



**ORANGE COUNTY HEALTH SERVICES DEPARTMENT
RENOVATION**

BID DOCUMENTS

**FOR
ORANGE COUNTY
CAPITAL PROJECTS
IOC II, 400 EAST SOUTH STREET
ORLANDO, FLORIDA 32801**

**BY
MATERN PROFESSIONAL ENGINEERING, INC.
130 CANDACE DRIVE
MAITLAND, FLORIDA 32751**

JULY 27, 2015

**ORANGE COUNTY HEALTH SERVICES DEPARTMENT
RENOVATION
BID DOCUMENTS
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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. When the titles such as Engineer, Project Engineer, or Owner are used throughout the specification, this implies Orange County as property owner and/or an officially appointed County Representative.

1.2 PROJECT DESCRIPTION

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

1.3 SCOPE OF WORK

A. Summary Of Work:

1. HVAC:

- a. Replacement of the existing HVAC systems serving the building with new high-efficiency DX systems.
- b. Replacement of the existing acoustical ceiling tile within the entire facility.

2. Electrical:

- a. Provision of new electrical equipment/devices and associated wiring/conduit to facilitate new HVAC equipment.
- b. Provision of new PDS locations.
- c. Provision of new electrical devices in locations shown on plans.

3. Architectural scope of work varies on the North and South portions of the facility divided by existing wall.

North:

- 1. Remove and replace all existing suspended acoustical ceilings and ceiling mounted devices to accommodate new HVAC distribution systems.
- 2. Remove existing smoke separation doors in existing exit access corridor and de-rate Janitor Closet so as not to swing into exit access door.
- 3. Convert existing space(s) for Mechanical Room and reverse door swing on existing Janitor Closet so as not to swing into exit access corridor.
- 4. Add one (1) roof mounted exhaust fan and associated roof repairs, curb and flashing.
- 5. De-rating of wall per FBC single occupant 'B' occupancy building and removal of smoke and rated wall doors.

South:

- 1. Comprehensive renovation of entire portion of the facility including built not limited to: New offices, conference rooms, ADA compliant toilet rooms and shower facilities, new mechanical, electrical, and plumbing systems.
- 2. Remove existing and replace with new roofing system, substrate and roof framing members. New roof expansion joint(s), flashing materials and roof drains.
- 3. Re-insulate and water-proof exterior walls and new cement plaster finish.
- 4. New exterior doors and windows.

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5. Demolish all interior finishes, ceiling, remove floor finishes, indicated wall, door and door frames.
6. Demolish selected areas of slabs to accommodate proposed work repairs due to wall demolition, removal of existing plumbing and HVAC.
7. De-rating of wall per FBC single occupant 'B' occupancy building and removal of smoke and rated wall doors.

1.4 CONTRACTOR RESPONSIBILITIES

- A. The contractor shall have all submittals approved by the Engineer and accepted by the Owner prior to the start of active construction.
- B. The contractor shall have all equipment and material onsite prior to the start of active construction.
- C. The contractor shall submit to the Owner prior to the project pre-construction meeting the following:
 1. Schedule of Values
 2. Construction Schedule
 3. Submittal Schedule
 4. Emergency Telephone List including subcontractors and suppliers
- D. The contractor shall field verify existing conditions of construction prior to start of active construction.
- E. The contractor shall coordinate with the Owner on the operation of the existing fire alarm system prior to the start of active construction. There shall be an action plan for the operation of the fire alarm system during construction submitted by the contractor to the Owner for acceptance. This action plan shall be in place prior to the start of active construction. Any false fire alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all costs incurred from the local fire department for responding to a false alarm.
- F. The contractor is responsible for moving furniture and/or equipment if necessary to perform the work included in the contract. The contractor is responsible for placing the furniture and/or equipment back in its original location. The contractor is responsible for any damages to furniture, equipment, etc., which occur during construction. The contractor shall provide protection for floors, walls, furniture, equipment and any other items that may be subject to damage during the construction periods and will be required to repair or replace to original or better condition.
- G. The contractor shall coordinate with the Owner on the operation of the security alarm system prior to the start of active construction. The contractor shall submit an action plan for operation of the security alarm system during construction to the Owner for acceptance prior to start of active construction. This action plan shall be in place prior to the start of active construction. Any false security alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all cost incurred from the local police and/or sheriff department for responding to a false alarm.
- H. The contractor shall take digital pictures or video of pre-existing conditions of the interior and exterior of the building prior to the start of active construction. Failure to provide digital pictures or video prior to start of construction places the responsibility on the Contractor to complete the necessary replacement, repairs, and/or cleaning as determined by the Owner, at no additional cost to the Owner. One CD copy of digital pictures or video of the existing site conditions shall be submitted to the Owner.
- I. The contractor shall at all times maintain daily cleanup of construction areas. Costs for work areas that are not cleaned by the contractor will be cleaned by the Owner and those costs shall

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be charged back to the contractor via change order.

- J. The contractor shall provide a construction schedule to the Owner's Project Manager prior to the pre-construction meeting.
- K. The contractor shall update the construction schedule weekly and submit it to the Owner's Project Manager for review.

1.5 WORK UNDER OTHER CONTRACTS

- A. Separate contracts may be issued to perform certain construction operations at the site. The contractor of this project will allow reasonable access and coordination to the other contractor's.

1.6 WORK SEQUENCE

- A. The facility shall remain fully occupied and operational for the duration of the project. All indoor and outdoor work shall be performed during normal business hours during the week. Normal business hours are defined as 7:00 am to 5:00 pm, Monday through Friday. Material and equipment deliveries will be during normal business hours.

1.7 CONTRACTOR USE OF PREMISES

- A. General: During the construction period, the contractor shall have full use of the premises for construction operations, including use of the site. The contractor's use of the premises is limited only the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.
- B. General: Limited use of the premises to construction activities in areas indicated within the limit of the premises. The Contractor may 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 its occupants during the construction period.
 - 5. Confine construction operations to the areas permitted by the contract documents and other Owner directives.
 - 6. Provide protection and safekeeping of material and equipment stored on premises.
 - 7. Contractor will move any stored material and equipment, which interfere with operations of the Owner or other contractors at no additional cost to the Owner..
 - 8. Comply with Owner's requirements for ingress and egress procedures, prohibitions against firearms, procedures for transportation of workers, safety and fire prevention requirements and all applicable pollution control requirements. Refer to the following reference requirements:
 - a) Orange County Safety and Health Manual
<http://www.orangecountyfl.net/VendorServices/OrangeCountySafetyandHealthManual.aspx>
 - b) Orange County Policy Manual page 96 regarding Firearms
<http://www.orangecountyfl.net/portals/0/resource%20library/employment%20-%20volunteerism/Policy%20Manual.pdf>
 - 9. Contractor to require all employees and subcontractors to wear non-objectionable clothing; prohibit revealing clothing and articles of clothing with offensive writings displayed. The contractor shall require offending personnel to leave the premises until such clothing is

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changed.

10. Contractor employees and subcontractors will not fraternize with County employees or the general public during the entire construction period.
11. Use of sound equipment (such as boom boxes, stereos, radios, etc.) is not allowed.
12. Contractor and their personnel shall abide to Orange County Tobacco free policy while on any Orange County Convention Center property. This policy shall apply to building, parking lots, parks, break areas and worksites. Tobacco is defined as tobacco products, including but not limited to: Cigars, cigarettes, pipes, chewing tobacco and snuff. Failure to abide by the policy may result in civil penalties levied under Chapter 386, Florida Statutes and/or Contract enforcement remedies. Refer to the following documents:
 - a) Orange County Smoking Policy:
<http://www.orangecountyfl.net/Portals/0/resource%20library/employment%20-%20volunteerism/Employee%20Handbook.pdf>
13. Conduct that is disrespectful, abusive or otherwise objectionable to the Owners' employees or general public will not be allowed at any time during the construction period. Repetitive complaints and violations of the requirements listed above will be cause for dismissal and or permanent removal of offending personnel from the project.
14. Contractor to coordinate with the Owner the site location for storage of equipment, machinery, materials, tools and a construction waste dumpster.
15. Contractor shall at all times keep the premises free of all waste or surplus materials, rubbish and debris, which is caused by contractor employees or subcontractors resulting from their work. Contractor shall maintain a safe work environment to all building occupants during the construction period.

1.8 SECURITY AND IDENTIFICATION

- A. The building shall be secured from unwarranted entry at the end of each workday.
- B. 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.
- C. 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 Orange County. All contractors' staff background checks will be sent to the Orange County Project Manager for approval.
- D. 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*****
- E. Orange County will inform the contractor of their Background Check results. Upon Background Check approval, the contractor's staff shall arrange an appointment with the Orange County staff to obtain 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.
- F. Contractor's employees will not be allowed in Orange County facilities without completed and approved background investigations.
- G. 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 or Orange County Clients renting convention space located in or adjacent to construction/renovation site.

1.9 OWNER OCCUPANCY

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- A. Owner Occupancy: The Owner will be occupying the building during construction. Normal occupancy hours are 7:00 a.m. to 6:00 p.m. Monday through Friday. 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.

1.10 DISTRIBUTION OF RELATED DOCUMENTS

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

1.11 CONTRACT DOCUMENT FILE

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

PART 2 - PRODUCTS

2.1 ASBESTOS FREE MATERIAL

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

PART 3 - EXECUTION (Not applicable).

