specifications. Pullcord must be fastened to prevent accidental removal. A phenolic or brass nameplate shall be attached to each end indicating the location of both ends of conduit as follows: THIS END = "LOCATION," OTHER END = "LOCATION."
- P. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Q. Ground and bond conduit under provisions of Section Grounding and Bonding.
- R. Identify conduit under provisions of Section Electrical Identification.
- S. Install all conduits concealed from view unless specifically shown otherwise on drawings
- T. Rigid steel box connections shall be made with double locknuts and bushings.
- U. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- V. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- W. All raceways shall be run from outlet to outlet as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.
- X. 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.).

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- CC. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified under other Sections of these specifications.
- 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

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SECTION 27 05 34 - OUTLET BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK

- A. 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 N.E.C.
- B. Section includes: Wall and ceiling outlet boxes (and/or small junction/pullboxes).

1.2 REFERENCES

- A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- C. ANSI/NFPA 70 - National Electrical Code.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

- A. Submit catalog cut sheet/product data on:
 - 1. Surface cast boxes.
- B. For pullboxes and junction boxes not covered in Section Pull and Junction Boxes, submit product data showing dimensions, covers, and construction.

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.

1.5 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of outlets in offices and work areas prior to rough-in.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All boxes and fittings shall be labeled by Underwriters Laboratories.
- B. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- C. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.
- D. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.
- E. Handy boxes shall not be used.
- F. Outlet boxes to be one-piece.
- G. 4" x 4" boxes and 4 11/16" x 4 11/16" boxes used as junction boxes shall be one piece.

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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 inch (13 mm) 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 suitable 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 inches (150 mm) 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 inch (150 mm) separation. Provide minimum 24 inches (600 mm) 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.

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- K. Support all outlet boxes from structure with minimum of one (1) 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two (2) 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 National Electrical Contractor's Association's (NECA) "Standard of Installation".
- R. Install outlets in the locations shown on the drawings; however, the Owner shall have the right to make, prior to rough-in, 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 electrical devices, once installed, 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 feet long. The pull box shall be located near the midpoint of the raceway length.
- X. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
- Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
- Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
- AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
- BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.
- CC. Outlet boxes mounted in metal stud walls, are to be supported to studs with two (2) 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 finished.

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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 plans and shop drawings for installing.

Switches	4'-0" AFF to top
Receptacles	1'-4" AFF to bottom
Phone outlets	1'-4" AFF to bottom

2. Bottoms of outlets above counter tops or base cabinets shall be minimum 2" above counter top 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 plans, prior to rough-in, regardless of height shown on Division 26 27 28 drawings.
3. Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans 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 sq. 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

ORANGE COUNTY CORRECTIONS COMPOUND
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SECTION 27 05 35 - PULL AND JUNCTION BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and install pull and junction boxes as shown on drawings or as required by the National Electric Code (NEC).
- B. Provide and install pull and junction boxes wherever required for a complete and operating distribution system whether shown on drawings or not.
- C. Where outlet boxes are used for pull and/or junction boxes, they shall meet the requirements of Section Outlet Boxes of these specifications.

1.2 - REFERENCES

- A. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- B. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- C. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

- A. Submit actual shop drawings on all pull boxes showing.
 - 1. Covers.
 - 2. Dimensions - inside and out.
 - 3. Rating of concrete or gauge of metal.
 - 4. Manufacturer.

1.4 PROJECT RECORD DOCUMENTS

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

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of pull and junction boxes prior to rough-in.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose and to maintain required access.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Dimensions of pull and junction boxes shall meet dimensions shown on drawings or dimensions required by NEC, whichever is largest.
- B. Pull and junction boxes shall meet all requirements of UL and NEC.

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- C. Small pull boxes (i.e. 4" x 4") shall meet the requirements of these specifications for outlet boxes as a minimum.
 - D. All boxes (above ground) of 100 cubic inches or more shall be constructed of 14 gauge steel with hot dip galvanized coating.
- 2.2 SHEET METAL BOXES:
- A. NEMA OS 1, galvanized steel.
 - B. Box to be fully weatherproof and watertight where installed outside.
- 2.3 SURFACE-MOUNTED CAST METAL BOX: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
- A. Material: Cast aluminum.
 - B. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
 - C. Provide all hubs as required for conduit connections.
- 2.4 IN-GROUND PULL BOXES:
- A. Material: Precast concrete, or composolite.
 - B. Bottom: Open with 6" of gravel for drainage.
 - C. Cover: Meet Florida Dept. of Transportation requirements for installed location. (Pedestrian, heavy traffic, light traffic).
 - D. Solid sides constructed to facilitate conduit entries.

PART 3- EXECUTION

3.1 GENERAL

- A. Install per N.E.C.
- B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- F. Install boxes to preserve fire resistance rating of partitions and other elements.
- G. Align adjacent wall-mounted boxes with each other.
- H. Use flush mounting boxes in finished areas.
- I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Pull and junction boxes larger than 25 square inches shall be supported with two (2) 3/8" all-thread rod hangers minimum.
- M. Pull and junction boxes used for Systems Sections larger than 25 square inches shall be hinged cover type.

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- N. Do not fasten boxes to ceiling support wires.
- O. Support boxes independently of conduit.
- P. Large Pull Boxes: Boxes larger than 100 cubic inches (1 600 cubic centimeters) in volume or 12 inches (300 mm) in any dimension.
 - 1. Interior Dry Locations: Per NEC, with screw covers.
 - 2. Other Locations: Use hinged enclosure under provisions of Section Cabinets and Enclosures.
- Q. Outdoor Locations: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

3.2 IN GROUND PULL BOXES

- A. Provide and install ground rod in each pull box. Connect #2 copper ground wires (counterpoise) to ground rod, run out pullbox 6" over conduits to next pull box; tie to respective building electrical ground rod at each building.
- B. Install pull boxes flush with finished grade. Provide extensions as required.
- C. In ground pullboxes to have interior watertight pull box mounted inside in-ground pull box as required by Local Authority Having Jurisdiction.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations and sizes of required access doors with applicable sections in these specifications.
- B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

3.4 ADJUSTING

- A. Install knockout closure in unused box opening.

END OF SECTION

ORANGE COUNTY CORRECTIONS COMPOUND
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SECTION 27 05 36 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF SYSTEM

- A. Provide and install all equipment, labor, material, accessories and mounting hardware for a complete and operating system for all cable trays called for on the construction documents and in these specifications, including the following cable tray systems for distribution and support of cables, installed in place:
 - 1. Metal center hung type
 - 2. Basket/cage type
 - 3. Ceiling/wall mounted ladder type cable tray/rack
 - 4. Wall mounted ladder-type cable tray system for distribution and support of cables installed in place.
 - 5. Factory assembled
- B. Cable tray shall include all supporting devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections and accessories required for complete installation.
- C. Cable tray systems are defined to include, but are not limited to straight sections of cable trays, bends, tees, turns, elbows, fittings, drop-outs, grounding, supports and accessories.
- D. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors and grounding straps.

1.3 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A36 – Specification for Carbon Structural Steel
- D. ASTM A1011 – Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy with Improved Formability
- E. ASTM A513 – Specification for Electric – Resistance- Welded Carbon And Alloy Steel Mechanical Tubing
- F. ASTM B633 – Specification for Electro-Deposited Coatings of Zinc on Iron and Steel
- G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- I. NEMA VE 1 - Metallic Cable Tray Systems.
- J. NEMA VE 2-2000 - Cable Tray Installation Guidelines
- K. ANSI/TIA/EIA 568A – Commercial Building Telecommunications Cabling Standard

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- L. ANSI/TIA/EIA 569 – Commercial Building Standard for Telecommunications Pathways and Spaces
- M. BICSI – Building Industry Consulting Service International

1.4 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general route of the wire basket systems. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.
- B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.5 SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section Submittals.
- B. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.
- C. Product Data: Provide data for fittings and accessories.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section 26 05 00 Common Work Results.
- B. Record actual routing of cable tray and locations of supports.

1.7 QUALIFICATIONS

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

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. NEMA Compliance: Comply with NEMA Standards Publication Number VE1, Cable Tray Systems.
- C. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC).
- D. UL Compliance: Provide products that are UL-classified and labeled.
- E. NFPA Compliance: Comply with NFPA 70B, Recommended Practice for Electrical Equipment Maintenance pertaining to installation of cable tray systems.

1.9 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner representative.
- B. Supply all equipment and accessories new and free from defects.
- C. All items of a given type shall be the products of the same manufacturer.

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- D. All trays shall be of uniform quality and appearance

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver cable tray systems and components carefully to avoid breakage, denting and scoring finishes. Do not install damaged equipment.
- B. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

PART 2- PRODUCTS

2.1 LADDER TYPE CABLE TRAY/RACK (UL CLASSIFIED CABLE RUNWAY) (WITHIN DATA/SYSTEMS ROOMS/CLOSETS)

- A. Ladder rack shall be manufactured from tubular steel. Stringers (sides) will be made from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness. Cross members (rungs) will be made from 1" wide by 1/2" high tubular steel with .065" wall thickness.
- B. Ladder rack (stringers) will be 9'-8-1/2" long. Cross members will be welded in between stringers on 9" centers beginning 4-1/4" from one end so that there are thirteen cross members per ladder rack. There will be 8" of open space in between each cross member.
- C. Ladder rack will be delivered individually boxed, and available in several widths. Provide width(s) as specified in the contract documents, however, width shall never be any less than 18 inches.
- D. Ladder rack will be UL Classified for suitability as an equipment-grounding conductor only. Minimum combined cross sectional area of the stringers will be 0.40 square inches. A label affixed to the side stringer of the ladder rack will identify the manufacturer, the UL Classification and the minimum combined cross sectional area of the stringers.
- E. Finish shall be gold chem. over zinc plating as specified below and in the contract documents.
- F. Side mounting 6" cable guides/cable fence shall be mounted every other cross member, from same manufacturer as cable tray/rack.
- G. Cable transition pans to be installed over racks vertical managers and cabinet entries, match LR width.
- H. Basis of design Chatsworth 12100-712 series or approved substitution.

I. SUPPORTS

- 1. The ladder tray shall be supported from one (1) aluminum splice connector, installed inside the inner portion of the main spine members.
- 2. Each Mono-Tray ladder tray section shall be supported on maximum 12 foot centers by one .50 inch piece of threaded rod which pass through the vertical hole in each of the splice connectors and fasten directly to each piece of spine by one .50 inch nut and washer on both the top and bottom sides of each piece spine. When shorter spans are required, then a 5/8 inch diameter hole should be drilled through the top and bottom walls of each piece of spine at support points only, and a single .50 inch threaded rod should be inserted, through each spine member, also using a .50 inch nut and washer on both the top and bottom sides of the spine.
- 3. Provide supports as recommended by manufacturer for installation required in this project.

J. BASIS OF DESIGN:

- 1. Mono-Systems, Inc
- 2. Cooper B-Line

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3. Approved substitution
4. Materials

2.2 MANUFACTURERS

- A. Mono-Systems, Inc. Model B1113-0323 (center hung), B6113-0322 (wall hung).
- B. Substitutions: Under provisions of Section Substitutions.

2.3 LADDER-TYPE CABLE TRAY

- A. Description: NEMA VE 1, Class 20C ladder type tray.
- B. Material: Aluminum.
- C. Inside Width: 12 inches (300 mm).
- D. Inside Depth: 3 inches (75 mm).
- E. Straight Section Rung Spacing: 6 inches (150 mm) on center.
- F. Inside Radius of Fittings: 12 inches (300 mm).
- G. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- H. Covers: Flanged cover.

2.4 WARNING SIGNS

- A. Engraved Nameplates: 1/2 inch (13 mm) high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE
ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install metallic cable tray in accordance with NEMA VE 1.
- C. Install fiberglass cable tray in accordance with NEMA FG 1.
- D. Support trays in accordance with Section Supporting Devices.
- E. Use expansion connectors where required.
- F. Ground and bond cable tray under provisions of Section Grounding and Bonding.
 1. Provide continuity between tray components.
 2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
 3. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.
 4. Connections to tray may be made using mechanical or exothermic connectors.
- G. Install warning signs under cable tray, located to be visible.

END OF SECTION

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SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

- 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.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. Americans with Disabilities Act - 1990

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Nameplates shall be laminated phenolic plastic, chamfer edges.
 - 1. For 120/208 Volt System:
 - a) Black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background.
 - 2. For 277/480 Volt System:
 - a) Orange with white letters.
 - 3. For Emergency System:
 - a) Red with white letters.
- B. Letter Size:
 - 1. 1/8 inch letters for identifying individual equipment and loads.
 - 2. 1/4 inch 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/ckt (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 P.B. station nameplates for that machine.

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- 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 C.B's.), 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 Sections, 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).

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

Fire Alarm	Popsicle Orange K02410
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. Conduits (not subject to public view) longer than 20 feet 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 are parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniformed. Paint boxes and raceways prior to installation or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.
- C. Junction boxes and conduit located in public areas (i.e. areas that can be seen by the public) shall be painted to match surface attached to. Provide written request to 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

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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 1/2 cover plate with appropriate color above, and 1/2 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° angles and 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: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel pop rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Nameplates installed inside on dead front cover shall be self adhesive tape. (Do not drill or install screws in dead front.)
- E. Identify new and existing conduit, junction boxes, and outlet boxes using field painting.
- F. Identify new underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.
- G. Install wire markers at all new connections and terminations and existing connections and terminations, modified or altered.

END OF SECTION

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SECTION 27 05 61 - CABINETS AND ENCLOSURES FOR COMMUNICATIONS 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. Hinged cover enclosures.
 - 2. Cabinets.
- B. Cabinets and enclosures are to include:
 - 1. Terminal blocks,
 - 2. Mounting panel,
 - 3. Ground bus/bar, and
 - 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 all sections of the Divisions 26, 27, 28 specifications.

1.2 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 for Industrial Control Equipment and Systems.
 - 3. ANSI/NFPA 70 - National Electrical Code.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.3 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 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.

1.4 EXTRA MATERIALS

- A. Provide two of each cabinet key.

PART 2 - PRODUCTS

2.1 GENERAL

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- A. Unless specifically called for otherwise on contract drawings, provide "CABINETS" as specified herein for terminal cabinets mounted indoor. 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" on 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 Section Systems, and Surge Suppression Equipment 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 (unless otherwise noted), steel.
 - 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: manufacturer's standard metallic gray enamel over phosphatized surfaces.
 - 2. NEMA 4X:
 - a) Within 10 miles of ocean or gulf: stainless steel or gray gel coat on fiberglass.
 - b) 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 specification for "Local Ground Bus/Bar" included

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within this section.

- 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: vented glass front door.
- 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 on 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 specification for "Local Ground Bus/Bar" included within this section.
- F. Manufacturer:
 - 1. StarTech.

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:

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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 N.E.C. and as required for proper clearance. Coordinate with panels.
- E. Provide and install terminal cabinets as shown on drawings or as required by the National Electrical Code (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 suppression equipment 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 enclosures.

END OF SECTION

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SECTION 27 10 00 - PREMISE DISTRIBUTION WIRING SYSTEM

PART 1 - GENERAL

1.1 GENERAL

- A. Furnish and install, complete with all accessories an EIA/TIA 568-B.2-1 Category 6 Premise Distribution System (PDS) with a minimum 25-year, LINK AND CHANNEL WARRANTY for the entire system. Enhanced PDS system shall serve as a vehicle for transport of data, and voice telephone signals throughout the building and from building to building from designated demarcation points to outlets located at various desk, workstation and other locations as indicated on the contract drawings and described herein.
- B. Support analog and digital voice applications, data, local area networks (LAN), video and low voltage devices for building controls and management on a common cabling platform. The applications that shall be supported include, but are not limited to:
 - 1. Data Processing - EIA-232-D, EIA-422A, EIA-43-A, RS-485, StarLAN, Fiber Distributed Data Interface (FDDI), Ethernet 10BASE-T (IEEE 802.3i), 10BASE-F (IEEE 802.3j), and TP-PMD. In addition, these links/channels shall be capable of supporting high-end applications such as 100 Base-T (IEEE 802.3u), 1000Base-T (IEEE 802.3z,ab), and 1000 base TX.
 - 2. Voice Applications - Avaya, Northern Telecom, NEC, SIEMENS.
 - 3. Video – Broadband and base band Analog Video, Digital Video, and Video Conferencing.
 - 4. Other Applications: ISDN, ATM, ADSL, VoIP.
- C. General: The system shall utilize a network of unshielded twisted pair cables (UTP) and fiber optic cables (FO) for horizontal cabling, Backbone cabling, Riser cabling, tie cabling, and patch cords. Cables and terminations shall be provided and located as shown and in the quantities indicated on the drawings. FO Cables shall terminate on rack-mounted Fiber Distribution Units (FDU's), UTP cables shall terminate on rack-mounted modular patch panels and work area outlets located as shown on the drawings. All cables and terminations shall be identified at all locations according to the EIA/TIA 606 standard. All cables shall be terminated in an alphanumeric sequence at all termination locations.
- D. Warranty: Cabling systems shall be required to be covered under a manufacturers warranty program for LINK and Channel configurations. Including cable, jacks, patch panels, patch cords and include cabling specifically approved for the LINK and Channel configuration as specified in the connectivity manufacturers warranty. The patch cords and workstation cords shall be manufactured by the same manufacturer as the jacks and patch panels. The patch cords shall be 100% factory tested for compliance to the Category 6 standard.
- E. All terminations shall comply with, and be tested to the EIA/TIA 568B.2-1 Category 6 requirements at a minimum, and providing at least a 25-year warranty.
 - 1. It should be anticipated by all installers that all horizontal cable supporting data applications must meet at a minimum the Category 6 performance requirements as listed by EIA/TIA standards for the link and channel. (Field testing for LINK only, 100% factory patch cord testing required)
- F. Data Services: Wiring utilized for data communications shall originate at Owner provided hubs and concentrators in vertical free standing equipment racks located at individual IDF'S.
- G. Work Included: Wiring, terminations and patch bays between these designated demarcation points and outlet locations designated on the plans shall be considered part of the contract. Outlets (jacks) shall be furnished, wired and installed by the contractor.
- H. The Contractor is advised that circuit routing for this system is not shown on the project drawings. The Contractor shall provide and install all conduit, wiring and cabling required for

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a complete and fully functional system as intended by these specifications. Individually homerun each device to respective MDF/IDF equipment rack. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.

1.2 SYSTEM DESCRIPTION

- A. The Premise Distribution Wiring System (PDS) is to include all equipment, materials and labor as required to provide, install and test a complete system as described herein.
- B. System to include but not be limited to:
 - 1. Telephone Service Entrance Pathway: Raceway from point of telephone utility connection at property line to building service terminal backboard.
 - 2. Backbone Pathway: Conform to EIA/TIA 569 using conduit, cable tray, backboards, etc. as indicated.
 - 3. Horizontal Pathway: Conform to EIA/TIA 569, using conduit, sleeves, backboards, and cabinets as indicated.
 - 4. Premises Wiring: Complete from Premise Distribution System Equipment to each outlet, and between each building using wire and cable as specified.
 - 5. Outlets: Complete as specified.
 - 6. Conduits, outlet boxes, cabinets, identification, etc.: Conform to applicable sections in these specifications. Provide/install complete with all required basic materials.
 - 7. Terminal backboards and/or cabinets.
 - 8. Equipment racks.
 - 9. Frames and termination hardware.
 - 10. Horizontal cables.
 - 11. Backbone copper and fiber optic cables (interbuilding and intrabuilding.)
 - 12. Terminal blocks
 - 13. Patch boards.
 - 14. Cross connect cables.
 - 15. Terminations.
 - 16. Surge suppression/Grounding
 - 17. Fireproofing.
- C. PDS equipment is to be installed in its own equipment rack.
- D. All backbone cable shall be installed in conduit.

1.3 RELATED SECTIONS

- A. All applicable sections of Division 0, Division 01, and Division 26.

1.4 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Standards - Conform to the requirements of the following:
 - 1. TIA/EIA-568-B.1 "Commercial Building Telecommunications Cabling Standard", CSA T529.

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2. TIA/EIA-568-B.2-1 "Transmission Performance Specifications for 4-pair 100Ohm Category 6 Cabling".
3. TIA/EIA-569 "Commercial Building Standard for Telecommunications Pathways and Spaces", CSA T530.
4. TIA/EIA-606 "Administration Standard for Telecommunications Infrastructure of Commercial Buildings", CSA T528.
5. TIA/EIA-607 "Commercial Building Grounding/Bonding Requirements".
6. TSB-67 "Transmission Performance Specification for Field Testing of Unshielded Twisted Pair Cabling Systems".
7. TIA/EIA TSB-72 "Centralized Optical Fiber Cabling Guidelines".
8. *TIA/EIA PN-3398 TSB-75 "Additional Horizontal Cabling Practices for Open Offices".
9. ANSI/NFPA 70 National Electrical Code, CSA C22.1.
10. BICSI Telecommunications Distribution Methods Manuals
11. BICSI Telecommunications Installation Manuals
12. County Codes and Regulations.
13. Underwriters Laboratories (UL)
14. FCC -Federal Communications Commission
15. ADA Requirements
16. Occupational Safety and Health Regulations (OSHA)
17. National Fire Protection Association (NFPA)
18. Florida Statutes and Administrative Rules
19. Cabling System Certified Cabling Catalog
20. American Society for Testing and Materials (ASTM)
21. EIA/TIA-492AAAA - Detail Specification for 50 Micrometer Core Diameter/125 Micrometer Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers.
22. EIA/TIA TSB-36 - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Cables.
23. EIA/TIA TSB-40-A - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Connecting Hardware.
24. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems
25. LPC - Lightning Protection Code (NFPA-780).
26. UL Certified - UL's LAN Cable Certification Program.
27. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
28. UL 1666 - Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts.
29. UL 1449, 3rd Edition – Standard for Safety for Surge Protective Devices.
30. UL 497, UL 497A, UL 497B
31. ANSI - American National Standards Institute

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32. NEMA - National Electrical Manufacturer's Association
33. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.5 QUALITY ASSURANCE

- A. Perform work governed by local telephone utility (service only) in accordance with telephone utility's rules and regulations.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- B. Supplier: Authorized distributor of specified manufacturer with minimum 5 years documented experience.
- C. Installer/Contractor:
 1. General: The contractor selected for the Project must show current certification as an installer of the manufacturers of the products approved for the project, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturers components and distribution channels in provisioning the Project.
 2. General: The Contractor directly responsible for this work shall be a "Premise Distribution Wiring Contractor" who is, and who has been, regularly engaged in the providing and installation of commercial and industrial telecommunications wiring systems of this type and size for at least the immediate past five years. Any sub-Contractor, who will assist the PDW contractor in performance of this work, shall have the same training and certification as the PDW contractor.
 3. Certification: The contractor's Project Manager shall possess a current BICSI Registered Communications Distribution Designer (RCDD) certificate. All shop drawings submitted by the contractor shall bear the RCDD's seal.
 4. Experience: The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical fiber and Category 6 copper premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.

1.7 SUBMITTALS

- A. Submit under provisions of Section Submittals.
- B. Shop Drawings: Submit typical outlet wiring diagram, plan of building(s) and site showing pathways with cable noted, detail drawings of each of the facilities terminal boards/cabinets, and equipment rack elevations to include all MDF and IDF locations.
- C. Product Data: Submittals shall include manufactures cut sheets for all proposed equipment including, but not limited to, the following:
 1. All wire and cable.
 2. All connectors and required tooling.
 3. All termination system components for each cable type.
 4. All IDF equipment frame types, hardware and LAN equipment if part of this project.
 5. All cable suspension j-hooks, cable fasteners, CAT6 cable suspension components.
 6. All grounding and surge suppression system components for the systems portion of the project.

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- 7. All outlets, devices and accessories.
- D. Qualifications: Submit qualifications of system installer.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Test Equipment: Submit a letter, signed by an officer of the company, that indicates what test equipment the company owns and shall use for accomplishment of the test procedures required in these specifications.
- G. Submit labeling scheme and sample of label.
- H. Contractor shall submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.
- I. For Surge Suppressors submit product data as follows:
 - 1. Dimensions.
 - 2. Means of mounting.
 - 3. Compliance with UL Standards referenced.
 - 4. Compliance with IEEE Standards referenced.
 - 5. Design type (Hybrid, MOV, etc.)
 - 6. Size of wire leads.
 - 7. Warranty.
 - 8. Performance data showing compliance with performance as specified herein.
 - 9. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
 - 10. Manufacturer's certified test data on each suppressor type.
 - 11. Test data from an independent test laboratory.
- J. Submittals that do not include all items as listed above, and as required elsewhere in these specifications shall, at the discretion of the Engineer, shall not be reviewed and shall be returned to the Contractor for resubmittal.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section Operation and Maintenance Manuals.
- B. Operation Data: Include instructions for adjusting, operating, and extending the system.
- C. Maintenance Data: Include repair procedures and spare parts documentation.
- D. Test Data. Record of results for all cables/cable runs tested, (including OTDR test results).
- E. Data sheets showing all field labeling used for termination blocks, cable (outside plant, backbone, riser and horizontal) runs, and telecommunications outlets.
- F. Cable Data:
 - 1. Part number.
 - 2. Reel or serial number, if available.
 - 3. Fiber type.
 - 4. Attenuation specifications.
 - 5. Bandwidth specifications.

1.9 PROJECT RECORD DOCUMENTS

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- A. Submit under provisions of the General and Supplemental Conditions of the Contract and Section Common Work Results.
- B. Record actual locations and sizes of pathways, outlets, terminal boards, etc.
- C. Record actual type and size of cables installed.
- D. Record "to and from" locations coordinated with cable labeling for all cables at each terminal board or cabinet.
- E. Cross-connects "to and from location" terminations for each Telecom and/or Communication Closet.
- F. Provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, detailed cable drawings, with all cables and terminations identified, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment (cables, connectors, outlets, equipment). A clear and consistent nomenclature scheme is to be defined and used on the documentation and the cable labeling which facilitates locating and identifying each cable.
- G. Cable Route Diagram: Provide locations and routes of "as-built" cable system and include:
 - 1. End points.
 - 2. Fiber routing.
 - 3. Splice points.
 - 4. Patch panels.
 - 5. Terminations (connector type).
 - 6. Cable lengths (include slack).
 - 7. Location of surge suppressors.