END OF SECTION

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SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for 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 "Submittal Procedures".

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: 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.

1.4 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

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each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:

- a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
3. Engineer's Action: Within two weeks of receipt of the request for substitution, the Engineer will request additional information or documentation necessary for evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever 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

2.1 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise request will be returned without action except to record noncompliance with these requirements.
1. Extensive revisions to Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of Contract Documents.
 3. The request is timely, fully documented and properly submitted.
 4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.

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5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 6. A substantial advantage is offered to the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.
 7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
 9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- B. The Contractor's submittal and Project Manager's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- C. Substitution request constitutes a representation that the Contractor:
1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
 2. Will provide the same warranty for substitution as for specified product.
 3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.
 4. Waives claims for additional costs which may subsequently become apparent. All costs associated with the substitution will be paid by the Contractor regardless of approvals given, and regardless of subsequent difficulties experienced as a result of substitutions.

END OF SECTION 01 25 00

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SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 MINOR CHANGES IN THE WORK

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

1.4 CHANGE ORDER PROPOSAL REQUESTS

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

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- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representatives findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.
 - 1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 - 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Comply with requirements in Section 012500 "Substitution Procedures" - if the proposed change in the work requires that substitution of one product or system for a product or system not specified.
 - 5. Contractor and subcontractors 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.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

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

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

END OF SECTION 01 26 00

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SECTION 01 29 00
PAYMENT PROCEDURES

PART I - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 013300 – "SUBMITTAL PROCEDURES".

1.3 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than Preconstruction Meeting.
 - 2. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - 1. Identification: Include the following project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Engineer
 - c. Project Number
 - d. Contractor's name and address
 - e. Date of submittal
 - 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
 - a. Generic name
 - b. Related Specification Section
 - c. Change Orders (numbers) that have affected value
 - d. Dollar Value
 - e. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent
 - 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items:

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- a. A value will be given for at least every major specification section (subsections can logically be grouped together).
 - b. A single material subcontractor will not be required to be broken down into labor and material unless it is anticipated the materials will be stored and invoiced prior to installation.
 - c. All multiple item subcontracts or work items (i.e. mechanical, electrical items, etc.) will be shown broken down at least in labor and material (all taxes, burden and overhead and profit included).
 - d. Mobilization (move-on, bond, insurance, temporary office and sanitary service installation) shall not exceed 2 1/2% of contract price.
 - e. For multi-story work all items broken down per floor.
 - f. HVAC: Typically shown per specification section, labor and material, per floor.
 - g. Electrical: same as HVAC.
 - h. Logical grouping of specification subsections are permitted.
4. Round amounts off the nearest whole dollar, the total shall equal the Contract Sum.
 5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
 - a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
 7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the contract sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner's representative and paid for by the Owner.
 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements. See items G, I, J and K of this section.
- B. Payment Application Times: The period of construction work covered by each Application of Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use the County's most updated form as the form for Application for Payment. Form given at the Preconstruction Conference.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

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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 (5%) will be held for all interim applications.
- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner

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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 017700.

PART 2- PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION 01 29 00

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SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.0 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specification that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required: notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Schedules
 - 2. Installation and removal of temporary facilities
 - 3. Delivery and processing of submittals
 - 4. Progress meetings
 - 5. Project close-out activities

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- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment (if any) involved in performance of, but not actually incorporated in, the Work.
- E. Lack of coordination as specified in this and other sections of the contract documents are in grounds for assessment of back charges and/or termination in order to remediate the situation.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the interrelationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with requirements contained in Section "Submittals".
- B. Staff Names: At the Preconstruction Conference submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
 - 1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to Project Manager for final decision.
- F. Recheck measurements and dimensions, before starting each installation.

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- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Project Manager for final decision.

3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as directed by the Project Manager and as frequently as necessary to ensure its integrity and safety through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where the applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading
 - 2. Excessively high or low temperatures
 - 3. Excessively high or low humidity
 - 4. Air contamination or pollution
 - 5. Water
 - 6. Solvents
 - 7. Chemicals
 - 8. Soiling, staining and corrosion
 - 9. Rodent and insect infestation
 - 10. Combustion
 - 11. Destructive testing
 - 12. Misalignment
 - 13. Excessive weathering
 - 14. Unprotected storage
 - 15. Improper shipping or handling
 - 16. Theft
 - 17. Vandalism

END OF SECTION 01 31 00

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SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 PRE-CONSTRUCTION CONFERENCE

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

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

1.4 PRE-INSTALLATION CONFERENCE

- A. Conduct a Pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise at least 48 hours in advance the Project Manager of scheduled meeting dates.
 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
 - a. Contract Documents
 - b. Options
 - c. Related Change Orders
 - d. Purchases
 - e. Deliveries
 - f. Shop Drawings, Product Data and Quality Control Samples
 - g. Possible conflicts
 - h. Compatibility problems
 - i. Time schedules
 - j. Weather limitations
 - k. Manufacturer's recommendations
 - l. Comparability of materials
 - m. Acceptability of substrates
 - n. Temporary facilities
 - o. Space and access limitations
 - p. Governing regulations
 - q. Safety
 - r. Inspection and testing requirements
 - s. Required performance results
 - t. Recording requirements
 - u. Protection
 2. Record significant discussions and agreements and disagreements of each conference along with and approved schedule. Distribute the record of the meeting to everyone concerned promptly including the Owner and Engineer.
 3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 COORDINATION MEETINGS

- A. Conduct project coordination meeting at weekly intervals on day and time as established by the Project Manager or more frequently, if necessary convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved, to include subcontractors and

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representatives.

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

1.6 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at bimonthly intervals or more frequently if necessary as directed by the Project Manager. Notify the Owner at least 48 hours in advance of scheduled meeting time and dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and Engineer, each subcontractor, supplier or other entity concerned with current progress of involved in planning, coordination or performance of future activities with the project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
 - 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time, ahead, or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements
 - b. Time
 - c. Sequences
 - d. Deliveries
 - e. Off-site fabrication problems
 - f. Access
 - g. Site utilization
 - h. Temporary facilities and services
 - i. Hours of work
 - j. Hazards and risks
 - k. Housekeeping
 - l. Quality and work standards
 - m. Change Orders
 - n. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, or progress since the previous meeting and report.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 19

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

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

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

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

1.3 ELECTRONIC SUBMITTAL PROCEDURES

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

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

- B. Electronic copies of CAD drawings made from the Construction/Contract Documents will not be provided by Engineer without a written indemnification. Indemnification form will be provided by the Engineer at Pre-Construction Meeting to the General/Mechanical/Electrical Contractor upon written request.

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

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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. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 221116.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 221116.01.A).
 - 2) Where multiple products are shown, highlight/circle or identify product intended to be used
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.

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- E. Contractor shall be responsible for cost of re-review of rejected submittals, shop drawing, etc. Costs for re-review shall be reimbursed to the County by deducting the cost from the Contractors monthly progress payments. Costs to be determined by applying the consultants standard billing rates, plus 10% handling by the County.
- F. Substitution request to specified products will be made within 30 days of Notice to Proceed. After the 30 day period, no requests for substitutions from the Contractor will be considered.
 - 1. Substitution submitted within the first 30 days will have product data from specified and requested substitute submitted together and demonstrate better quality, cost savings if of equal quality, or show benefit to the County for excepting the substitute.
- G. Once electronic submittals are approved or approved as noted, they will be transmitted to the owner.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.
 - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the Schedule of Values.
 - 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 - 3. Prepare the schedule on a sheet, series of sheets, stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 - 4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.
 - 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.
 - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.
- B. Phasing: Provide notations on the schedule to show how the sequence of the work is affected by requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.
- C. Work Stages: Indicate important stages of construction for each major portion of the work, including testing and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating precalculated and actual costs. On the line show dollar-volume of work performed as the dates used for preparation of payment requests.

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1. Refer to Section Applications for Payment for cost reporting and payment procedures.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the project meeting room and temporary field office.
 1. When revision are made distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- G. Schedule Updating: Revise the schedule monthly or activity, where revisions have been recognized or made. Issue the updated schedule concurrently monthly pay request.

1.5 SUBMITTAL LOG

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete log of submittals.
 1. Coordinate submittals log with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
 2. Prepare the log in chronological order; include all submittals required. Provide the following information:
 - a. Scheduled date for the first submittal
 - b. Related Section number
 - c. Submittal category
 - d. Name of subcontractor
 - e. Description of the part of the work covered
 - f. Scheduled date for resubmittal
 - g. Scheduled date for the Engineer's final release or approval.
 3. All submittals must be received within the first 25% of contract time.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Project Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Log Updating: Revise the log after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Project Manager at weekly intervals:
 1. List of subcontractors at the site
 2. Approximate count of personnel at the site
 3. High and low temperatures, general weather conditions
 4. Accidents and unusual events

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5. Meetings and significant decisions
6. Stoppages, delays, shortages, losses
7. Meter readings and similar recordings
8. Emergency procedures
9. Orders and requests of governing authorities
10. Change Orders received, implemented
11. Services connected, disconnected
12. Equipment or system tests and start-ups
13. Partial completions, occupancies
14. Substantial Completions authorized

1.7 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawings and will be rejected.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 1. All required dimensions
 2. Identification of products and materials included
 3. Compliance with specified standards
 4. Notation of coordination requirements
 5. Notation of dimensions established by field measurement
 6. Electronic Sheet Size: Except for templates, patterns and similar full-size Drawings on electronic PDFs of 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 one (1) electronic copy. Mark up and retain one returned electronic copy as a Project Record Drawing.
 8. Submit one (1) hard copy once approved for legal seal stamping if needed at jobsite. Coordinate with Engineer and County's Representative.
 9. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
 1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.
 2. Submit coordination Drawings for integration of different construction elements. Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.
 3. Contractor is not entitled to additional payments due to lack of compliance with this Section.