1.10 SPECIAL REQUIREMENTS FOR CABLE ROUTING AND INSTALLATION

- A. General: Cable routing and Installation practices shall be in accordance with BICSI's Telecommunications Distribution Methods Manual (TDMM) and Telecommunications Installation Manual.
- B. Plenum Spaces and cable routing: The majority of PDW wiring in this building will be installed above ceilings. All communications cabling used throughout this project shall comply with the requirements as outlined in the National Electrical Code (NEC) article 800. All cabling shall bare the CMR, MPR OR OFNR (RISER) and or appropriate markings for ducted "air return" applications, and for cable run in conduit. Cable shall bare CMP, MPP or OFNP (plenum) markings for all non-ducted return air applications or as required by local and/or State code requirements. It shall be the responsibility of the contractor to verify with local and State code enforcement officers where plenum and non-plenum cables are required. All cable shall bare the appropriate markings for the environment in which they are installed.
- C. Cable Pathway: In suspended ceiling and raised floor areas where duct, cable trays, or conduits are not available, the Contractor shall bundle, in bundles of 40 or less, horizontal wiring with cable ties snug, but not deforming the cable geometry. Cable ties in plenum areas shall be plenum rated. The cable bundling shall be supported via "CLIC" fasteners in Telecommunications closets and non-plenum areas and Category 6 compliant J-hooks or basket tray in ceiling spaces. Provide a minimum of two hangers at any corners or 90 degree turns. Attachment shall be to the building structure and framework at a maximum of five (5) foot intervals. Ceiling suspension wire or independent tie wire shall not be allowed in any space for cable support. Where cable is run above the ceiling in areas without walls, all thread rod shall be used (minimum 1/4", however sized to support the intended weight) with

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the appropriate CAT 6 hanger for cross-room support. Support rods shall be level and plumb after cable installation. The contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.

- D. Protection: Sealing of openings through rated fire and smoke walls, existing or created by this contractor for cable pass through shall be the responsibility of the contractor. Sealing material and application of this material shall be accomplished in such a manner, which is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of this contractor's work. Any openings created by or for this contractor and left unused shall also be sealed as part of this work. Penetration rating shall equal structure rating.
- E. Damage: The contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces including painting and ceiling tile replacement shall be included as part of this contract.
- F. Avoiding EMI: To avoid EMI, all pathways shall provide clearances of at least 4 feet (1.2 meters) from motors or transformers; 1 foot (12 inches) from conduit and cables used for electrical-power distribution; and 1 foot (12 inches) from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables and conduits.

1.11 DEFINITIONS

- A. Communications Equipment Room (CER). The "communications equipment room" (CER) is a dedicated room for termination of cable and to house the primary voice and data equipment. NOTE: The CER normally houses the MDF
- B. Communications Closet (CC). A "communications closet" (CC) is a dedicated room for termination of cable and to house secondary voice and data equipment. NOTE: The CC normally houses an IDF
- C. Communications Panel (CP). A wall mounted cabinet for termination of cable and to house secondary and data equipment. NOTE: The CP may serve as an IDF.
- D. Intermediate Distribution Frame (IDF). The "intermediate distribution frame" (IDF) is an equipment rack(s) and/or cabinet(s) housing secondary (intermediate) voice and data equipment.
- E. Main Distribution Frame (MDF). The "main distribution frame" (MDF) is an equipment rack(s) and/or cabinet(s) housing the primary voice and data equipment.
- F. Horizontal Pathways. Horizontal pathways are facilities for the installation of communication cable from the communications closet to the work area communications outlet. Horizontal pathways encompass underfloor, accessfloor, conduit, tray and wireway, ceiling, sleeves, perimeter facilities and applicable fireproofing.
- G. Backbone Pathways. Backbone pathways consist of intrabuilding and interbuilding pathways. The term backbone replaces rise, house and building-tie cable terminology. Backbone pathways may be either vertical or horizontal. Interbuilding backbone pathways extend between buildings. Intrabuilding backbone pathways are contained within a building.
 - 1. Intrabuilding pathways consist of conduit, sleeves or slots, and trays, within a building, and provide the means for placing backbone cables from:
 - a) CER to CC
 - b) CC or CP to CC or CP
 - 2. Interbuilding pathways interconnect separate buildings such as in campus environments. These consist of underground pathways.

1.12 EXTRA MATERIALS

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- A. Provide 20% spare modular jack inserts.
- B. Provide 20% spare termination blocks of each kind.
- C. Provide 20% spare dust covers of each type.
- D. Provide 20% spare patch cables and pigtail assemblies of each kind.

1.13 MAINTENANCE SERVICE AND WARRANTY

- A. Furnish service and maintenance of premises wiring for one year from Date of Substantial Completion.
- B. Surge Suppression:
 - 1. All surge suppression devices shall be warranted to be free from defects in material and workmanship for a period of five (5) years.
 - 2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be replaced by the manufacturer and installer at no cost to the Owner.
 - 3. Equipment that is damaged by surges during the warranty period shall be replaced at no expense to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.
- B. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for PDS configurations specified in this section.

2.2 PATHWAYS

- A. General:
 - 1. All pathways (conduit, raceways, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 26 of these specifications.
 - 2. All pathways (conduit, raceways, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of EIA/TIA-569.
- B. Conduit. (Comply with Section Conduit except as noted below).
 - 1. Metal flexible conduit shall not be used for PDS system.
 - 2. Bushings: Provide insulated bushings on ends of all raceway. All backbone conduits shall have bonding bushings and be bonded to the Systems Ground Bus Bar with an insulated #6 AWG wire.
 - 3. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
 - 4. Size:
 - a) See Part 3 for size requirements.
 - b) Minimum size shall be 1".
- C. J-Hooks
 - 1. Provide size as required for cables with a maximum fill of 50% cross-area.
 - 2. Provide mounting/fastener type as required for installation.
 - 3. Manufacturers: Caddy Series Cable Cat J-Hooks, or acceptable substitution.
- D. Boxes:

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1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
 2. Boxes shall be sized as required by EIA/TIA and NEC for cables, conduit and/or device installed.
 3. Junction/pull boxes shall not be mounted more than ten (10) feet above the floor and must be mounted in such a way as to make them readily accessible.
 4. Junction/pull boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably fire rated, marked, hinged panel.
- E. Cable Trays
1. Refer to Section Cable Trays
- 2.3 TERMINATION BACKBOARDS
- A. Material: 3/4" A/C Class A fire retardant plywood
 - B. Size: 8 ft. high with width as shown on drawings unless otherwise noted or required in these specifications.
 - C. Finish: Paint terminal board with gray paint having a flame spread rating of Class A as a minimum.
- 2.4 TERMINATION CABINETS
- A. Terminal cabinets are to comply with applicable sections of these specifications.
- 2.5 "SYSTEMS" AND "LOCAL" GROUND BUS
- A. Bus to comply with applicable sections of these specifications.
- 2.6 TERMINATION BLOCKS
- A. General:
 1. The Systimax 110 or equivalent type cable termination components shall meet EIA/TIA 568 and EIA/TIA TSB-40 Category 6 specification on all pins for connecting hardware.
 2. Provide 110 support brackets and termination strip mounting hardware to mount onto terminal backboard. Include necessary grounding termination lugs and legs.
 3. Include designation strips and termination tools.
 4. Unit shall be fire retardant.
 - B. 110 Standalone Wiring Block:
 1. 100 or 300 pair as required.
 2. Fire retardant molded plastic.
 3. For terminating 20-AWG through 26 AWG cable.
 4. Provide with legs.
 5. Manufacturer:
 - a) Systimax #110 DW2 Series, or approved equivalent.
 - C. 110 Cross Connect System Terminal Block (With Surge Protection) (188 Type):
 1. Unit to be a completely prewired 188 type multipair protector unit to protect incoming voice circuits from voltage surges and "sneak currents."
 2. Input to be via 110 wiring block.
 3. Output to be via 110 wiring block.

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4. Unit to include protector units with gas tube surge arrestors and heat coils.
 5. Size unit as required for number of connected voice pairs (25, 50 or 100 pair).
 6. Manufacturer:
 - a) Systimax #489 ACAI Series with #4CIS series protectors or approved equivalent.
- D. 110 Cross Connect System Terminal Block (Without Surge Protection):
1. Input to be via 110 wiring block.
 2. Output to be via one (1), two (2), or four (4) prewired 25 foot, 25 pair, 26 AWG cable. Number of pairs to match number of connected voice pairs (25, 50 or 100). Connect to voice backbone patch panel.
 3. Size unit as required for number of connected voice pairs (25, 50 or 100 pair),
 4. Manufacturer:
 - a) Systimax #110-AW2 or approved equivalent.

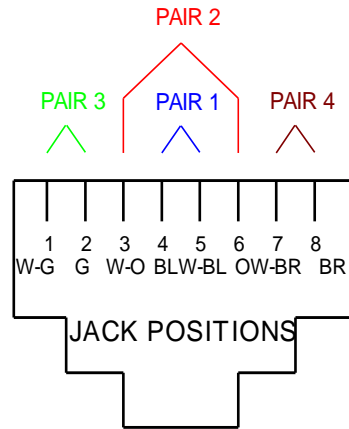
2.7 OUTLETS

- A. General: Communications outlets that contain copper services shall be equipped with ANSI/TIA/EIA-568-B.2-1 Category 6, 8-position modular jacks (RJ45 type) matching existing wiring. All outlet cabling shall terminate on appropriate termination blocks at their associated IDF. Outlet jack module arrangement and quantities are shown on the drawings. Outlets shall be certified to operate at 1000 Mbps data speed with twisted pair terminal wiring as verified by ETL or UL. Faceplates shall be able to accommodate up to 6, 8-position modular jacks each.
- B. Wall outlets: shall consist of single gang wall plates. Provide blank module inserts for all unused module locations
- C. Floor outlets: shall consist of single gang wall plates inside the floor box. Provide blank module inserts for all unused module locations.
- D. Modular furniture outlets: Shall consist of modular furniture faceplate capable of housing up to (6) 8-position modular connectors. Provide blank module inserts for all unused module locations.
- E. House wall phone, if indicated, shall consist of SE630 type wall plates with Cat 6 minimum cable to each, terminating in 8-position modular jack.
- F. 8-position modular jacks: CAT 6 jacks shall meet or exceed the following electrical and mechanical specifications:
 1. Jacks shall be standard 8-position, RJ-45 style, un-keyed, FCC compliant.
 2. Jacks shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.
 3. Each jack shall be single unit construction, with snap – fit to industry standard keystone opening (.760" x .580").
 4. Jack housings shall be high impact UL 94 V-0 rated thermoplastic.
 5. Jacks shall have a temperature rating of -10 °C (14°F) to 70°C (158 °F).
 6. Jacks shall utilize a 2-layer printed circuit board to control NEXT.
 7. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
 8. Housing shall be ultrasonically welded for tamper resistance.
 9. Modular jack contacts shall accept a minimum of 2000 mating cycles without degradation of electrical or mechanical performance.

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10. Jack contacts shall maintain a minimum deflection force of 100 grams while mated with an FCC-standard RJ-45 plug.
11. Jack contacts shall be formed flat for increased surface contact with mated plugs.
12. Jack contacts shall be arranged on the PC board in 2 staggered arrays, one array having 6 contacts and the other array having 2 contacts.
13. Jack contacts shall be constructed of Beryllium copper for maximum spring force and durability.
14. Contact plating shall be a minimum of 50 micro-inches of hard gold in the contact area over 50 micro-inch of nickel.
15. Jack termination method shall follow the industry standard 110 IDC punch-down.
16. IDC contact termination towers shall have tapered pair-splitting features to aid wire insertion and minimize pair un-twist.
17. IDC contacts shall be arranged in staggered arrays of 4 sets of 2 contacts.
18. Jacks shall have the Category 6 designation, visible from the front when installed.
19. Bottom of jack shall have date code and an abbreviated catalog number.
20. Jacks shall utilize a paired punch-down sequence to maximize electrical performance.
21. IDC contacts shall be Phosphor Bronze with 100 micro-inch tin lead 60/40 plating over nickel.
22. Jacks shall terminate 26-22 AWG solid or stranded conductors.
23. Jacks shall terminate insulated conductors with outside diameters up to .050".
24. Jacks shall not require special cords, specialty tools or special installation requirements.
25. Jacks shall be compatible with single conductor standard 110 impact termination tools.
26. Jacks shall be compatible with a 4-pair single punch impact tool designed specifically for the purpose.
27. Jacks shall include a translucent stuffer cap for wire retention and to permit visual inspection.
28. Stuffer cap shall have retention snaps to assure conductor strain relief.
29. Jacks shall accept FCC compliant 6 position plugs.
30. Jacks shall accept optional hinged dust covers.
31. Jacks shall be compatible with ANSI/TIA/EIA-606-A color code labeling.
32. Jacks shall accept snap-on icons for specific identification.
33. Jacks shall be available in various colors to meet specific customer applications.
34. Jacks shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
35. Category 6 jacks shall be backward compatible with existing Category 3, 5, and 5e cabling systems for fit, form, and function.
36. JACKS SHALL BE MANUFACTURED IN THE USA.

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Optional Eight-Position Jack Pin/F
Assignments
(designation T568A)

- G. Channel Performance: All Enhanced CAT 6 jacks shall be utilized in a channel configuration meeting or exceeding the following specifications at 250 Mhz:
1. Performance Requirements
 - a) All transmission performance parameters shall be independently verified by a UL or ETL third party testing organization.
 - b) Category 6 jacks shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-B.2-1, Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling.
 - c) The manufacturer shall provide Category 5e component compliance certificates from third party testing organization upon request.
 - d) Jacks shall be UL LISTED 1863 and CSA certified.
 - e) Jacks shall exceed IEEE 802.3af DTE Power specification to 4 times the rated current limits with no degradation of performance or materials.
 - f) Jacks shall be third party verified, error free Gigabit Ethernet performance to IEEE 802.3ab.
 - g) Jacks shall exceed 4 Gb/s data transmission capacity within the bandwidth of 1 – 250 MHz when configured in a 4-connector channel.
 - h) Category 6 jacks shall meet or exceed the 4-connector channel performance requirements of Category 5e, per the ANSI/TIA/EIA-568-B.2-1 standard.
 - i) The 4-connector channel test configuration shall utilize Category 6 patch panels and Category 6 patch cords, from the same manufacturer, with qualified Category 6 cable.
 - j) The 4-connector channel performance margins in the table below shall be guaranteed, provided the configuration satisfies requirement No. 9 above.