1.8 PRODUCT DATA

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- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawing".
1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations
 - b. Compliance with recognized trade association standards
 - c. Compliance with recognized testing agency standards
 - d. Application of testing agency labels and seals
 - e. Notation of dimensions verified by field measurement
 - f. Notation of coordination requirements
 - g. Manufacturers local representative and phone number.
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
 4. Submittals: Submit six (6) copies of each required submittal. The Project Manager will return two (2) sets to the Contractor marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.
1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Engineer's/Owner's Sample. Include the following:
 - a. Generic description of the Sample
 - b. Sample source
 - c. Product name or name of manufacturer
 - d. Compliance with recognized standards
 - e. Availability and delivery time
 2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these

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characteristics between the final submittal and the actual component as delivered and installed.

- a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
- a. Preliminary submittals will be reviewed and returned with the Engineer's/Owner's mark indicating selection and other action.
4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
5. Maintain sets of Samples, as returned, at the project site, for quality comparisons throughout the course of construction.
- a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field Samples specified in individual sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
 - a. Comply with submittal requirements. Process transmittal forms to provide a record of activity.

1.10 ENGINEER'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Project Manager will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Engineer/Project Manager will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:
 1. Final Unrestricted Release: Where submittals are marked No Exceptions Taken, that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

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2. Final-But-Restricted Release: When submittals are marked Made Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked Revise and Resubmit to be used at the Project site, or elsewhere where work is in progress.
4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION 01 33 00

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SECTION 01 73 29
CUTTING AND PATCHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division-23 and Division-26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements.
 - a. Foundation construction
 - b. Bearing and retaining walls
 - c. Structural concrete

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- d. Structural steel
 - e. Lintels
 - f. Timber and primary wood framing
 - g. Structural decking
 - h. Miscellaneous structural metals
 - l. Stair systems
 - j. Exterior curtain wall construction
 - k. Equipment supports
 - l. Piping, ductwork, vessels and equipment
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Refer to Divisions 15 and 16 regarding Fire Rated Penetrations.
- 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.
 - a. Shoring, bracing and sheeting
 - b. Primary operational systems and equipment
 - c. Air or smoke barriers
 - d. Water, moisture, or vapor barriers
 - e. Membranes and flashings
 - f. Fire protection systems
 - g. Noise and vibration control elements and systems
 - h. Control systems
 - l. Communication systems
 - j. Conveying systems
 - k. Electrical wiring systems
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.
- 1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
 - a. Processed concrete finishes
 - b. Preformed metal panels
 - c. Window wall system
 - d. Stucco and ornamental plaster
 - e. Acoustical ceilings
 - f. Carpeting
 - g. Wall covering
 - h. HVAC enclosures, cabinets or covers
 - l. Roofing systems

PART 2- PRODUCTS

2.1 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing

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adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise indicated by Engineer/Owner. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3- EXECUTION

3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
 - 1. Before proceeding, meet at the site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas and interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
 - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.
 - 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching required excavating and backfilling.

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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.

3.4 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged materials to their original condition.

END OF SECTION 01 73 29

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:
 - 1. Inspection procedures
 - 2. Project record document submittal. (substantial completion requirements)
 - 3. Operating and Maintenance Manual Submittal (substantial completion requirements).
 - 4. Submittal of warranties (substantial completion requirement).
 - 5. Final cleaning
- B. Final Payment to be made when the County has reviewed and accepted all required close-out documents.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following: List exceptions in the request.
 - 1. In the Application for Payment that coincided with, or first follows, the date Substantial Completion 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 Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - 1. Results of the completed inspection will form the basis of requirements for final acceptance.

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

1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following list exceptions in the request:
 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and complete operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Engineer or Owner's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager.
 4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment.
 6. Submit a final liquidated damages settlement statement
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Engineer will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.
 1. Upon completion of reinspection, the Engineer will prepare a certification of final acceptance, or advise the contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposed; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation; where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the
- C. Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owner's representative.
 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 3. Note related Change Order numbers where applicable.

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4. **Submit one (1) hardcopy of the most current record set of drawings when the project is considered 50% substantially complete for review and comment by Owner.**
 5. Organize record drawing sheets, and print. suitable titles, dates and other identification on the cover of each set.
 6. Provide three (3) additional sets of black line drawing sets of As-Built Drawings.
 7. Provide one (1) CD-ROM with all As-Built Drawings in AutoCAD and PDF format.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.
1. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.
- D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Engineer for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Engineer and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owner's records.
- G. Maintenance Manuals: Organize operating and maintenance data into four (4) suitable sets of manageable size and electronically as PDFs on one (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

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8. Fixture lamping schedule

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLOSE-OUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that required regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. All items to be provided or 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

3.2 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

- A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide one (1) hardcopy.
- B. Bind in commercial quality 8 ½" x 11" three ring binder, indexed with hardback, cleanable, plastic covers.
- C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.
- D. Provide table of contents: Neatly typed, in the following sequence:
 1. Final Certificate of Occupancy
 2. Warranty Service Subcontractors Identification List
 3. Final Lien Waivers and Releases
 4. Warranties and Guarantees
 5. Systems Operations and Maintenance Instruction

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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 16 standard divisions. Bookmarks will be needed for the appropriate divisions.
 4. Operations and Maintenance Manual: Specify the division name only in the bookmarks (1-46). Please note that all items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify works on the scanned documents.
 5. Permitting: This should include the Certificate of Occupancy and any other document that the Project Manager may include pertaining to the permitting for the project.

3.3 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore

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- reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
- d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
- 1. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01 77 00

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SECTION 01 78 00
WARRANTIES AND BONDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 WARRANTY REQUIREMENTS

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

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1.4 WARRANTY PERIOD

- A. The Contractor shall participate with the County and the Engineer's representative, at the beginning of the tenth month of the warranty period, in conducting an on site review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Engineer/Owner during on the site review.
- B. All warranties and guarantees shall commence on the date of Substantial Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the County's acceptance of that work.
- C. Warranty period shall be manufacturer's standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

1.5 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Engineer's Certificate of substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the work, submit written warranties upon request of the Project Manager.
 - 1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen days of completion of that designated portion of the work.
- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for executing by the required parties. Submit a draft to the Engineer for approval prior to final execution.
 - 1. Refer to individual Sections of Division 2 through 28 for specific content requirements, and particular requirements for submittal of special warranties.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 1/2" by 11" paper.
 - 1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
 - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the Contractor.

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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 01 78 00

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SECTION 02 41 13 - DEMOLITION AND ALTERATIONS

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.
- B. See Mechanical, Plumbing and Electrical Divisions for additional requirements.

1.2 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.
- B. The South side of the building will require removal of the following existing elements to the extent shown on drawing and specified.
 - 1. Remove roof membrane
 - 2. Remove insulation and lightweight concrete
 - 3. Remove all roof steel framing
 - 4. Remove existing interior finishes down to existing masonry and concrete surface
 - 5. Remove existing window, louvers, doors and frames
 - 6. Removal of all cabinetry and shelving
 - 7. Selective demolition of concrete slabs
 - 8. Demolition of selected interior masonry partitions
 - 9. Demolition of all existing plumbing
 - 10. Demolition of all existing mechanical and ventilation system
 - 11. Demolition of all electrical, communication, low voltage systems and conduits
 - 12. All miscellaneous demolition required associated with the renovations of the South half of the building

1.3 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.
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

C. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1. NFPA 241; Safeguarding Construction, Alteration and Demolition Operations

D. 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.

E. Structural Members: Do not cut any building structure without written authorization of the Architect. 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 Steel structure, existing metal deck, concrete masonry and concrete structure scheduled to remain.

1.4 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 have 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).

D. Portable Coverings: For minor interior alterations, where acceptable to Architect, 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.

H. Provide temporary structural bracing on structural wall noted to remain until proposed structural steel roof framing and deck are constructed.

I. Maintain watertight conditions during demolition process. Install permabarrier from top of coping to top of slab along the entire surface and length of wall to remain that separates the North and South building.

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1.5 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.

1.6 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.

1.7 OCCUPIED FACILITY

- A. Since the facility is in operation, coordination will be required with staff to coordinate time of demolition to minimize disturbance of occupants.
- B. Coordinate with Orange County P.M. for coordination of demolition operations.

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.

2.4 WATERTIGHT ENCLOSURE

- A. Peel and Stick Permabarrier by W.R. Grace or approved equal

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PART 3 - EXECUTION

3.1 RELOCATION AND REMOVAL

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

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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.