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Electrical Parameter (1 - 250MHz)	GUARANTEED MARGINS TO CATEGORY 6 / CLASS E CHANNEL SPECIFICATIONS
Insertion Loss	3 %
NEXT	4 dB
PSNEXT	5 dB
ELFEXT	4 dB
PSELFEXT	5 dB
Return Loss	2 dB

- H. Design Selection: Hubbell Premise Wiring Xcelerator, as follows. See drawing details for exact outlet configurations.
 - 1. Wall faceplate (office white): #IFP16OW
 - 2. Voice jack (office white): #HXJ6OW or #HXJ6OW25 (bulk packaged)
 - 3. DATA jack (Blue): #HXJ6B or #HXJ6B25 (bulk packaged)
 - 4. Blanks (office white): #SFB10
 - 5. Provide blank module inserts for all unused module locations.
- I. Approved Equals: Panduit, Wiremold, Siemon, meeting the listed requirements, if submitted with a 25-year or greater total PDW warranty and if meeting the physical characteristics described. Warranty shall include all components including cabling.
- J. Outlet Labeling: Each jack on all outlets shall be identified with permanent machine generated labels, meeting the EIA/TIA 606 requirements, matching the numbering plan indicated on the drawings with the addition of a letter suffix indicating the jack position on the faceplate. All labeling must be permanent. All labeling shall be a minimum 12 pt. in size. All labeling systems shall be submitted to the engineer for acceptance prior to fabrication.

2.8 CATEGORY 6 DATA AND VOICE HORIZONTAL CABLE

- A. General: Data pairs shall be extended between the outlet location and its associated IDF. The cable shall consist of 4 pair 24 gauge, solid copper conductors, Certified to the Category 6 standards. ETL or UL Verified for EIA/TIA electrical performance Comply with FCC Part 68. Cables shall be terminated on each of the 8-position modular jacks provided at each outlet. Voice jacks shall also utilize this cable type. Only virgin materials shall be used.
- B. Cable selection shall be based upon meeting an end-to-end channel performance and shall be shown to have been tested with the proposed component manufacturers products and warranted as a complete permanent link and channel solution.
- C. Cable Insulation and Jacket: Cable jacket shall comply with Article 800 NEC for the environment in which the cable will be installed. All cables shall bear the U.L. And NEC, CMR or MPR markings. (All cable shall be RISER rated unless otherwise specified or required by code.) All PLENUM cables shall bear the UL and National Electrical Code, CMP or MPP markings. Cables utilizing 2x2, 3x1, or other combinations of construction shall not be acceptable
- D. Horizontal Cables drops from IDF to specified outlets locations are to be without splices.
- E. Properties: Electrical Characteristics for horizontal cable tested on 100 m length shall be as follows:

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	<u>TIA/EIA CAT 6</u>
Frequency	250 MHz
Characteristic Impedance	100Ω+15%
NEXT (DB)	38.3 dB
Minimum	
PS NEXT	26.3 dB
Minimum	
ELFEXT	19.8 dB
Minimum	
PSELFEXT	16.8 dB
Minimum	
ACR	5.5 dB
Minimum	
PSACR	3.5 dB

F. Horizontal Cable Specified:

1. Basis of Design:
 - a) Superior Essex, DataGain (Cat.6)
2. Approved Equals:
 - a) If submitted with a 25 year or greater total PDW warranty and if meeting the physical characteristics described and certified as part of the channel solution. The cable selected must be an approved cable for use in a warranted system from the connectivity manufacturer.
 - b) Uniprise – Media 6
 - c) Birktek – Landmark 1000
 - d) General Cable – Genspeed 6000

2.9 CABLE SUPPORT SYSTEM

- A. All Horizontal cables shall be in one (1) inch conduit. Extending from outlet location to Systems Room /MDF
- B. Cable Tray (Systems Room /MDF): Description: Provide a system of manufactured, factory assembled, cable raceway (where indicated) to provide a convenient method of routing, organizing, and separating cables of different systems, and running in close proximity of one another where specified herein. Unless otherwise noted, the system shall be a continuous system bonded together to make a continuous grounding path. Where system is discontinuous, provide a #10 bonding conductor between the pieces of the system, and bond as previously indicated. Cable tray shall include all supporting devices and equipment, as listed on drawings and as specified herein with all necessary fittings, and hardware (i.e. splice plates, bolts, nuts, washers, clips, covers, etc.) required for a complete tray installation system.
 1. Materials: Insert anchors shall be installed on concrete or brick construction, with hex head machine screws. Recessed head screws shall be used in wood construction. An electric or hand drill shall be used for drilling holes for all inserts in concrete or similar construction. Installed inserts, brick, shall be near center of brick, not near edge or in joint. Drilled and tapped, and round head machine screws shall be used where steel members occur. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Gunpowder set anchors are not permitted.
 2. Description: Design shall be such that all like parts are interchangeable and may be readily assembled and joined without use of special tools. The trays shall be free of sharp edges or burrs that might damage cable while being pulled into the trays.

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3. Tray Type: Ladder Rack 18" Tray of cable pathway,
 - a) Hardware: Bolts, nuts and washer shall be galvanized steel compatible with aluminum so as not to cause a galvanic reaction.
4. Radius Bend: All tray fittings used to provide vertical and horizontal bends shall have a minimum radius of 24 inches, unless noted otherwise on the drawings.
5. Each straight section, and each tray fitting, shall be provided with two "heavy duty" splice connectors and appurtenant hardware. The splice, when bolted together to form a tray joint, shall be designed to have the same strength (or better) than the tray, when such joint is placed in mid-span, between two tray supports.
6. Adjustable: Adjustable splice connectors shall be installed where needed to accommodate non-standard vertical and horizontal bends.
7. Resistance: Splice connector's resistance between sections shall not exceed 0.00033 ohms.
8. Strength: Cable tray shall be capable of carrying 50 lb./linear foot without exceeding 1.5 inch mid-span deflection when supported every 4 feet, NEMA Class 8A.
9. Support: The tray system shall be mounted to wall studs above ceiling or suspended from the structural ceiling.
10. LADDER tray for Telecommunications Rooms.
 - a) Basis of Design:
 1. CPI (Chatsworth Product Inc) 18" wide universal ladder rack
 - b) Approved Substitutions
 1. Hubbell
 2. B-Line

2.10 FIBER OPTIC CABLING

- A. General: Multi-mode fiber optic cabling shall be provided between IDF'S and MDF if designated on the contract drawings. Multimode selection depends on future Gigabit requirements and distance constraints. The manufacturer for that environment shall certify Cables placed below grade. The following tables are for planning the type of fibers to be selected for a specific run maintain a viable path for future Gigabit transmission speeds. These characteristics shall be used as a standard for type selection criteria.

TABLE 1: (850 nm) Operating Distance

Fiber Type	Modal Bandwidth @ 850 nm	Distance
62.5 μm	160 MHz-km	220 m
62.5 μm	200 MHz-km	275 m
50 μm	400 MHz-km	500 m
50 μm	500 MHz-km	550 m

TABLE 2 (1300 nm) Operating Distance

Fiber Type	Modal Bandwidth @ 1300 nm	Distance
62.5 μm	500 MHz-km	550 m
50 μm	500 MHz-km	500 m
50 μm SM	n/a	5000 m

- B. Multimode Cable Construction (50 Micron):
1. Number of fibers: 24, or as shown on the drawings.

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2. Core/Cladding: 50 micron/125 micron.
 3. Buffering: 900 micron
 4. Attenuation: ≤ 3.5 decibels/kilometer at 850 nanometers, ≤ 1.5 dB decibels/kilometer at 1300 nanometers.
 5. Minimum bandwidth: 500 megahertz/kilometer at 850 nanometers, 500 megahertz/kilometer at 1300 nanometers.
 6. Sheath construction: Non-metallic
 7. Design Selection:
 - a) Site Below Grade, indoor-outdoor riser rated: Superior Essex #230125GO1.
 8. Approved Equals:
 - a) Corning, Commscope, Belden, Berk-tek, or OCC.
- C. Composite cables are approved with compliance of above specifications where applicable.
- D. If loose tube 250 micron outside plant cable is installed it is required that all terminations utilize a Fan-out Kit: All kits shall be installed per manufacturers guidelines to provide fiber protection at each termination point. Kits shall be equal to Corning SFK-P.
- E. Labels: Labeling for fiber cabling shall be by IDF number, plus the color suffix designating which fiber is terminated. Die cut acetate labels or Kroy labels shall be considered acceptable the purpose. Labels shall also be provided at any exposed cable location 20' on center and at all IDF'S locations. Identification shall include to and from information.

2.11 EQUIPMENT RACKS – 4 post rack

- A. General: Each IDF shall be equipped with 19" EIA (s), caster provided 4-post racks, to house owner-provided equipment and contractor provided termination bays for the multiple cable types. Caster racks shall be provided with (4) casters from the rack manufacturer as part of the rack assembly. Caster racks will provide the movement of the racks from their normal position to allow for servicing of the equipment and cabling inside the rack. Equipment Selections:
1. (Caster Rack) – Basis of design
 - a) Startech RK2236BKF (black)
 2. Approved Substitutions:
 - a) Panduit (black)
 - b) Hubbell (black)
 - c) Ortronics (black)
- B. Rack Accessories: Each equipment rack will be provided with the following accessories:
Horizontal cable organizer:
1. Basis of Design:
 - a) Hubbell Premise Wiring, front/rear 19" rack mount, 2U high cable manager. 3.5" tall, w/ 3.5" deep rings on the front (with cover), and 4.6" deep rings on the rear (no cover).
 1. Design selection:
 - (a) Hubbell Premise Wiring #HC219CR3N (front), and (rear).
 2. Approved Substitutions
 - a) Panduit

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- b) Hubbell
 - c) Ortronics
- C. Power plug strip: Leviton 5500-192 or approved equal.
- D. Cable Routing: Station cables will be routed into the rear station Cable manager, neatly organized and terminated onto the patch panel following TIA/EIA-568-B, 569 termination guidelines. It is required that a horizontal cable manager be installed above and below any patch panel installed onto a rack. Patch panels and front/rear cable managers will then be installed in alternating order on the rack. It is further required that on 48 port patch panels, the cable terminated to the top 24 ports shall be neatly routed through the cable manager mounted above the patch panel. The lower set of 24 ports shall be routed through the wire manager mounted below the patch panel. This routing method is required to allow easier moves, adds and changes at a later date.
- E. Vertical Cable Management: Free standing relay racks shall have vertical cable management installed on each side of the rack both front and back . If more than one rack is installed, then each rack will be separated by a vertical, duct style cable manager. Black, 4" channels with covers.
- 1. Basis of Design:
 - a) CPI MCS series 7' single sided used both front and back of 4 post rack
 - 2. Approved Substitutions:
 - a) Panduit
 - b) Hubbell
 - c) Ortronics
- F. Plywood backboards: shall be installed in each IDF rooms on walls to a height of 8' AFF. Rooms shall have walls covered as shown on the drawings. Plywood shall be minimum 3/4" AC with the best side out. All imperfections shall be sealed and sanded prior to painting with 2 coats fire retardant paint. (Color to be Gray) Coordinate color selection with the owner/Architect.

2.12 CATEGORY 6 PATCH PANELS

- A. General: Equipment racks: shall be equipped with 19" rack mounted, 8-position modular jacks (RJ-45 type), non-keyed, factory configured, patch panels for termination of all copper horizontal cables.
- B. Work Area outlet patch panels: Shall be tested to meet the Category 5e standard for component and channel performance and shall be modular-to-110, wiring to match existing pin outs for the cables serving the Outlets
- C. Category 6 patch panels component values:
- 1. NEXT (dB) at 250 MHz - 46.0 dB or exceed
 - 2. Insertion Loss (dB) at 250 MHz - .32 dB or less
 - 3. FEXT (dB) at 250 MHz - 35.1 dB or exceed
- D. Patch panels shall be provided in 48 port configurations as shown on the drawings.
- 1. Basis of Design:
 - a) Hubbell Premise Wiring, Category 6, (48 port), (2μ)
 - 2. Approved Substitutions:
 - a) Panduit, Category 6, (48 port), (2μ)

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- b) Ortronics, Category 6, (48 port), (2μ)
 - c) Uniprise Category 6 (48 port) (2μ)
- E. Voice site patch panels: shall be used for distribution of the voice pairs to the work area patch panels via patch cords. Terminate the site copper tie cables, 25 pair or 50 Pair as shown on the drawings, via the protector units to voice patch panels. These patch panels shall be configured with one voice pair per port (Purple pair) via the 110-connector side of the panel. The panels shall be configured as 8-position modular jack-to-110 termination panels in quantities as indicated on the drawings. These panels shall be patched to another set of work area voice patch panels, which shall be connected to the voice jack of the work area outlets in the field. The panels shall be in 24 and 48 port configurations as shown on the drawings. Punch down all Cat 6 pairs to the work area 110 ports.
- 1. Basis of Design
 - a) Hubbell Premise Wiring # (48 port), (2μ)
 - 2. Approved Substitution:
 - a) Panduit
 - b) Ortronics
 - c) Uniprise
- F. Identification: Designation strips for each port shall be provided on the patch panel. All cables shall be terminated in numerical sequence and each position labeled as to outlet number and jack position as is noted for the outlets.
- G. Category 6 Modular Patch Cords and Work-area Cords: The contractor must supply the same brand of patch cables as the Jack/patch panel manufacturer in order to maintain the requirement for a channel warranty.
- 1. Provide one Category 6 Modular Work-area Cord for each wall outlet in the project to be used at the WORK AREA locations. Work-area cords shall be provided in length as follows with 8-position modular connectors on both ends: 20% 6', 30% 8' and 50% 10'. Color selection desired is blue for DATA.
 - 2. Provide one Category 6 Modular Patch Cords for each outlet containing DATA jacks, for the rack patching. Patch cords shall be provided in length as follows with RJ-45 modular connectors on both ends: 50% 4', and 50% 6'. Color desired is blue for DATA.
 - 3. Provide one Category 6 Modular Patch Cords for each outlet containing VOICE jacks, for the rack patching. Patch cords shall be provided in length as follows with RJ-45 modular connectors on both ends: 50% 4', and 50% 6'. Color desired is yellow for Voice.
 - 4. All cords shall be round, and consist of stranded conductors insulated with high-density polyethylene and jacketed with flame retardant PVC. Cords shall be a component part of the proposed CAT 6 channel solution and have been tested as such.
 - a) Basis of Design:
 - 1. Data: Hubbell, blue
 - 2. Voice: Hubbell, yellow
 - b) Approved Substitutions:
 - 1. Panduit,
 - 2. Ortronics
 - 3. Uniprise

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2.13 FIBER OPTIC TERMINATION

- A. Rack Mounted Panels: Fiber optic cabling shall be terminated in fiber distribution Units (FDU) where indicated on the contract drawings and described herein. Provide blanking modules in all unused connection ports. FDU's shall be provided in quantities and configurations as shown on the drawings complete with loaded with SC Style coupler plates for a minimum of 144 fiber terminations, unless otherwise indicated. All FDU's shall be provided with rack mounting hardware allowing the unit to be placed in a standard EIA 19" rack.
1. "FDU" Basis Of Design: (ST):
 - a) Hubbell Premise Wiring
 2. Design selection (ST, MM fiber-optic distribution unit):
 - a) Hubbell Premise Wiring , Unloaded with adapter panels. (Holds up to 6 adapter panels)
 3. Approved Substitutions:
 - a) Panduit (back)
 - b) Ortronics (black)
 4. Coupling Panels for "FDU", (multi-mode, 50/125)
 - a) Hubbell Premise Wiring
 1. (12 fiber, 6 duplex SC)
- B. Blank Adapter panels for unused adapter openings. Provide blank adapter in all unused openings in the FDU. All panels shall include strain relief points where fiber optic cable strength members shall be securely attached.
1. Hubbell Premise Wiring
 - a) # FSPB
 2. Approved Substitutions:
 - a) Panduit
 - b) Ortronics
 - c) Uniprise
- C. Fiber-Optic Patch cables: Provide (2) ST multimode fiber optic patch cords with ST to ST connectors at each TR. Provide (12) twelve ST to ST fiber optic patch cords at the MDF location. All patch cords shall be 50/125 and 3 meters in length, (unless otherwise noted) and of the same manufacturer as the Fiber Distribution Units, (FDU).
1. Basis of Design (ST, fiber optic patch cords),
 - a) 50/125
Hubbell Premise Wiring # DFPCRJRJD3MM
 2. Approved Substitutions:
 - a)

2.14 FIBER OPTIC CONNECTOR

- A. Multimode 50/125 μm ST type connector field installable. Connectors shall meet or exceed the following transmission and mechanical specifications:
1. 900um terminations only
 2. Mated pair insertion loss per shall be field-installed ST connector pair shall not exceed 0.75 dB per ANSI/TIA/EIA-455-34 method.

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3. Operating temperature 0-60C
 4. Special tooling is required for the termination of ST connectors.
 5. Factory pre-polished fiber stub connectors with alignment pins.
 6. Basis of Design:
 - a) 50/125 applications: Hubbell Premise Wiring ST connector
 7. Approved Substitutions:
 - a) Corning
 - b) 3M
- B. ST connectors shall be installed as factory terminated "pigtails" and fusion spliced on to the installed cabling as specified on the drawings

2.15 UNSPECIFIED EQUIPMENT AND MATERIAL

- A. Any item of equipment or material not specifically addressed on the contract drawings or in this document and required to provide a complete and functional installation shall be provided in a level of quality consistent with other specified items.

2.16 GROUNDING SYSTEM AND CONDUCTORS

- A. Communications bonding and grounding shall be in accordance with the NEC and NFPA as well as EIA/TIA grounding and bonding standards. Backbone and entrance cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices.
- B. A #6 AWG stranded copper wire cable shall be extended between new ground bars located at each IDF and the building main electrical service ground point or secondary transformer ground point. The building steel, the equipment rack, and all surge suppressors, protectors and metallic cabinets shall be bonded to the ground bar via a #6 AWG stranded copper cable and U.L. accepted connecting hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
1. Install equipment in accordance with manufacturer's instructions.
 2. Install equipment, cables, raceways and outlets as required to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.
 3. Install all electrical basic materials per applicable sections of these specifications.
 4. Install all rack mountable equipment in equipment rack.
 5. Install system racks in locations shown; arrange to provide adequate ventilation and access.
 6. Coordinate location of equipment with drawings and all equipment provided by Telephone System, Television System, Fire Alarm System.
 7. Properly ground system per applicable sections of these specifications.
 8. Support raceways, backboards, and cabinets as required by manufacturer's instructions.
 9. Install raceways to conform to applicable sections of these specifications.
 10. Install PDS system wiring and/or conduits away from any surface that may become hot, including and not limited to, hot water piping and heating ducts.

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11. Install PDS system conduit with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power and Class 1 circuits, separation may be reduced to six inches. Increase separation if so required to comply with EIA/TIA referenced standards or manufacturer's recommendations.
 12. Each PDS outlet shall have cables homerun in 1" conduits to the respective voice or data patch panels in the associated Main/Intermediate Distribution Frame (MDF/IDF) at the communication equipment room (CER), communication closet (CC), or communication panel (CP) as indicated on the drawings. Exception is given to existing PDS outlets that are connected to the existing terminal boards, in existing IDF locations. Those existing outlets shall be cross connected onto a NEW terminal boards, and be continued into the new rack locations..
 13. Components of the premise distribution system shall be installed in a neat, workmanlike manner consistent with the best telephone and data practices.
 14. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the building.
 15. Identification markings and systems shall be uniform.
 16. T568A wiring codes as shown on the drawings shall standardize all twisted pair wiring.
- B. Patch Panels:
1. All horizontal cables shall be terminated in order, lowest room number first, station A first, and ports 1-4 in order.
- C. Outlets:
1. General: Install outlets for PDS where indicated on the drawings. Install devices/inserts in outlets so that same orientation is used throughout project.
 2. Outlets: Install per applicable section of these specifications
- D. Pathway
1. General
 - a) All conduit shall meet the applicable requirements of all Sections 16100 through 16199.
 - b) All conduit at terminal boards shall terminate at point within 6 inches of termination board with appropriate bushing, (ground if metal).
 - c) Conduit shall not be shared by power or any other electrical wiring that is not part of the low voltage PDS systems. PDS system wiring may be installed in underground pull boxes with other low-voltage systems provided:
 1. Installation meets/complies with all applicable codes and standards.
 2. PDS system cables are separated by at least 12 inches from any non-shielded wire/cable.
 - d) Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.
 - e) Install conduit so no more than two 90o bends are in any raceway section without a pullbox. Install additional pullboxes as required to maintain maximum of two 90o bends between pullboxes and/or termination points.
 - f) Install conduit so no more than one hundred (100) feet of raceway are in any

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raceway section without a pullbox. Install additional pullboxes as required to maintain maximum of one hundred (100) feet between pullboxes and/or termination points.

- g) Label all conduit at both ends to indicate destination and PDS source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.
 - h) Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.
 - i) Properly support cables/wire not installed in conduit.
 - j) Conduit at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.
2. Fire Stop
- a) Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.
 - b) Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.
 - c) Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.
3. Fire and Smoke Partition Penetrations
- a) Openings in sleeves and conduits used for the PDW system cables and those that remain (empty) spare shall be sealed with a U.L. approved fireproof, removable safing material.
 - 1. Additional penetrations through rated assemblies necessary for passage of PDW wiring shall be made using an approved method and permanently sealed after installation of cables.
4. Horizontal Cable Pathway
- a) Cable Support
 - 1. Install 1" conduit for all PDS stations. Routing from MDF/IDF to station location.
 - b) Communication Outlet (CO) Pathway:
 - 1. Each CO outlet shall have conduit homerun to MDF/IDF.
 - 2. Minimum size to be 1" conduit.
5. Backbone Pathways (Intrabuilding or Interbuilding)
- a) Install raceways as required above under "General."
 - b) Minimum size: 4" C.
 - 1. Increase size of conduit/raceway/pathway called for above if larger size is called for on drawings or larger size is required per paragraph "2)" below.
 - 2. Conduit/raceway/pathway size shall not be smaller than that required by EIA/TIA-569, Table 5.2-1, "Conduit Fill for Backbone Cable." Conduit size shall be based on type of cable and quantity of cables.
6. Pullboxes, Splice (Junction) Boxes, Outlet Boxes
- a) Install per applicable sections of these specifications and all applicable codes/standards.

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- b) Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.
- c) A pull or splice box shall be placed in a conduit run where:
 - 1. The length is over 100 feet
 - 2. There are more than two 90 degree bends
 - 3. If there is a reverse bend in the run
- d) Boxes shall be placed in a straight section of conduit and not used in lieu of a bend unless specifically noted otherwise or accepted by the Engineer. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.
- e) Outlet boxes shall be installed at locations shown on drawings per applicable codes/standards.
- f) Every pullbox and/or splicebox shall have a hinged cover. Install appropriate access panel to allow cover to open.
- g) No pullbox shall be installed such that from finished floor to the top of the box exceeds ten (10) feet unless accepted by the Engineer.
- h) Size
 - 1. Where a pullbox is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pullbox.
 - 2. Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
 - (a) For straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway;
 - (b) For angle and U pulls:
 - (1) Have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and
 - (2) Have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
 - (3) Six (6) times the trade size diameter of the raceway
 - (c) six times the trade size diameter of the larger raceway if they are of different sizes.
 - 3. For a raceway entering the wall of a pullbox opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
 - 4. Where a splicebox is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."
- 7. No box shall be smaller than that required by NEC 314.28(A) (1) and (2).
- 8. Cable Trays:

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- a) Install in all CO's and CER's as shown on drawings.
- b) Support no more than four (4) feet on center. Reduce support spacing if so recommended/required by manufacturer.
- c) Install at approximately 8 ft. A.F.F.
- d) Support/brace to wall.

E. Termination Backboards

1. Plywood backboards shall be installed in each IDF and MDF room on walls to a height of 8' AFF. Rooms shall have walls covered as shown on the drawings. Plywood shall be minimum ¾" AC with the best side out. All imperfections shall be sealed and sanded prior to painting with 2 coats fire retardant paint. (Color to be Black, Grey or white) Coordinate color selection with the owner/Architect.
2. Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.
3. Install termination backboards plumb, and attach securely to building wall at each corner.
4. Finish paint termination backboards with durable gray paint having flame spread rating of Class A prior to installation of any equipment on termination boards.
5. Mark all backboards with the legend "PDS" under the provisions of Section Identification for Electrical Systems.

F. Grounding

1. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.
2. Connect Central Equipment rack to "systems" ground bus with #6 green insulated copper ground wire.
3. Connect metal conduit (via grounding bushing) to "systems" ground bus.
4. Connect cable shields to "systems" ground busbar.
5. Connect surge suppression equipment to "systems" ground busbar.
6. Ground each terminal board by extending 1 AWG #2 green insulated copper conductor in ¾" non-metallic conduit from a junction box at terminal board to the nearest accessible acceptable building grounding electrode system as defined in NEC Article 800.100(B). Where "SYSTEMS" grounding bus/bar (see Section Grounding and Bonding) is provided in same room as terminal board, the bus/bar may be used for grounding point if acceptable to telephone system installer and all applicable codes.

G. Surge Suppression

1. General
 - a) Provide and install surge suppression devices for 120 volt source to all equipment. Install on line side of UPS (or power strip) at equipment rack.
 - b) Extreme care shall be taken by the contractor to assure a properly surge protected system.
 - c) Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
 - d) Installation of surge protection equipment and it's grounding must be per manufacturer's recommendations to assure short and proper ground paths.
2. Equipment Selection

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- a) Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.
3. Equipment Installation
 - a) Install surge suppression equipment per manufacturer's recommendation.
 - b) Install surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
 - c) Locate surge suppression equipment in terminal cabinet nearest equipment cabinet being served (MDF, IDF, Telephone Company Service Entrance, etc.).
 - d) Contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.
4. Ground Installation
 - a) Ground Bus Connections.
 1. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
 2. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
 3. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per 16170 with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
 4. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
 - b) Surge suppression equipment grounding.
 1. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.
 2. Contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section for same system (i.e. Premise Distribution, Telephone Company Service Entrance, etc.).
 - c) Conductors.
 1. Conductors shall meet requirements of Section Building Wire and Cable. Minimum size to be #12 THWN.
 2. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.
 3. Do not bundle unprotected conductors with protected conductors.
 4. Conductors shall be kept as short as possible.
 5. Conductors shall be secured at 12" intervals with an accepted copper clamp.
 6. Grounding conductors shall be properly connected to the building service ground by accepted clamps.
 - d) Grounding Connectors

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1. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or U.L. for the purpose.
2. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.
3. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.

e) Telephone Circuits

1. Systems utilizing telephone company pairs as a transmission medium shall be provided with a suppressor conforming to respective device in Part 2 of this specification.
2. Suppressors shall be installed at each point where interface is made to telephone company pairs.
3. In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:
 - (a) Where the modem or coupling device is furnished by the telephone company the suppressors shall be installed on the system side of the modem or coupling device.
 - (b) Where the modem or coupling device is furnished by the system contractor, the suppressor shall be installed on the telephone line side of the modem or coupling device.