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 precast concrete slabs, columns, joist and beams.
- C. Patch all existing slab penetrations caused by demolition of mechanical and plumbing.

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 Architect/Engineer. If electrical, communications, fire protection and systems lines are encountered and not shown on drawings, contact the Architect/Engineer prior to the start of the work.
- B. Temporary support of all lighting, low voltage wiring other devices on, below, and in the ceiling system will be required will require temporary support until new ceiling system is installed.

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 refinishing as necessary to complete 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.

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- 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 the work remove drywall ceiling and ceiling suspension system and supports, fasteners complete. Provide support for adjacent ceilings to remain.

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

- 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 acoustical ceiling and suspension system as required by the work U.O.N. on the drawings.

3.15 TEMPORARY PROTECTION

- A. Install Peel and Stick waterproofing membrane from top of parapet to floor slab for a watertight protection of the North offices during demolition and reconstruction of structure on the South. The Temporary protection will include the entire East to West wall that currently separates the North and South half of the building. Maintain membrane watertight throughout construction until South roof is dry-in.

END OF SECTION 02 41 13

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SECTION 02 41 19.07
SELECTIVE ROOFING DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies requirements for the following Scope of Work:
 - 1. Removal and disposal of existing: base flashings, sheet metal flashings, counterflashings, pitch pockets, parapet and curb caps, drain components, and perimeter wood blocking in preparation for replacement system and associated components.
 - 2. Removal of accessory items such as antennae, skylights, skylight sunscreens, curbs, and deck assemblies is specified in another Division 2 section, and designated on the Demolition Plans.
 - 3. Temporary protection of existing roof.

1.3 SPECIAL JOB CONDITIONS

- A. Remove only as much existing roofing as can be 100% replaced and made weathertight in the same day's operation, including flashing work.
- B. Prior to start of the work, photograph and video existing roof condition and correlate to name plan for location of photos. This is a record of existing conditions prior to start of work.

1.4 SUBMITTALS

- A. Submit a detailed removal plan to the Owner with the following:
 - 1. Outlining the means and methods to be utilized in the removal, transportation and disposal of the existing roof system and related debris.
 - 2. Proposed locations of chutes, dumpsters, cranes, hoists and other temporary equipment or facilities required for demolition work.
 - 3. Proposed methods for interior and exterior protection and clean-up during removal and roofing operations.
 - 4. Proposed plan for protection of existing roof to remain.
 - 5. Proposed plan for warranty continuity of existing roof.

1.5 REMOVAL AND DISPOSAL EQUIPMENT

- A. Conveyances: Buggies or wheelbarrows used on roofs to transport removed debris to chutes or crane apparatus location shall be limited to 3/8 cubic yard capacity.
- B. Chutes: Provide enclosed chutes for debris transfer from roof areas which are at a height of 10 feet or more. Debris shall not spill from the bottom of the chute directly onto the ground. Direct chutes into an approved construction debris container (dumpster). Control and contain dust and noise from falling debris by use of breaks in vertical alignment of chute or tarps covering dumpster. Provide a hose with a nozzle connected to an adequate water supply, near chute outlet to wet debris as necessary for dust control.
- C. Hoists/Cranes: Provide hoists or cranes to remove debris and transport materials to and from the roof. Materials shall be properly secured to prevent loose materials/debris from breaking loose from hoisting apparatus. Debris to be transported from the roof shall be

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placed directly in approved construction debris containers. Proper protection of wall areas for their entire height shall be provided in the form of heavy duty tarps secured or affixed to exterior walls directly adjacent to or under the area of hoisting.

- D. The use of "bobcat" type removal equipment on the roof is prohibited.
- E. Mechanical cutting equipment: Roof cutting equipment shall be equipped with operable blade depth setting mechanisms, in order to control the cutting depth of the blade and alleviate the potential of damaging the structural deck during cutting operations.
- F. Provide for daily clean up of roof area of loose material and debris which may become air borne FOD on the A.O.A.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. During the removal of existing roofing and related materials, the Contractor shall report to the OAR and Designer areas of damaged, deteriorated or otherwise unsuitable structural deck or framing materials uncovered during the work. Do not cover or remove unacceptable deck or framing areas until reviewed by the OAR and Designer. Provide temporary protection to the areas in question.
- B. See Phasing Drawing. Exterior wall will be removed from below the enclosed building. The existing wing substructure will remain in place and structure additional permanent steel constructed for proposed work.

3.2 REMOVALS

- A. Remove and dispose of existing roof systems, insulation, vapor retarder and membrane flashing materials. Set cutting blades of mechanical cutting equipment to proper depth so as not to score or damage the structural deck. Use care in the removal of membrane flashings, so as not to damage the substrates. Control visible emissions during roof removal and at dumpster level. Remove roofing materials down to the lightweight concrete fill or exposed steel deck. Sweep, clean and vacuum debris from deck.
- B. Remove and dispose of existing sheet metal edge metal, parapet caps, counterflashings, penetration flashings and related sheet metal items unless indicated on the drawings to remain.
- C. Remove and dispose of deteriorated perimeter wood blocking uncovered during demolition.
- D. Remove, disconnect and store existing rooftop mechanical equipment and vents (as necessary to perform work) for reinstallation. Removal and reinstallation of powered mechanical units shall be performed by a licensed tradesman and in accordance with Division 23 requirements. Coordinate all work with the OAR.
- E. Remove and dispose of deteriorated lightweight concrete decking components and associated materials uncovered during the roof removal operations. Make clean, delineated cuts between deteriorated and sound deck. Notify the Owner prior to removal of deteriorated deck.
- F. Remove and dispose of abandoned pipe and conduit penetrations. Verify current condition of equipment prior to removal. Coordinate removals with the OAR.

3.3 CLEAN-UP AND DISPOSAL

- A. Upon completion of the work of this section and following removal of debris from roof level, leave site in clean condition satisfactory to Owner on a daily basis in accordance with Division 01 requirements. Clean-up shall include disposal of all items and materials

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not required to remain property of the Owner as well as debris and rubbish resulting from demolition operations. Dispose of debris in accordance with applicable regulations at an approved landfill.

3.4 INSPECTION

- A. Inspect roof after removal of protection by representative of company providing warranty for reaffirmation of warranty and acceptance of roof.

END OF SECTION 02 41 19.07

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SECTION 03 20 00- CONCRETE REINFORCING

PART 1 - GENERAL

Applicable provisions of "General Conditions", "Special Conditions" and Division One, govern work under this Section.

1.01 DESCRIPTION

- A. Work Included: Labor and materials to complete all concrete reinforcing steel, indicated on Drawings, as specified herein, or both, for all site-cast concrete.
- B. Concrete Slabs for HVAC equipment.
- C. Foundations
- D. Filled cells, Lintels and Bond Beams
- E. Concrete sills, tie columns and tie beams
- F. Misc work and repairs associated with renovation work.

1.02 QUALITY ASSURANCE

- A. The Code of Standard Practice for Reinforcing Materials and Service, as published by the Concrete Reinforcing Steel Institute shall become a part of this Specification.
- B. Florida Building Code (latest adopted edition and revisions).
- C. American Concrete Institute (ACI).
- D. American Society for Testing and Materials (ASTM).

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Shop Drawings shall be prepared immediately on award of this Contract. No steel shall be ordered until shop drawings have been approved.
 - 2. Drawings shall indicate necessary information of fabrication and erection.
 - 3. Contract documents shall not be duplicated for use as shop drawing submittals.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Reinforcement: Shall conform to current standard specifications of ASTM.
- B. Bars: ASTM Specification A-615, Grade 60, for Billet-Steel Bars for concrete reinforcement.
 - 1. Provide special size bars where called for on Drawings.
- C. Accessories: Such as bolsters, spacers, ties, chairs, shall be hot-dipped

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galvanized furnished to permit proper placement of steel.

- D. Fabric: Shall be manufactured to meet ASTM Specifications A-185-79. Fabric shall be manufactured of cold drawn wire of size specified on Drawings and welded at intersections.

2.02 FABRICATION

- A. Shop drawings showing dimensions, bar schedules, bending details, stirrup spacing for all other details shall be submitted for approval before beginning of fabrication of reinforcing materials in accordance with requirements of General Conditions.
- B. All bars shall be shop fabricated and cut to required length.
- C. Bars with kinks, twists or bends, other than shown by approved shop drawings, not to be used.

2.03 CLEANING

- A. All reinforcing shall be free from rust, scale, grease or other coating which might prevent proper bond.
- B. Provide means at site for cleaning before placement.
- C. Where is delay in depositing concrete, reinforcement shall be reinspected and when necessary cleaned and retied.

2.04 STORAGE

- A. At site, in racks to keep steel at least 6" above ground.
- B. Protect, as required, against excessive rusting or mechanical injury.

PART 3 - EXECUTION

3.01 PLACING

- A. Placing of reinforcing shall be in strict accordance with Concrete Reinforcing Steel Institute, "Specifications for Placing of Reinforcements".
- B. Before placing reinforcing, all forms to be coated with form and release agents to avoid coating reinforcing steel.
- C. All reinforcing shall be placed accurately and held in position to prevent its displacement during concrete operations by using at intersections annealed wire of not less than No. 18 gauge. It shall be supported by metal chairs or spacers.
- D. All spacing shall be as shown on Drawings.
- E. Footing, Columns, Beams, Wall and Slab Reinforcement:

- 1. Unless otherwise shown, cover reinforcing with concrete to following thickness:

Footing Bottoms	3"
Walls	2"
Slabs	1"
Columns	1 1/2"
Beams	1 1/2"

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2. Support reinforcing at proper intervals and distances from forms by means of welded wire spacers or chairs.
 3. Separate multiple layers with approved spacers.
 4. All rods securely wired with No. 18 gauge annealed wire at all intersections with reinforcement and temperature rods, spacers or chairs.
 5. Wire fabric where shown, to extend to within 2" of all edges of slab or sections. Do not extend fabric across expansion joints. Lap adjacent sheets at least 6".
- F. Shrinkage and Temperature Reinforcement:
1. Where not otherwise shown on Drawings, provide temperature steel or mesh equivalent to a ratio of .003 reinforcement area to concrete area.
(For foundation, slabs, aprons, etc.).

END OF SECTION 03 20 00

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

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 cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Cast-in-place concrete includes the following:
 - 1. Foundations and footings.
 - 2. Slabs-on-grade, Equipment Pads.
 - 3. Concrete Beams.
 - 4. Concrete columns and tie columns
- C. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Section 03 20 00, Concrete Reinforcing
 - 2. Section 07 26 16, Below Grade Vapor Barrier

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and others if requested by Architect.
- C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
- D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
 - 1. Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.
- E. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:
 - 1. Color finishes.
 - 2. Normal weight aggregates.
 - 3. Fiber reinforcement.
 - 4. Reglets.

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5. Waterstops.
 6. Vapor retarder/barrier.
 7. Form liners.
 8. Expansion Joints
- F. Laboratory test reports for concrete materials and mix design test.
- G. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
- H. Minutes of preinstallation conference.
- 1.4 QUALITY ASSURANCE
- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 2. ACI 318-08, "Building Code Requirements for Reinforced Concrete."
 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.
- C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.
- D. Mockup: Cast mockup of size indicated or as required to demonstrate typical joints, form tie spacing, and proposed surface finish, texture, and color. Maintain sample panel exposed to view for duration of Project, after Architect's acceptance of visual qualities.
1. Demolish mockup and remove from site when directed by Architect.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" and the following:
1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:
 - a. Contractor's superintendent.
 - b. Agency responsible for concrete design mixes.
 - c. Agency responsible for field quality control.
 - d. Ready-mix concrete producer.
 - e. Concrete subcontractor.
 - f. Primary admixture manufacturers.

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- F. **No one, except for the concrete supplier's quality control representative is to be allowed to add water to the concrete after it leaves the plant. If water is added, the person authorizing it must legibly print his/her name and how much water was added and then sign the delivery ticket.**

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class I.
 2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.
- D. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Form Release WB; Lambert Corporation
 - b. Euco Super-Slip; Euclid
 - c. Cast-Off; Sonneborn
- E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches (38 mm) to the plane of the exposed concrete surface.
1. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- D. Deformed-Steel Welded Wire Fabric: ASTM A 497.
- E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs such as Besser Brick.

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2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
 1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
- B. Fly Ash: ASTM C 618, Type F.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
 1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
 2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
- D. Water: Potable.
- E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Air-Tite, Cormix Construction Chemicals.
 - b. Air-Mix or Perma-Air, Euclid Chemical Co.
 - c. Darex AEA or Daravair, W.R. Grace & Co.
 - d. MB-VR or Micro-Air, Master Builders, Inc.
 - e. Sealtight AEA, W.R. Meadows, Inc.
 - f. Sika AER, Sika Corp.
- G. Water-Reducing Admixture: ASTM C 494, Type A.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Chemtard, ChemMasters Corp.
 - b. PSI N, Cormix Construction Chemicals.
 - c. Eucon WR-75, Euclid Chemical Co.
 - d. WRDA, W.R. Grace & Co.
 - e. Pozzolith Normal or Polyheed, Master Builders, Inc.
 - f. Metco W.R., Metalcrete Industries.
 - g. Prokrete-N, Prokrete Industries.
 - h. Plastocrete 161, Sika Corp.
- H. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Q-Set, Conspec Marketing & Manufacturing Co.

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- b. Lubricon NCA, Cormix Construction Chemicals.
 - c. Accelguard 80, Euclid Chemical Co.
 - d. Daraset, W.R. Grace & Co.
 - e. Pozzutec 20, Master Builders, Inc.
 - f. Accel-Set, Metalcrete Industries.
- I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. PSI-R Plus, Cormix Construction Chemicals.
 - b. Eucon Retarder 75, Euclid Chemical Co.
 - c. Daratard-17, W.R. Grace & Co.
 - d. Pozzolith R, Master Builders, Inc.
 - e. Protard, Prokrete Industries.
 - f. Plastiment, Sika Corporation.

2.4 RELATED MATERIALS

- A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217- inch- (0.46-mm-) thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (0.76 mm) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
- C. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.
- D. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as indicated on the drawings.
- E. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - a. EMAG; Lambert Corporation
 - b. Euco Non-slip; Euclid
 - c. Frictex NS; Sonneborn
- F. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m), complying with AASHTO M 182, Class 2.
- G. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. Polyethylene-coated burlap.

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- H. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft./gal (4.9 sq. m/L).
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.
 - b. Spartan-Cote, The Burke Co.
 - c. Conspec #1, Conspec Marketing & Mfg. Co.
 - d. Sealco 309, Cormix Construction Chemicals.
 - e. Day-Chem Cure and Seal, Dayton Superior Corp.
 - f. Eucocure, Euclid Chemical Co.
 - g. Horn Clear Seal, A.C. Horn, Inc.
 - h. L&M Cure R, L&M Construction Chemicals, Inc.
 - i. Masterkure, Master Builders, Inc.
 - j. CS-309, W.R. Meadows, Inc.
 - k. Seal N Kure, Metalcrete Industries.
 - l. Kure-N-Seal, Sonneborn-Chemrex.
 - m. Stontop CS2, Stonhard, Inc.
 - n. Lambco 120, Lambert Corporation
- I. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aquafilm, Conspec Marketing and Mfg. Co.
 - b. Eucobar, Euclid Chemical Co.
 - c. E-Con, L&M Construction Chemicals, Inc.
 - d. Confilm, Master Builders, Inc.
 - e. Waterhold, Metalcrete Industries.
 - f. Lambco Skin, Lambert Corporation
- J. Bonding Agent: Polyvinyl acetate or acrylic base; ASTM C-1059.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Polyvinyl Acetate (Interior Only):
 - 1) Superior Concrete Bonder, Dayton Superior Corp.
 - 2) Euco Weld, Euclid Chemical Co.

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- 3) Weld-Crete, Larsen Products Corp.
 - 4) Everweld, L&M Construction Chemicals, Inc.
 - 5) Herculox, Metalcrete Industries.
 - 6) Ready Bond, Symons Corp.
 - 7) Hibond; Lambert Corporation
- b. Acrylic:
- 1) Acrylic Bondcrete, The Burke Co.
 - 2) Strongbond, Conspec Marketing and Mfg. Co.
 - 3) Day-Chem Ad Bond, Dayton Superior Corp.
 - 4) FlexCon, Euclid Chemical Co.
 - 5) Daraweld C, W.R. Grace & Co.
 - 6) Hornweld, A.C. Horn, Inc.
 - 7) Everbond, L&M Construction Chemicals, Inc.
 - 8) Acryl-Set, Master Builders Inc.
 - 9) Intralok, W.R. Meadows, Inc.
 - 10) Acrylpave, Metalcrete Industries.
 - 11) Sonocrete, Sonneborn-Chemrex.
 - 12) Stonlock LB2, Stonhard, Inc.
 - 13) Strong Bond, Symons Corp.
 - 14) Acrylbond, Lambert Corporation
- K. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements. **No substitutions will be accepted.**
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hilti - HY 150 MAX, HIT-RE 500.
 - b. Powers – PE1000, AC100+ Gold.
 - c. Simpson Strong Tie – SET XP, SET, AT, AT XP, ET-HP
 - d. Euco Epoxy System #452, Euclid Chemical Co.
 - e. Red Head A7, C6 and G5 Epoxy
- L. Joint Protector shall be furnished to protect saw cut joints at intersections of joints as follows:
1. While cutting a new joint across a previously cut fresh joint to prevent the corners from breaking down on the previous cut, insert the proper Soff-Cut Joint Protector. Place the Joint Protector into the previous cut, flush with the top surface. An additional Joint Protector may be used to prevent breakdown where the drive wheels of the saw crosses the initial cut. After proper installation, cut through the joint protector and do not remove until the concrete has permanently set.

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- M. Warehouse floors that will receive hard wheel industrial vehicular traffic shall be provided with a special metallic or mineral aggregate surface hardener and repeated hard steel-troweling.