H. Cables/Wires

1. Install cables/wires in accordance with manufacturer's instructions and EIA/TIA 568.
2. All cables shall be installed as illustrated on the drawings except where necessary to avoid EMI sources or other obstacles. Major deviations from the illustrated path must be accepted in advance by the Engineer.
3. PDS system cables will be in 1" conduit.
4. Splice cable only at terminal block units.
5. Provide adequate cable size and length for each backbone/riser run.
6. Tie cables of adequate sizes and quantities in 25, 50, and 100 pair increments shall be used to splice smaller cable into large sizes.
7. Provide adequate size and quantities of cross-connect/patch cables to perform necessary cross-connections.
8. Provide riser/backbone cable which meets performance requirements specified, and links all Closet locations indicated on Electrical Drawings.
9. Spare Cable: The following spare cable lengths are to be left at termination ends of conduits:
 - a) Communications Equipment Room (CER): Fiber and copper cables terminating in the CER shall have enough spare cable length left in the CER to be routed to the equipment rack or backboard, then down to the floor plus three (3) feet.
 - b) Communications Closets (CC): Fiber cables and copper backbone cables terminating in the CC shall have the same amount of spare cable length left in the CC as specified for the CER above. The four 4-pair UTP cables shall be terminated with enough spare cable length to be routed to the equipment rack or backboard, and down to the floor plus three (3) feet.

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- c) Communications Outlets: At the CO's, the four 4-pair UTP cables shall terminate with approximately one (1) foot of spare cable length. This spare cable shall be pulled out at CO's that are wall or floor mounted during cable installation. Following installation, spare cable length shall be pushed back into the wall or floor for future use in terminating cables.
 - d) All cable runs shall contain service slack prior to the termination point. Provide 12-inch service slack in the ceiling above each outlet. Service slack at IDF shall consist of a 10 foot slack section all station cables located and placed neatly in the cable ladder above the equipment rack.
- 10. Install Premise Distribution Cables no closer than 12" from any wire/cable installed for power system cable/raceway, or fluorescent/ballasted light fixtures.
 - 11. Provide protection for exposed cables where subject to damage.
 - 12. Use suitable cable fittings and connectors.
 - 13. All cables in CC's and CER's shall be routed in overhead cable trays in IDF/MDF, provided by the PDS Contractor and dropped into the appropriate racks. All cables shall be neatly routed and properly secured to the cable tray, racks, or cabinets.
 - 14. Cables shall be terminated to preserve wiring order consistently across all terminations (jacks, patch panels, connector blocks and patch cords). It is the Contractor's responsibility to ensure this consistency. Corrections will be made at the Contractor's expense.
 - 15. Cables shall be terminated in order, lowest room number first, station A first, and ports 1-4 in order.
 - 16. Install appropriate cable to match application, i.e., plenum, riser, etc. All cables shall bear CMP and/or appropriate marking for the application in which they are installed.
 - 17. Cables routed through rated walls, floors and assemblies shall be routed via appropriate fireproofing system as accepted by UL.
 - 18. Label cable at both ends indicating the originating and terminating location of each end. This labeling/identification shall be fully documented in as-built (record) drawings.
 - 19. Cat 6 Cable Installation
 - a) Installation of Category 6 UTP cable shall be in accordance with EIA/TIA guidelines for Category 6. The contractor shall replace Cable installation and terminations that do not comply.
 - 1. The maximum pulling tension shall not exceed 25 pounds to avoid stretching the conductors.
 - 2. The minimum bending radius of the cable shall not be less than 4x the diameter of the Category 6 cabling.
 - 3. The cable shall be installed without kinks or twists and the application of cable ties shall not deform the cable bundle.
 - 4. Strip back only as much cable jacket as is required to terminate the cable and the amount of untwisting in a pair as a result of the termination shall not exceed 0.5 in.
 - 20. Service Slack
 - a) All cable runs shall contain service slack prior to the termination point. Provide 12-inch service slack in the ceiling above each outlet. Service slack at IDF shall consist of a 10 foot slack section all station cables located and placed neatly in the cable ladder above the equipment rack.

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21. Support and Routing of Cables

- a) Horizontal cables used in this system are to be installed within conduit. Cables shall be routed through these spaces at right angles to electrical power circuits and supported only from the structure. Tie cables shall be extended between MDF to IDF'S utilizing conduit runs as shown on the drawing
- b) The PDW system contractor shall install supporting hardware for this system as part of the PDW contract. All supporting hardware shall be submitted to the engineer for acceptance prior to installation. Hardware shall also be utilized by other systems work. Comply with basic layout indicated on drawing details for cable placement.

22. Horizontal Cables

- a) Horizontal cables shall be color Blue.
- b) Provide and install adequate number cables and cable lengths for each horizontal run. A 4-pair Category 6 cable is required for each modular jack in an outlet to voice or data patch panel in respective CP, CC (IDF), or CER (MDF).
- c) Horizontal cables shall be installed in a neat and orderly manner. All cables entering a room shall enter through a single point. Where possible, all cables shall be routed along a single path and bundled together.
- d) Install cables via acceptable conduit as specified herein.
- e) Install cable type rated for environment.
- f) Install cables in cable tray in CC's and CER's.
- g) Terminate all horizontal station cable pairs according to EIA/TIA 568A wiring schedule.
- h) Terminate all four pair cables to RJ-45 modular jacks at each outlet.
- i) Terminate all cables at IDF/MDF in voice or data patch panel as required for system configuration. No cables shall be left unterminated.
- j) Contractor shall ensure individual pair twists of horizontal station cable shall be maintained at both the CO and Patch Panel. Category 6 cable pair untwisting shall not exceed 1/2".
- k) Fiber Optic Cable
 - 1. Install a minimum of one (1) 24- strand multimode 50mn fiber optic cable from the Immediate Needs IDF to new IDF locations.
 - 2. Terminate all fibers in respective fiber optic patch panel.
 - 3. Provide 30 feet of slack (service loop) on both ends of each fiber optic cable. Slack cable to be stored in MDF/IDF fiber optic patch panel splice tray. If fiber optic patch panel splice tray cannot accommodate 30 feet of slack Contractor shall provide a separate storage tray mounted in equipment rack adjacent to the fiber optic patch panel.
 - 4. Observe all manufacturer's specifications relative to cable bend radius and pulling tension. There shall be no intermediate splices between fiber terminating equipment.
 - 5. All fiber strands shall be field terminated to SC-style connectors. Any termination with a greater than 0.5 dB loss shall be replaced by Contractor at no expense to Owner.
 - 6. Loose tube, gel-filled fiber optic cables shall be spliced to pig tail assemblies

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- in splice tray. Use mechanical, re-enterable splices.
7. Install adequate fiber terminating equipment to properly terminate all fiber optic cable strands. No single chassis shall support more than 144 fiber optic cable strands. No spare connector panels are required.
 8. All fiber terminating equipment installed in the CER and CC's shall be 19 - inch rack or cabinet mounted. All fiber terminating equipment installed in the systems equipment rooms shall be rack mountable and capable of holding 144 individual strands.
 9. Each six strand shall be terminated on a separate 6-port SC connection panel.
- I. All conduits and/or innerducts containing fiber optic cables shall have a pull string to accommodate the future installation of additional fiber optic cables.
- J. Labels
1. All PDS components must be easily identifiable for any person that may need to locate telecommunications equipment, facilities, or circuit information. Cable and equipment management shall be performed using PDS administration database programs that track all telecommunications circuit components.
 2. The labeling scheme is to enable tracing data/circuit information flow between devices without physically tracing each cable, and will be used to identify the following communications paths:
 - a) Each active device and its rack location.
 - b) Each patch panel, row and the associated active device.
 - c) Each active device cable and the device it is attached to at the other end.
 - d) Each Closet cable and the Closet/Equipment Room located at the other end.
 3. All labels must be printed (not hand written) and applied on all specified PDS components. The label shall be of a type which can be easily applied to PDS components. Label sheet with adhesive backing, a durable surface side is recommended for cables. Other components can follow this format, but the contractor must provide for acceptance, details on how labeling will be accomplished.
- K. All Fiber Optic strands shall be labeled at all termination points, and all fiber distribution units (FDU) shall be labeled, using the following scheme:
1. Bldg#(2) CC#(3)-Bldg#(2)CER#(3)-Port ID (3) where:
 - a) Bldg#(2) = two digit building number as per labeled in drawing
 - b) CER#(3) = three digit room number as per labeled in drawing
 - c) CC#(3) = three digit room number for CC or CER as per drawing
 - d) Port ID #(3) = Single letter designation plus two digit Port designation
 - e) Sample: 01110-05110-A01
- L. Copper Cables
1. Each jack on the Communications Outlet shall be labeled at the faceplate using the following scheme:
 - a) Station ID(2) - Bldg#(2)CC#(3) – Port ID (3) where:
 1. Station ID (2) = single capital letter and single digit representing which jack in room

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2. Bldg#(2) = two digit building number as per labeled in drawing
 3. CC#(3) = three digit room number of CC or CER as per drawing
 4. Port ID (3) = single capital letter representing the patch panel order and then two digits representing the patch panel port number. Patch Panels are labeled alphabetically from top to bottom, left to right.
 5. Sample: A1-01100-A24
2. All wires shall be labeled at all termination points, and the patch panels shall be labeled, using the following scheme:
- a) Station ID(2) - Bldg#(2) Rm (3) where:
 1. Station ID(2) = single capital letter and single digit representing which jack in room. Communications outlets are labeled alphabetically clockwise from main entrance to the room.
 2. Bldg#(2) = two digit building number as per labeled in drawing.
 3. Rm(3) = three digit number as per labeled in drawing.
 4. Sample: A1-01004
- M. Related PDS Component Color Codes
1. The following "color coding" shall be used to identify types of cable terminations on punch down blocks, equipment racks, or patch panels. The color coding is not required for the actual outlet, but attachments to devices used to identify different elements of the telecommunications wiring. This applies to device attachments such as termination block hinged covers, device labels, or tab inserts that attach/snap onto devices for circuit patch to service association.
 2. Reference table below for the following rules (colors used shall be the Pantone number given or its equivalent):
 - a) Termination labels identifying the two ends of the same cable shall be of the same color;
 - b) Cross-connections are generally made between termination fields (groups of termination labels) of two different colors;
 - c) The color orange (Pantone 150C) shall be reserved for the identification of the demarcation point (central office termination);
 - d) The color green (Pantone 353C) shall be used to identify the termination of network connections on the customer side of the demarcation point;
 - e) The color purple (Pantone 264C) shall be used to identify the termination of cables originating from common equipment (e.g., PBXs, computers, LANs, and multiplexers);
 - f) The color white shall be used to identify the first-level backbone telecommunications media termination in the building containing the main cross-connect;
 - g) The color gray (Pantone 422C) shall be used to identify the second-level backbone telecommunications media termination in the building containing the main cross-connect;
 - h) The color blue (Pantone 291C) shall be used to identify the termination of station telecommunications media and is required only on the TC and ER end of the cable, not at the telecommunications outlet;
 - i) The color brown (Pantone 465C) shall be used to identify interbuilding backbone

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- cable terminations;
- j) The color yellow (Pantone 101C) shall be used to identify the termination of auxiliary circuits, alarms, maintenance, security, and other miscellaneous circuits;
 - k) The color red (Pantone 184C) shall be used to identify the termination of key telephone systems;
 - l) In buildings not containing the main cross-connect, white may be used to identify second-level backbone terminations.

TABLE
EXAMPLES OF COLOR CODING

TERMINATION TYPE	COLOR	PANTONE	COMMENTS
Demarcation Point	Orange	150C	Central office terminations
Network Connections	Green	353C	Network connections or auxiliary circuit termination
Common Equipment PBX, Host, LANs, Muxes	Purple	264C	Used for all major switching and data equipment terminations.
First Level Backbone	White		MC-IC cable terminations.
Second Level Backbone	Gray	422C	IC-TC cable terminations.
Station	Orange	291C	Horizontal cable terminations.
Interbuilding Backbone	Brown	465C	Campus cable terminations.
Miscellaneous	Yellow	101C	Auxiliary, maintenance alarms, security, etc.
Key Telephone Systems	Red	184C	

3. Differentiation of Termination Fields by Performance Category

- a) If the cables are of different performance classes, their termination should indicate this difference, either by enhanced color coding, or suitable marking. For example, high performance cable used in the horizontal may be terminated on a field color coded with blue and white stripes to differentiate these higher-grade cable terminations from lower-grade cable terminations. Alternatively, the labels may be marked with the category of the terminating cable (per EIA/TIA TSB-36).
- N. The Contractor will supply as part of the proposal all man-hours during move-in for cross connecting of telephone and data service required per Owner's schedule.
 - O. Fire Alarm and/or Security System Auto Dialer Lines:
 - 1. Provide and install Category 6, two pair cables from fire alarm control panel(s) and security/alarm/intrusion control panel(s) direct to telephone company system outside line terminations.
 - 2. Install via PDS system, raceways, etc., as required.
 - 3. Provide and install surge suppression on each end.

3.2 FIELD QUALITY CONTROL

- A. General

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1. Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.
 2. Test all cables/outlets.
 3. The Contractor shall submit to the Engineer a testing schedule fifteen (15) days prior to commencement of testing. Testing schedule shall be accepted by the Owner. If unacceptable to the Owner, resubmit testing schedule that will allow Owner to have personnel at the site during testing.
 4. Contractor shall make a minimum of two (2) personnel available for the Owner's testing of active components after their installation. Active physical layer components shall be fully tested by dynamic node emulation, simulating IEEE 802.3 data communications environment. Communications simulators and analyzers will test all component ports for packet passing integrity throughout the logical network.
- B. Fiber Optic Cable Testing:
1. Each strand of fiber optic cables shall be tested for correctness of termination, overall transmission loss, and defects using an accepted Optical Time Domain Reflectometer (OTDR) and a power meter. The Engineer shall be present during all tests. Notify the engineer one week prior to testing to assure attendance.
 2. Testing Equipment: Tester shall be as manufactured by Agilent Technologies, Fluke, Microtest, Noyes or Wavetek.
 3. Multimode fiber testing shall be I.A.W. TIA/EIA-526-14 method B. System loss measurements (both calculated and measured) shall be provided at 850 and 1300 nanometers in both directions for multimode cables (1310 and 1550 nanometers for singlemode) for each strand. Per IEEE 802.3z, maximum fiber strand attenuation shall not exceed 2.38 dB @ 850 nm with a modal bandwidth of 160 Mhz-km and 2.35 dB @ 1310 nm with a modal bandwidth of 500 Mhz-km. Test as follows:
 - a) Measure and record normalized fiber loss at operating wavelength in dB/km.
 - b) Detect and record point faults or discontinuities.
 - c) Measure and record overall length of cable.
 4. Certification report shall be provided listing both the calculated and measure loss for each fiber optic circuit and submitted with the test results as called for above. Provide test results in IBM text format on 3-1/2" diskettes as well as (2) hardbound copies in 3-ring binders. Documentation of testing shall include:
 - a) Wavelength, fiber type, fiber manufacturer and cable model number, cable manufacturers' attenuation specifications, cable manufacturers' bandwidth specifications, measurement direction, test equipment and serial numbers (with date of last calibration), date of each test, reference setup, name of technician(s) performing testing.
 - b) OTDR trace(s) shall be submitted with request for substantial completion.
- C. Copper UTP Cable Testing:
1. General: Premises Distribution Cabling Contractor shall test wiring setting tester for a channel configuration which includes the patch cord, patch panel, UTP Cable, work-area jack and work-area cord.
 2. Testing Equipment: Tester shall be as manufactured by Agilent technologies, Fluke, Microtest or Wavetek. Tester shall be 100% Level IIE compliant with TSB-95/ADDENDUM 5 to ANSI/EIA/TIA 568A-5 specifications for testing of CAT 65e cabling. No tester will be accepted with out meeting these requirements.
 3. Each jack in each outlet shall be tested at a minimum to the Category 5e compliance in

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a channel configuration to verify the integrity of all conductors and the correctness of the termination sequence. Testing shall be performed between work-area cord at the outlets and the patch cord at the equipment rack. Prior to Testing UTP runs, the tester shall be calibrated per manufacturer guidelines. These tests shall comply with ANSI/TIA/EIA-568-B.1 standards, as well as the TIA standards for Cat 5e performance, with the classifications defined by the ISO. The correct cable NVP shall be entered into tester to assure proper length and attenuation readings. During Channel testing the patch cords and the work-area cords shall be the same as those provided by the contractor per this specification. Each Channel test shall include one patch cord and one work-area cord, with no cord used twice.

4. Documentation of cable testing shall be required. The contractor shall provide the results of all Category 5e cable tests in electronic format as well as two (2) hardbound copies in 3-ring binders. Provide IBM format text files on disk. Provide a separate text file for each building in the project. Each test page shall be separated by standard page break (one test per page). The test results shall include:
 - a) 100 MHz sweep tests, continuity, polarity checks, wire map, Attenuation, NEXT, PSNEXT, FEXT, PSFEXT, ELFEXT, PSELFEXT, ACR, PSACR, Return Loss, Delay Skew, and the installed length for Category 6 cables.
 - b) Cables not complying with ANSI/TIA/EIA-568-B.1 standards, as well as the TIA standards for Cat 5e performance, with the classifications defined by the ISO and/or EIA/TIA 568A Category 5e tests for 250 Mb rating shall be identified to the engineer for corrective action which may include replacement at no additional expense to the Owner. Testing of existing PDS outlets, existing cable and outlets shall be identified to the engineer, and the contractor shall be responsible for providing a contiguous and acceptable signal path from the new rack location to each existing outlet location. If necessary, the contractor shall provide this connectivity in the means of new category 6 cabling from the existing outlet to the new rack location, bypassing the cross-connection point, if the contractor is unable to obtain an acceptable signal path after the cross connect has been completed and cabling has been terminated into the new rack location.

D. Acceptance:

1. Contractor shall provide the Engineer with written notification of testing schedule ten (10) days prior to commencement.
2. System verification and acceptance documentation signed and dated by the installer (Contractor) shall be provided. This documentation shall include test measurements and system calibrations performed for the entire system. Sample system operations shall also be performed with actual hardware or using Contractor provided test equipment and documented to verify that the system is operational and ready for acceptance. This shall also establish the baseline performance of the system.

E. System Commissioning:

1. Upon completion of the aforementioned tests and before system commissioning, actual telephone, data and video testing shall be performed. The tests may be performed with existing equipment, if in place, or using contractor provided equipment or test equipment.

3.3 DEMONSTRATION

- A. Demonstrate system to designated Owner personnel as required by applicable sections of these specifications.
- B. Conduct walking tour of project. Briefly describe function, operation, and maintenance of each component.
- C. Provide detailed operation and maintenance instruction and training.

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- D. Use submitted operation and maintenance manual as reference during demonstration and training.

3.4 TRAINING

- A. The contractor shall provide one 2-hour training session to familiarize the owner with the locations of all IDF's, cable and jack labeling and numbering systems, data and voice connections.

3.5 DOCUMENTATION

A. Close Out Documents

1. As well as documents indicated elsewhere, the project close out documents shall include those listed below.
2. Any and all testing results will be provided to the Owner and the engineer, with proof of acceptance for all terminations within the scope of the contractor. Non-compliant terminations will also be provided, as part of the close out documentation.
3. Detailed as-built drawings shall be adapted from the original prints provided. Each CER and CC shall contain a copy of that building's as-built drawing affixed to an adjacent wall or located in an interior pouch for quick reference. Revised rack and equipment cabinet elevations shall be provided including serial numbers of all installed equipment.
4. Building drawings shall be left in each closet and three (3) copies supplied for use by the Owner's MIS Department.

B. As-Built and CAD Drawings

1. As-built drawings are required.
2. Computer Assisted Design (CAD) drawings on disk are required.
3. As-built CAD drawings shall show all cable runs, communications closets, and cable runs with distances marked between buildings in DFX format.
4. The cable route drawings shall contain end points, fiber routing, conduit routing, patch panels terminations (connector type) and cable length (including slack).
5. The as-built drawing for each building shall show communications closets, placement of A/C power, point of entry, communication outlets and types of jacks. The communication outlets may be summarized by indicating the type used in all locations throughout the installation as a representation of the installation.
6. A completed closet schematic and each diagram must be submitted to MIS/Telecommunications prior to completion of wiring.

3.6 AS-BUILT DOCUMENTATION

- A. As-built documentation shall be provided as part of the contract. As-built drawings shall be a complete set of AutoCAD Release 14/2000 floor plans with all outlets shown and numbered as installed. The original project floor plan disks shall be obtained from the Owner. All cable routings (trunk lines) and elevations of each IDF or MDF indicating outlet, tie, and riser cable terminations shall be required. All addendum information or project revisions resulting in drawing changes that occur during the construction period shall be documented and included in the as-built material. All required as-built documentation is mandatory and shall be required prior to project closeout. A set of prints with all changes shall be submitted to the Engineer for review. Upon completion of the Engineer's review, the Contractor shall provide updated disks and a reproducible set of drawings, which include final As-built conditions and the Engineer's review comments, if any.
- B. Contractor shall provide Excel software spreadsheet that defines the telecommunications outlet number, location, and number of voice, data and special jacks. This database shall

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also provide the outlet patch panel connection to the riser/inter-floor cable, equipment, and telephone company demarcation circuit pairs as part of the as-built documentation.

3.7 TESTING OF WIRING ACCURACY

- A. General: Premises Distribution Cabling Contractor shall test wiring setting tester for a channel configuration which includes the patch cord, patch panel, UTP Cable, work-area jack and work-area cord.
- B. Testing Equipment: Tester shall be as manufactured by Agilent Technologies, Fluke, Microtest or Wavetek. Tester shall be 100% Level III compliant with TIA/EIA 568B.2-1 specifications for testing of CAT 5e cabling. No tester will be approved without meeting these requirements.
- C. Testing guidelines: Each jack in each outlet shall be tested at a minimum to Category 5e compliance, with ANSI/TIA/EIA-568-B.1 standards, as well as the TIA standards for Cat 5e performance, with the classifications defined by the ISO. The test shall be done in a LINK configuration to verify the integrity of all conductors and the correctness of the termination sequence. The Contractor and Manufacturer shall provide a minimum 25 year application assurance Warranty for the LINK and CHANNEL. The manufacturer shall provide 100% factory testing of the patch cords. It is not an acceptable practice for patch cords to be unpackaged for use in certification testing. The cords shall remain boxed, and stored for installation by the owner or as otherwise indicated by the scope of work.
- D. Testing shall be performed between the outlets and the patch panel at the equipment rack, prior to testing UTP runs the tester shall be calibrated per manufacturers guidelines. The correct cable NVP shall be entered into the tester to assure proper length and attenuation readings.
- E. The contractor must verify that this testing method is acceptable to the manufacturer that will be providing the LINK AND CHANNEL warranty for this project.
 - 1. 250 MHz sweep tests, Wire map, Attenuation, NEXT, PSNEXT, ELFEXT, PSELFEXT, ACR, PSACR, Return Loss, Delay, Delay Skew, and the installed length for Category 6 cables.
 - 2. Cables not complying with ANSI/TIA/EIA-568-B.1 and B.2-1 Category 6 tests shall be identified to the engineer for corrective action which may include replacement at no additional expense to the Owner.
 - 3. Documentation of cable testing shall be required. The contractor shall provide the results of all Category 5e cable tests in electronic format as well as two (2) hardbound copies in 3-ring binders. Provide IBM format text files on 3 1/2" diskette. Provide a separate text file for each building in the project. Each test page shall be separated by standard page break (one test per page).

END OF SECTION

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SECTION 27 21 12 - NETWORK ELECTRONICS

PART 1- GENERAL

1.1 GENERAL

- A. Applicable provisions of applicable sections of Division 16, "General Conditions," "Supplementary General Conditions," "General Requirements," and Division One, govern work under this Section.
- B. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test the Network Electronics to support the Premise Distribution System (specified elsewhere). Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.
- C. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at the time of design. However, it is this contractor's responsibility to coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the authority having jurisdiction.

1.2 SCOPE OF WORK

- A. All active network electronics and uninterrupted power supplies will be supplied and installed by the owner, please see corresponding drawings for further details. (*added for Revision #1, July 21, 2014)

1.3 DESCRIPTION OF SYSTEM

- A. The Network Electronics is to include all equipment, materials, and labor as required to provide, install and test a complete system as described herein.
- B. System to include but not be limited to:
 - 1. Modular hubs.
 - 2. Modular hub fiber optic and UTP ethernet modules.
 - 3. Stackable hubs.
 - 4. Management modules.
 - 5. Management software.
 - 6. Programming.
- C. Network Electronics equipment is to be installed in the designated area of the PDS equipment cabinet/rack as indicated in the rack elevations. Refer to the drawings for rack elevations.
- D. The Network Electronics contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- E. Coordinate all work with Section Premise Distribution System (PDS).

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1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

- A. Reference Section Reference Standards and Regulatory Requirements.
- B. The equipment and installation shall comply with the current or applicable provisions of the following standards:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. ANSI X3T9.5 - Standard for 100 Mbs Twisted Pair-Physical Media Dependent (TP-PMD).
 - 3. ANSI/TIA/EIA-568-A-1995 - Commercial Building Telecommunications Cabling Standard.
 - 4. ANSI/EIA/TIA-569-1990 - Commercial Building Standard for Telecommunication Pathways and Spaces.
 - 5. ANSI/TIA/EIA-606-1993 - Administration Standard for The Telecommunications Infrastructure of Commercial Buildings.
 - 6. ANSI/TIA/EIA-607-1994 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
 - 7. ANSI/EIA/TIA-492-AAAA - Detail Specification for 62.5 Micrometer Core Diameter/125 Micrometer Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers.
 - 8. ANSI/EIA/TIA-TSB-67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
 - 9. FCC: Federal Communication Commission Part 68 as modified by Wiring Docket 88-57.
 - 10. BICSI TDMM-1995 - Building Industry Consulting Service International, Inc. Telecommunications Distribution Methods Manual (1995)
 - 11. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems.
 - 12. LPC - Lightning Protection Code (NFPA-780).
 - 13. NEC - National Electrical Code (NFPA-70).
 - 14. NFPA 262-1985 - National Fire Prevention Association, 1470 Atlantic Avenue, Boston, MA 02210.
 - 15. IEEE 802.3 - Institute of Electrical and Electronics Engineers LAN Standard for Ethernet.
 - 16. IEEE 802.5 - Institute of Electrical and Electronics Engineers LAN Standard for Token Ring.
 - 17. UL Listed - Underwriters Laboratories Listed.
 - 18. UL Certified - UL's LAN Cable Certification Program.
 - 19. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
 - 20. UL 1449-1987 - Standard For Safety, Transient Voltage Surge Suppressors.