2.5 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
 - 1. Do not use the same testing agency for field quality control testing.
 - 2. Limit use of fly ash to not exceed 20 percent of cementitious material by weight.
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.
- C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules shall be provided as shown below when strength data from field experience or trial mixtures are not available.
 - 1. 4000 psi, 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air-entrained), 0.35 maximum (air-entrained).
 - 2. 3000 psi, 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained).
- D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
 - 1. Subjected to freezing and thawing: W/C 0.45.
 - 2. Subjected to deicers/watertight: W/C 0.40.
 - 3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.
- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 - 1. Ramps and sloping surfaces: Not more than 4 inches.
 - 2. Reinforced foundation systems: Not more than 4 +/- 1 inches.
 - 3. Slabs: Not more than 4 +/- 1 inches.
 - 4. Other concrete: Not more than 5 inches.
- F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.6 ADMIXTURES

- A. Use water-reducing admixture in concrete, as required, for placement and workability.
- B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
- C. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

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1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
 - a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2 inch (38 mm) maximum aggregate.
 - b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1 inch (25 mm) maximum aggregate.
 - c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4 inch (19 mm) maximum aggregate.
 - d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2 inch (13 mm) maximum aggregate.
 2. Concrete slabs not exposed to freezing, thawing, or hydraulic pressure: 0 to 2 percent air.
 3. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.
- D. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING

- A. Job-Site Mixing: Mix concrete materials in appropriate drum-type batch machine mixer. For mixers of 1 cu. yd. (0.76 cu. m) or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than 1 cu. yd. (0.76 cu. m), increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
1. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- B. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
1. Provide Class A tolerances for concrete surfaces exposed to view.
 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings,

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offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Provisions for Other Trades: Coordinate openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION

- A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended mastic or pressure-sensitive tape.
 - 1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.4 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
 - 1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, besser brick, and hangers, as approved by Architect.

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- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and tie splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect. Construction joints shall be per FBC Sections 1907.4.1 and 1907.4.2 (cleaned, laitance removed, wetted, standing water removed).
- B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.
- F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."
- G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab unless otherwise indicated.
 - 1. Form contraction joints in exterior slabs by inserting 1/4" wide premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 - 2. If joint pattern is not shown, provide joints not exceeding 15 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
 - 3. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

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- B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
 - C. Install dovetail anchor slots in concrete structures as indicated on drawings.
 - D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.
- 3.7 PREPARING FORM SURFACES
- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
 - B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
 - 1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.
- 3.8 CONCRETE PLACEMENT
- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
 - B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified. Concrete shall be per FBC 1906.4.2 and shall be carried on at such a rate that the concrete is at all times plastic. Prohibit the following concrete per FBC 1906.4.3 and 1906.4.4, partially hardened concrete, contaminated concrete, re-tampered concrete or concrete that has been re-mixed after it has taken its initial set.
 - C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
 - D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
 - E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

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1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures and as follows:

1. Minimum Concrete placement temperatures as a function of thickness:

<12 inches	12-26 inches	36-72 inches	>72 inches
55 degrees F	50 degrees F	45 degrees F	40 degrees F

Once the concrete has been placed, it must be maintained at a temperature above 50 degrees F for a period of 72 hours to allow for adequate curing.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients (if required) before mixing to maintain concrete temperature at time of placement to below 100 deg F (35 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster,

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painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

- C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.
 - 1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
 - 1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
 - 1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

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- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.
 - 1. After completing float finishing and before starting trowel finish, uniformly spread dampened nonslip aggregate at a rate of 25 lb per 100 sq. ft. (12 kg/10 sq. m) of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.
 - 2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items if required by Architectural drawings. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling. Suggest a wet cure time of 7 days minimum at 50 degrees minimum temperature per ACI 318-02 section 5.11.1 and FBC section 1906.5.1.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified. **It is highly recommended that one of the moist cure methods be used.**
- D. Provide moisture curing by the following methods:

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1. Keep concrete surface continuously wet by covering with water.
 2. Use continuous water-fog spray.
 3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.
- E. Provide moisture-retaining cover curing as follows:
1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.
1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

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3.14 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.
- B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.
 - 1. Cut out honeycombs, rock pockets, voids over 1/4 inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 - 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
 - 1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
 - 1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 - 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

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3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- F. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Architect.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Contractor (unless provided by Owner) will employ an independent testing agency to perform tests and to submit test reports.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.
1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one test at point of placement (end of hose if pumped) for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 - d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. (4 cu. m) plus additional sets for each 50 cu. yd. (38 cu. m) more than the first 25 cu. yd. (19 cu. m) of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

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2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
 4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).
- C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 03 30 00

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SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 RELATED SECTIONS:

- A. Section 03 30 00 – Cast-in-Place Concrete.
- B. Section 04 71 13 – Reinforced Unit Masonry

1.03 CODES AND SPECIFICATIONS:

- A. Codes and Specifications:

All concrete masonry construction shall conform to the requirements of the local building code and the following codes:

1. Building Code Requirements for Masonry Structures, ACI 530-08.
2. Building Code for Masonry Structures, The Masonry Society (TMS) Document No. 402-08.

1.04 DESCRIPTION OF WORK:

- A. Extent of each type of masonry work is indicated on the architectural and structural drawings and in schedules. Provide all labor, materials, equipment, and services necessary for and incidental to the installation of all masonry construction as indicated on the drawings and specified herein.

Masonry construction includes non-reinforced concrete masonry including concrete filled masonry beams, columns, pilasters, lintels, and soffits. Accessories include, but are not necessarily limited to ties, horizontal and vertical reinforcement, anchors to the structure, and control joints.

- B. The masonry contractor shall install all accessory items that are required in the work and supplied by others, including: bolts, nailing blocks, inserts, anchors, flashing, lintels, expansion joints, conduits, etc.
- C. Types of masonry work required include:
 1. Concrete unit masonry (CMU).

1.05 QUALITY ASSURANCE:

- A. Single Source Responsibility for Masonry Units:

Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

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B. Single Source Responsibility for Mortar Materials:

Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

C. Fire Performance Characteristics:

Where indicated or required, provided materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

1.06 SUBMITTALS:

A. Product Data and Samples:

1. Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements. Provide certification of pull-out strength of all masonry ties and anchors. Submit certification of compliance with required standards for all masonry units. Submit one sample each of all masonry accessories items.
2. Submit unit masonry samples for each type of exposed masonry required, including all special shapes. Include colors and textures to be expected in completed work.

B. Mix Designs:

Mix designs for mortar and grout specifying type, source, and brand of all materials shall be submitted for Engineer and Owner testing laboratory approval prior to start of the work. Mix designs shall be submitted only for structural load bearing walls and exterior walls subjected to wind load.

C. Certificates:

1. Prior to delivery, submit to Architect/Engineer certificates attesting compliance with the applicable specifications for grades, types or classes included in these specifications.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes.
- C. Limit moisture absorption of concrete masonry units during delivery and until time of installation to the maximum percentage specified for Type I units for the average annual relative humidity as reported by the U.S. Weather Bureau Station nearest project site.
- D. Store cementitious materials and masonry units off the ground, under cover and in dry location. All materials must be protected from wetting by capillary action, rain, or snow, and

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protected from mud, dust, or other materials and contaminants likely to cause staining or defects.

- E. Store aggregates where grading and other required characteristics can be maintained.
- F. Store masonry accessories including metal items to prevent deterioration by corrosion or accumulation of dirt.
- G. Store mortar materials on dunnage, in a dry place. During freezing weather, protect masonry units with tarpaulins or other suitable material.
- H. Protect reinforcement and accessories from elements.

1.08 PROJECT CONDITIONS:

A. Protection of Work:

The Contractor shall construct and maintain temporary protection as required to permit continuous progress of the work. During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

- 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- 2. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.
- 3. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS:

- A. Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.
- B. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bond beams, knock out panels, and other special conditions. All special shapes provided shall match approved samples.
- C. Provide square-edged units for outside corners, except where indicated as bullnose.
- D. Provide units complying with characteristics indicated below for Grade, Type, face size, exposed face and, under each form of block included, for weight classification.
 - 1. Size:
 - a. Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thicknesses indicated unless shown otherwise on the drawings. The Contractor shall furnish all required sizes and shapes as required to complete the work.

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2. Type II, non-moisture-controlled units.
3. Hollow Loadbearing Block:
ASTM C 90 normal weight.

2.02 MORTAR AND GROUT MATERIALS:

A. Portland Cement:

ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color.

B. Hydrated Lime:

ASTM C 207, Type S.

C. Quicklime:

ASTM C5.

D. Aggregate for Mortar:

ASTM C 144, except for joints less than 1/4" use aggregate graded with 100% passing the No. 16 sieve.

E. Coarse Aggregate for Grout:

ASTM C404, maximum size 3/8".

F. Water:

Clean and potable. Mixing water must be free of harmful amounts of acids, alkalis, organic materials, or other substances that would adversely affect the quality or appearance of the mortar or the masonry units.

G. Proprietary Mortar Mixes:

Proprietary mortar mixes may not be used.

2.03 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES:

A. General:

1. Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics:
2. Manufacturers:
 - a. Subject to compliance with requirements, provide products of one of the following:
 - (i) AA Wire Products Co.

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- (ii) Dur-O-Wall, Inc.
- (iii) Hohmann & Barnard, Inc.
- (iv) National Wire Products Corp.

- b. Other manufacturers shall be used only with Engineer approval. The Contractor shall submit technical literature for all reinforcing units.