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21. UL 497, UL 497A, UL 497B.
 22. ANSI - American National Standards Institute.
 23. NEMA - National Electrical Manufacturer's Association.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.5 RELATED SECTIONS

- A. All applicable sections of Division 0, Division 1, and Division 16.
- B. Section Premise Distribution System (PDS).

1.6 DEFINITIONS

- A. Communications Equipment Room (CER). The "communications equipment room" (CER) is a dedicated room for termination of cable and to house the primary voice and data equipment. NOTE: The CER normally houses the MDF
- B. Communications Closet (CC). A "communications closet" (CC) is a dedicated room for termination of cable and to house secondary voice and data equipment. NOTE: The CC normally houses an IDF
- C. Communications Panel (CP). A wall mounted cabinet for termination of cable and to house secondary and data equipment. NOTE: The CP may serve as an IDF.
- D. Intermediate Distribution Frame (IDF). The "intermediate distribution frame" (IDF) is an equipment rack(s) and/or cabinet(s) housing secondary (intermediate) voice and data equipment.
- E. Main distribution Frame (MDF). The "main distribution frame" (MDF) is an equipment rack(s) and/or cabinet(s) housing the primary voice and data equipment.

1.7 QUALITY ASSURANCE

- A. Provide products which are compatible with other components in the system with which they must interface. Components and materials shall fit into the confines indicated, leaving adequate clearance as required by applicable codes or manufacturer for adjustment, repair or replacement.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- C. Supplier: Authorized distributor of specified manufacturer with minimum 5 years documented experience.
- D. Installer:
 1. The Network Electronics Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of network electronics and the associated optical and metallic Premise Distribution Systems (PDS) and have personnel who are adequately trained in the use of such tools and equipment.

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2. Company or person installing system must specialize in installing Network Electronics shall provide a minimum five (5) years documented experience.
 3. A minimum of one (1) full-time employee who is a Novell Certified Network Engineer (CNE).
 4. Installer shall be currently licensed as a Certified Limited Energy System Specialty Contractor (ES 069).
 5. Certification from manufacturer of proposed network transmission equipment.
 6. Authorized installer of specified manufacturer with service facilities within fifty (50) miles of project.
 7. A resume of qualification shall be submitted with the Contractor's proposal indicating the following:
 - a) Revenues for the previous year must be at least three (3) times the contracted value of this section.
 - b) Five (5) years documented experience in Ethernet Local Area Networks (LANs)
 - c) A list of recently completed Network Electronics projects of similar type and size with contact names and telephone numbers for each. Included shall be documentation of completion of three (3) networking Systems of over 100 stations within the last two (2) years.
 - d) A list of test equipment proposed for use in verifying the installed integrity of the network electronics and the associated metallic and fiber optic cable systems on this project.
 - e) A technical resume of experience for the Contractor's Engineer and on-site installation foreman who will be assigned to this project.
 - f) Similar documentation for any sub-contractor who will assist the Network Electronics Contractor in performance of this work.
- E. To establish the type and operating characteristics of the Network Electronics, the equipment specified herein is used as a guide in determining the functions of the system. Other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the engineer (See Section Basic Electrical Requirements on Substitutions):
1. Contractor qualifications (as listed above).
 2. Complete lists, descriptions and drawings of materials to be used.
 3. Manufacturer's technical literature providing sufficient information for the engineer to determine if the proposed equipment does meet the intent of the specifications.
 4. A narrative outlining the differences between the specified equipment and the equipment proposed for substitution.
 5. Samples of the equipment proposed for substitution if required by the engineer. The bidder proposing the equipment substitution shall contact the engineer prior to submitting the written request (as outlined above) to confirm exact samples that will be required.

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F. Coordination/Project Conditions

1. Verify proper grounding is in place.
2. Verify proper clearances, space, etc. is available for surge suppressor.

1.8 SUBMITTALS

A. Submit in accordance with Sections 16010 and 16012.

B. In addition to requirements of 16010 and 16012, the contractor shall submit:

1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
2. Manufacturer's data on all products, including but not limited to:
 - a) Catalog cut sheets.
 - b) Roughing-in diagrams.
 - c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
 - d) Operation and maintenance manuals.
 - e) Typical wiring diagrams.
 - f) The contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.
3. Shop Drawings: Submit typical hub wiring diagram for each type of hub, detail drawings of each of the facilities equipment racks showing elevations and equipment layout, coordinated with the Premise Distribution System (PDS) contractor's work, for each MDF and IDF location, showing orientation of all rack mounted equipment items.
4. Qualifications: Submit qualifications of system installer.
5. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
6. Test Equipment: Submit a letter, signed by an officer of the company, that indicates what test equipment the company owns and shall use for accomplishment of the test procedures required in these specifications.
7. Submit labeling scheme and sample of label.
8. Contractor shall submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.
9. Submit a detailed step by step testing procedure for a component by component system functional checkout and test.
10. Point to point wiring diagrams and block diagrams of all network electronics to be installed. Point to point wiring diagrams may be submitted at time of operation and

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maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with submittals.

11. Submittals that do not include all items as listed above, and as required elsewhere in these specifications shall, at the discretion of the Engineer, shall not be reviewed and shall be returned to the Contractor for resubmittal.

1.9 PROJECT RECORD DOCUMENTS

- A. Submit in accordance with Sections 16010 and 16098.
- B. In addition to the requirements of 16010 and 16098, the contractor shall submit:
 1. Provide detailed documentation of the network electronics system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, detailed cable drawings, with all cables and terminations identified, a bill of materials of all installed equipment and wiring, equipment rack elevations and model and serial numbers of all installed equipment (hubs, modules, etc.). A clear and consistent nomenclature scheme is to be defined and used on the documentation which facilitates locating and identifying connection between the network electronics and the Premise Distribution System (PDS).
 2. Record actual locations of all installed equipment. These records shall consist of floor plans indicating all MDF and IDF locations and the equipment type and quantities installed, rack elevations for each MDF and IDF locations detailing the layout of equipment coordinated with the Premise Distribution System (PDS) contractor's work, and detail drawings showing each piece of equipment and the backbone or horizontal cable it is connected to based upon the cable labeling scheme provided by the PDS contractor. The information outlined above may be provided through the use of a cable management software package. If a cable management software package is used the Network Electronics contractor shall provide the Owner with all data and the original software package (including all original disks and documentation) with the project closeout documents.
 3. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".
 4. All drawings required herein to be on AutoCAD Release 12.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit in accordance with Sections 260500 and 260509.
- B. In addition to the requirements of 260500 and 260509, the contractor's O & M Manuals shall include:
 1. A complete as-installed equipment list, listed by MDF and IDF, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
 2. A complete and correct system schematic, showing detailed connections for all parts of the system, including jack numbers, and other designations and codings (point-to-point wiring diagrams).
 3. Repair parts list for each and every major equipment item furnished.
 4. Service manuals for each and every major equipment item furnished.

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5. Operation Data: Include instructions for adjusting, operating, and extending the system.
 6. Manufacturer's warranties and operating instructions for each and every equipment item furnished.
 7. Test Data.
 8. Data sheets showing all field labeling used for hubs.
 9. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.
 10. Complete equipment rack layouts showing locations of all rack mounted equipment items.
 11. Provide all network electronics management software (including all original disks and documentation).
 12. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing communication outlet locations and orientation, rack locations, cable tray locations, cable routing, CER and CC Room enlarged plans, and all other related device locations.
 13. The Contractor/Installer shall videotape the entire training session(s), and submit the video tape with the Operational Manual.
- C. Drawings required herein are in addition to those required under "PROJECT RECORD DOCUMENTS".
1. All drawings required herein shall be on AutoCAD Release 12.

1.11 WARRANTY

- A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one (1) year from date of acceptance by owner, repair or replace any equipment found to be defective.
1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
 2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.
 3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of Network Electronics System for one (1) year from date of Substantial Completion.
1. No charge shall be made by the installer and/or contractor for any labor, equipment, or transportation during this period to maintain functions.
 2. Respond to trouble call within twenty-four (24) hours after receipt of such call.

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1.13 EXTRA MATERIALS

- A. Provide 20% spare capacity in all network electronics installed at each MDF and IDF location.
- B. Provide one (1) extra hub of each stackable type.
- C. Provide 20% spare management modules.

1.14 OWNER'S INSTRUCTION

- A. Training of school personnel (a minimum of two) shall be provided. Training to cover the location nomenclature, documentation structure contents, documentation maintenance procedures, a "walk-through" for location and labeling orientation, system reconfiguration, operation of network equipment installed as part of the contract, test documentation, and troubleshooting of the data signal portion of the installation.

1.15 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. General: Ensure all system equipment, devices and materials arrive at the designated installation site in good condition, intact, and in factory package or crate. Any equipment found to be damaged will be removed from the project site and will be replaced by the Contractor at his expense.
- B. Storage: Store all equipment, devices and materials in their factory containers or package until ready for use. Storage facilities will be a clean, dry and indoor space which provides protection against the weather. Avoid condensation damage by providing temporary heating when required. Storage-related costs will be the responsibility of the Contractor. It is anticipated that little or no storage space will be available on site. Thus, Contractor shall store materials off site.
- C. Handling: Handle all equipment, devices and materials carefully to prevent breaking, denting, or scoring of the finish and/or cable jackets. Damaged materials will be removed from the project site, and replaced by the Contractor at no additional cost. No sheath cuts will be accepted. All cables must be installed with sheath intact to the point of termination.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.
- B. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for PDS configurations specified in this section.
- C. All transmission equipment must be manufactured by a single vendor.
- D. All equipment shall provide SNMP in-band and optional out-of-band network management.
- E. All equipment must be fully equipped with network management (supervisor) module, power supply, network management software, licensing, and appropriate rack mounting equipment.

2.2 NETWORK ELECTRONICS

- A. Network Electronics: The following types and model network electronics are acceptable:
 - 1. Intelligent Hub Chassis: Synoptics #3000N

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2. Ethernet 10BaseT Host Module: Synoptics #3308A
3. Network Management Module: Synoptics #3314A-04
4. Ethernet 10BaseF Host Module: Synoptics #3304A
5. Ethernet 10BaseT Workgroup Hub: Synoptics 2814-04
6. Ethernet 10BaseT Workgroup Hub: Synoptics #2803
7. Contractor shall provide and install equipment described as follows:

2.3 NETWORK TRANSMISSION EQUIPMENT SCHEDULE

LOCATION	EQUIPMENT
MDF Bldg. #?	(X) Manufacturer & Model#
IDF-? Bldg. #?	(X) Manufacturer & Model#
IDF-? Bldg. #?	(X) Manufacturer & Model#
IDF-? Bldg. #?	(X) Manufacturer & Model#
IDF-? Bldg. #?	(X) Manufacturer & Model#
IDF-? Bldg. #?	(X) Manufacturer & Model#
IDF-? Bldg. ?	(X) Manufacturer & Model#
IDF-? Bldg. #?	(X) Manufacturer & Model#

2.4 MANAGEMENT SOFTWARE

A. Network Management Software:

1. Synoptics Lattis EZview Ethernet Network Management Station, Version 2.2 or higher. - EXECUTION

3.1 INSTALLATION

A. General

1. Install equipment in accordance with manufacturer's instructions.
2. Contractor shall provide and install all equipment, software and other components

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necessary for a turn-key installation.

3. Install equipment to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.

B. Network Electronics

1. Install all rack mountable equipment in equipment rack.
2. Coordinate location of equipment with drawings and all equipment provided by Section Premise Distribution System (PDS).
3. Contractor is responsible for the custom and neat installation of all patch cords.
4. Properly ground equipment per applicable sections of these specifications.
5. The Network Electronics contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
6. Maintain proper separation between Network Electronics cables and all power and/or unshielded cables, as required to prevent noise, crosstalk, etc.
7. Cable Support
 - a) Provide proper cable support through the use of cable management as provided by the Premise Distribution System (PDS) contractor.
 - b) Where large quantity of cables are congested in an area provide/install special supports designed to carry weight.
 - c) Size shall be as required to provide for cables installed plus 50% spare and still not exceed rating of support device.

- C. Contractor shall serve as a "systems integrator" for the school. In this role, Contractor shall burn in, setup, configure, and trouble shoot all installed equipment. Contractor shall also assist in the integration of this equipment with the school's existing LAN based systems, if any. Important, Contractor shall allow appropriate time for setup, configuration, and trouble shooting of local area network. Contractor shall install network management software on an appropriate workstation (provided by the Owner), this workstation shall be located in the CER. Contractor shall furnish appropriate software/connections for managing the Synoptics equipment from the location of the workstation.

3.2 FIELD QUALITY CONTROL

- A. Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.
- B. Test all cables.
- C. System verification and acceptance documentation signed and dated by the installer (Contractor) shall be provided. This documentation shall include test measurements and system calibrations performed for the entire network electronics system. Sample system operations shall also be performed with actual hardware or using Contractor provided test equipment and documented to verify that the system is operational and ready for acceptance.

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This shall also establish the baseline performance of the system.

D. System Commissioning:

1. Upon completion of the aforementioned tests and before system commissioning, actual data testing shall be performed. The tests may be performed with existing equipment, if in place, or using contractor provided equipment or test equipment. The tests shall be performed on a sample basis (10% of installed hub ports) on various portions of the network as determined by the design professional and school. The tests shall be witnessed by the Contractor, design professional and school representatives.

3.3 DEMONSTRATION

- A. Demonstrate system to designated Owner personnel as required by applicable sections of these specifications.
- B. Conduct walking tour of project. Briefly describe function, operation, and maintenance of each component.
- C. Provide detailed operation and maintenance instruction and training.
- D. Use submitted operation and maintenance manual as reference during demonstration and training.

END OF SECTION