B. Hot-Dip Galvanized Steel Wire:

ASTM A 82 for uncoated wire and with ASTM A 153, Class B-2 (1.5 oz. per sq. ft. of wire surface) for zinc coating applied after prefabrication into units.

- 1. Application: Use for masonry exposed to exterior and in contact with earth.

C. Zinc-Coated (Galvanized) Steel Sheet:

Carbon steel with zinc coating complying with ASTM A 525, Coating Designation G90.

- 1. Application: Use for dovetail slots and where indicated.

D. Hot-Dip Galvanized Carbon Steel Sheet:

ASTM A 366, Class 2 or ASTM A 635; hot-dip galvanized after fabrication to comply with ASTM A 153, Class B.

- 1. Application: Use for anchors.

E. Joint Reinforcement:

Provide welded-wire units prefabricated with deformed continuous side rods and plain cross rods in straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:

- 1. Width: Fabricate joint reinforcement in units with widths a minimum of 2" less than nominal width of walls. Provide mortar coverage over joint reinforcement of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.
- 2. Wire Size for Side and Cross Rods:
 - a. 0.1483" diameter (9 ga.) for all masonry construction except as noted below.
 - b. 0.1875" diameter (6 ga.) for loadbearing or reinforced concrete masonry construction.
- 3. For single-wythe masonry provide type as follows with single pair of side rods:
 - a. Ladder design with perpendicular cross rods spaced not more than 16" o.c.

F. Bend-Wire Ties:

Provide individual prefabricated bent-wire units complying with requirements indicated below:

- 1. Wire Size: 0.1875" diameter.

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2. Length: Provide units of length indicated but not less than that required for embedment into each wythe of 2" for solid units and for a minimum of 2" embedment of tie end into face shells of hollow units, with not less than 5/8" mortar cover on exterior face joints, 1/2" elsewhere.
3. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with ends welded closed and not less than 2" wide.
4. Tie Shape for Solid Masonry Unit Construction: Z-shaped ties with ends bent 90° to provide hooks not less than 2" long.
5. Type for Masonry Where Coursing Between Wythes Align: Unit ties bent from one piece of wire.
6. Type for Masonry Where Coursing Between Wythes Does Not Align: Adjustable ties composed of two parts, one with a pintle, the other with an eye.

G. Flexible Anchors:

Where flexible anchors are indicated for connecting masonry to structural framework, provide 2-piece anchors as described below which permit vertical or horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall.

1. For anchorage to concrete framework, provide manufacturer's standard anchors with dovetail anchor section formed from 0.1046" (12 gage) thick sheet metal and triangular-shaped wire tie section sized to extend within 1" of masonry face.
2. For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4" diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1" of masonry face.
3. Wire Size: 0.1875" diameter.

H. Rigid Anchors:

Provide straps of form and length indicated, fabricated from sheet metal strips of following width and thickness, unless otherwise indicated. Typical length to be 24" plus 2" long, 90° bends at ends.

1. Width: 1-1/4".
2. Thickness: 1/4".

I. Unit Type Masonry Inserts in Concrete:

Furnish cast iron or malleable iron inserts of type and size indicated.

J. Dovetail Slots:

Furnish dovetail slots, with filler strips, of slot size indicated, fabricated from 0.0336" (22 gage) sheet metal.

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K. Anchor Bolts:

Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM C 153, Class C, in sizes and configurations indicated.

2.04 MISCELLANEOUS MASONRY ACCESSORIES:

A. Reinforcing Bars:

Deformed steel, ASTM A 615, Grade 60.

B. Non-Metallic Expansion Joint Strips:

Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE 41E1, capable of compression up to 35%, of width and thickness indicated.

C. Premolded Control Joint Strips:

Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Premolded PVC Control Joint Strips. Strips shall be polyvinyl chloride complying with ASTM D 2287, Type PVC 654-4 with a durometer hardness of 90.

D. Bond Breaker Strips:

Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.05 MASONRY CLEANERS:

A. Job-Mixed Detergent Solution:

Solution of trisodium phosphate (1/2 cup dry measure) and laundry detergent (1/2 cup dry measure) dissolved in one gallon of water.

2.06 MORTAR AND GROUT MIXES:

A. General:

1. Do not add admixtures including coloring pigments, air-entraining agent, accelerators, retarders, water repellent agent, anti-freeze compounds or other admixtures.
2. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry:

Comply with ASTM C 270, Proportion Specification, for types of mortar required, unless otherwise indicated. Minimum twenty-eight day compressive strength shall be 1800 psi.

1. Limit cementitious materials in mortar to portland cement-lime.
2. Use Type S mortar for reinforced masonry unless noted otherwise.

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3. Mortar mix design shall conform to Florida Building Code (FBC) requirements.
- C. Grout for Unit Masonry:
1. Comply with ASTM C476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Minimum twenty-eight day compressive strength shall be 3000 psi.
 2. Use fine grout in grout spaces less than 2" in horizontal direction, unless otherwise indicated. Fine grout shall be composed of one part portland cement, to which may be added not more than one-tenth part hydrated lime or lime putty, and two and one-fourth to three parts sand.
 3. Use coarse grout in grout spaces 2" or more in least horizontal dimension, unless otherwise indicated. Coarse grout shall be composed of one part portland cement to which may be added not more than one-tenth part hydrated lime or lime putty, and two to three parts sand, and not more than two parts gravel.
 4. Satisfy all local codes for maximum aggregate size with respect to minimum clear opening to be grouted.
 5. Do not add admixtures to grout.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL:

- A. Inspect surfaces that are to support masonry work to assure completion to proper lines and grades free of dirt and other deleterious material. Do not begin work until surfaces not properly prepared have been satisfactorily corrected.
- B. Do not wet concrete masonry units.
- C. Cutting masonry units:
 1. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous patterns and to fit adjoining work. Use full-size units without cutting where possible.
 2. Use dry cutting saws to cut concrete masonry units.
- D. Match bonding, coursing height, jointing, color, and texture of new masonry work with existing masonry work.

3.02 CONSTRUCTION TOLERANCES:

- A. Variation from Plumb:

For vertical lines and surfaces of columns, walls and arises do not exceed 1/4" in 10 feet, or 3/8" in a story height not to exceed 20 feet, nor 1/2" in 40 feet or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story

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or 20 feet maximum, nor 1/2" in 40 feet or more. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10 feet, 1/2" maximum.

B. Variation from Level:

For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20 feet maximum, nor 1/2" in 40 feet or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10 feet or 1/16" within width of a single unit.

C. Variation of Linear Building Line:

For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20 feet maximum, nor 3/4" in 40 feet or more.

D. Variation in Cross-Sectional Dimensions:

For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".

E. Variation in Mortar Joint Thickness:

Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.03 LAYING MASONRY WALLS:

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to accurately locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

C. Pattern Bond:

Lay exposed masonry in the bond pattern shown or indicated. If not shown or indicated, lay in running bond with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work:

Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces at set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-in Work:

Install bolts, anchors, nailing blocks, inserts, frames, vent flashings, conduit, and other built-in items specified under this and other sections of these specifications as masonry work

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progresses. Avoid cutting and patching. Solidly grout spaces around built-in items. Provide joints around exterior framed openings 1/4" to 3/8" wide, raked and tooled smooth to a uniform depth of 3/4", ready for caulking by others. Build chases, do not cut. Consult other trades in advance and make provisions for installation of their work to avoid cutting and patching. Install chases minimum of one full masonry unit length from jambs.

1. Fill in space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core, unless detailed otherwise.
3. Fill cores in hollow concrete masonry units with grout to supporting beam or slab below under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

F. Bondbreaker Strips at Corners:

Unless shown otherwise, provide bondbreaker strips between concrete foundation and first masonry course for a length of 3 feet each direction from all corners.

G. Bond pattern layout of Ramp Level exterior walls shall be stacked bond to match existing.

3.04 MORTAR BEDDING AND JOINTING:

- A. Provide uniform nominal joint thickness as shown below, unless noted otherwise on the drawings:
 1. Concrete Masonry Units 3/8"
- B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells of cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- C. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8" joints.
- D. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners of jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.
- E. Provide weatherproof, concave, tooled joints in exposed surfaces when mortar is thumbprint hard, using round jointing tool. Strike joints flush in surfaces to be plastered, stuccoed, or covered with other material or surface-applied finish other than paint. Remove mortar protruding into cells or cavities to be grouted. Do not permit mortar droppings to fall into cavities of multi-wythe walls or to block weep holes. Do not fill horizontal joints between top of masonry partitions and underside of concrete or steel construction with mortar unless specifically shown on the drawings. If not shown otherwise, provide 1" clear joint to be filled with caulk. Keep movement joints clean of all mortar and debris. For tuckpointing, rake mortar joints to a depth of 1/2 to 3/4 in., saturate with clean water, fill solidly with pointing mortar, and tool to match existing joints.

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3.05 HORIZONTAL JOINT REINFORCEMENT:

A. General:

1. Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6" at splices.
2. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
3. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.
4. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
5. Space continuous horizontal reinforcement as follows:
 - a. For single-wythe walls, laid in running bond space reinforcement at 16" o.c. vertically, unless otherwise indicated.
 - b. For masonry walls laid in stacked bond, concrete masonry cantilever walls and fences, space reinforcement at 8" o.c. vertically, unless otherwise indicated.
6. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in two horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints. Horizontal joint reinforcement interrupted by the jamb of an opening shall have the cross rod or side rod bent and hooked at the jamb. Provide an additional rectangular adjustable tie at the jamb for each joint not containing the normal horizontal reinforcing unit.
7. Provide reinforcement at openings in addition to other specified wall reinforcement.

3.06 ANCHORING MASONRY WORK:

A. General:

1. Provide anchor devices of type indicated.
- B. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following, unless noted otherwise on the drawings:
1. Provide an open space not less than 1" in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

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3. Space anchors as indicated, but not more than 24" o.c. vertically and 24" o.c. horizontally.
- C. Where wire ties are welded to structural members, paint welded area with Z.R.C. Cold Galvanizing Compound after welding.
 - D. Anchor single wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:
 1. Fasten each anchor section through sheathing to metal studs with 2 metal fasteners of type indicated.
 2. Embed tie section at least 2" into masonry joints. Provide not less than 1" air space between back of masonry veneer wythe and face of sheathing.
 3. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.
 4. Space anchors at not more than 16" o.c. vertically and 24" o.c. horizontally. Install additional anchors within 1'-0" of openings and at intervals around perimeter not exceeding 3'-0".

3.07 GROUTING

- A. Fully grout vertical cells of concrete masonry containing steel reinforcement. Wherever possible, grouting shall be done from inside face of masonry. Exercise extreme care to prevent grout from staining face of masonry. Immediately remove any spilled grout from face and top of masonry.

3.08 CONTROL AND EXPANSION JOINTS:

- A. General:
 1. Provide vertical and horizontal expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.
- B. Where control joints are not indicated on the drawings the Contractor shall submit a proposed control joint layout for Architect and Engineer approval. General guidelines for control joint locations are as follows:
 1. At major changes in wall height
 2. At changes in wall thickness
 3. At corresponding control joints in foundations, floor, or roof construction
 4. At one or both sides of wall openings (masonry veneer only)
 5. Near wall intersections
 6. At column centerlines.
- C. Maximum Spacing:

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Maximum control joint spacing shall be as follows:

1. Non-Reinforced Masonry. Ratio of wall length to height shall not exceed 3 with maximum spacing of fifty feet.

3.09 LINTELS

- A. Provide masonry lintels where shown or required, and wherever openings of more than 2'-0" are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels until grout is properly cured.
 1. For hollow concrete masonry unit walls, use specially formed U-shaped lintel units with reinforcement bars filled with coarse grout.
- B. Provide minimum bearing of 8" at each jamb, unless otherwise indicated.

3.10 FLASHING OF MASONRY WORK

- A. Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar. Extend flashings through exterior face of masonry and turn down to form drip.
- B. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4", and through the inner wythe to within 1/2" of the interior face of the wall is exposed work. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2". At heads and sills turn up ends not less than 2" to form a pan.

3.11 REPAIR, POINTING, AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing:
 1. During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Pointup all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants. If the repairs must be made after the mortar has hardened, the joint must be raked or chiseled out to a depth of about 1/2" thoroughly wetted, and repointed with fresh mortar.
 2. To prehydrate mortars, thoroughly mix all ingredients except water in proportions used for original mortar mix; then mix again, adding only enough water to produce a damp unworkable mix which will retain its form when pressed into a ball. After 1 to 2 hours, add sufficient water to bring it to the proper consistence; that is conventional masonry mortars.

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- C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - 2. Clean concrete unit masonry to comply with masonry manufacturer's directions and applicable NCMA "Tek" bulletins.

- D. Protection and Cleanup
 - 1. Provide final protection and maintain conditions in a manner acceptable to Installer, which ensure unit masonry work being without damage and deterioration at time of substantial completion.
 - 2. Leave work area and surrounding surfaces clean and free of mortar spots, droppings, and broken masonry.

END OF SECTION 04 20 00

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SECTION 04 71 13 – REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Requirements of Section 04 20 00 – Unit Masonry apply to work of this Section.

1.02 SCOPE OF WORK:

- A. Extent of reinforced unit masonry work is indicated on drawings. Provide all labor, materials, equipment, and services necessary for and incidental to the installation of all reinforced unit masonry construction as indicated on the drawings and specified herein. Reinforced unit masonry construction includes reinforced concrete masonry walls, including grout filled masonry columns, pilasters, beams, and lintels. Accessories include, but are not necessarily limited to ties, horizontal and vertical reinforcement, anchors to the structure, and control joints.

1.03 SUBMITTALS:

- A. Mill Certificates: Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcement steel required for project.
- B. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars and for steel templates for layout of dowels for columns and pilasters. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of all reinforcement for reinforced unit masonry work.
- C. Formwork Design Calculations: Prepared and sealed by a Professional Engineer licensed in the State of Florida.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. General: Refer to Section 04 20 00 – Unit Masonry for masonry materials and accessories not included in this Section.
- B. Reinforcement Bars: Provide deformed bars of following grades complying with ASTM A615, except as otherwise indicated.
 - 1. Provide Grade 60 for bars No. 3 to No. 11, except as otherwise indicated.
 - 2. Where No. 2 bars are shown, provide plain, round, carbon steel bars, ASTM A675, Grade 80.
 - 3. Shop fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

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3.01 GENERAL:

- A. Refer to Section 04 20 00 – Unit Masonry for general installation requirements of unit masonry.

3.02 PLACING REINFORCEMENT:

- A. General: Clean reinforcement of loose rust, mill scale, earth, or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 8'-0".
- C. For columns, piers, and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2", whichever is greater. Provide lateral ties as indicated.
- D. All dowels shall be grouted into a cell with vertical reinforcement. Unless detailed otherwise on the drawings, dowels shall be the same size and number as the vertical steel. Unless noted otherwise provide a lap length of dowels to vertical reinforcement equal to 50 times the nominal dowel diameter. Dowels for columns and pilasters shall be set using 1/8" thick steel plate templates. Templates shall be detailed and submitted with reinforcing steel shop drawings.
- E. All horizontal reinforcing steel shall be placed in continuous bond beam or lintel block units and shall be solidly grouted in place. Maintain a minimum of one bar diameter or 1" (whichever is greater) clearance between adjacent bars. Horizontal reinforcement may be placed as the masonry work progresses.
- F. Splice reinforcement bars as indicated. Do not splice at other points unless acceptable to Architect/Engineer. Where splices occur, adjacent splices shall be staggered so that no more than 25% of the total number of bars are spliced at any one point, with a minimum stagger between splices in adjacent bars of at least the lap length. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact, and tie with wire. Minimum lap splice length shall be 50 bar diameters unless indicated otherwise.
- G. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.

3.03 FORMWORK:

- A. Temporary Formwork: Provide formwork and shoring as required for temporary support of reinforced unit masonry elements.
- B. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
- C. Formwork shall be designed and shop drawings prepared by a Professional Engineer licensed in the State of Florida.

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- D. Formwork shall not be removed until the reinforced masonry element has cured sufficiently to carry its own weight and any other loads that may be placed on it during construction. Allow not less than the following minimum time to elapse after completion of the element before removing shores or forms provided adequate curing conditions have been maintained during the full curing period:
1. Lintels and beams: 10 days.
 2. Allow 16 hours to elapse after completion of masonry columns and walls before placing floor or roof construction loads. Allow an additional 48 hours before applying concentrated loads such as girders, beams, or trusses.

3.04 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY:

A. General:

1. Do not wet concrete masonry units (CMU).
2. Lay CMU with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to but not less than the thickness of longitudinal face shells. Solidly bed all cross-webs in mortar. Maintain head and bed joint widths indicated, or if not indicated, provide 3/8" joints.
 - a. Where solid CMU are shown, lay with full mortar head and bed joints.

B. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2 stack bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams, and other special conditions.
2. Maintain vertical continuity of core or cell cavities which are to be reinforced and grouted to provide minimum clear dimensions indicated or required, and to provide maximum grout coverage for vertical reinforcing bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontal reinforced beams (bond beams) are indicated or required, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joint under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

C. Columns, Piers, and Pilasters:

1. Use CMU of the size, shape and number of vertical core spaces indicated. If not indicated, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars indicated.
2. Provide pattern bond indicated, or if not indicated, alternate head joints in vertical alignment.

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3. Where bonded pilaster construction is indicated, lay wall and pilaster inits together to maximum pour height specified.

D. Grouting:

1. General:
 - a. Use "Fine Grout" per ASTM C476 for filling spaces less than 4" in one or both horizontal directions.
 - b. Use "Coarse Grout" per ASTM C476 for filling spaces 4" or larger in both horizontal directions.
 - c. Use 3000 psi normal weight concrete for filling spaces 10" and larger in both directions.
 - d. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.
2. Low-Lift Grouting:
 - a. Provide minimum clear dimension of 2" and clear area of 8 square inches in vertical cores to be grouted.
 - b. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diametes nor 8'-0".
 - c. Lay CMU to maximum pour height. Do not exceed 5 feet height, or if a bond beam occurs below 5 feet height stop pour at course below bond beam.
 - d. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top of course of pour.
 - e. Bond Beams: Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections. Place grout in bond beam course before filling vertical cores above bond beam.
3. High-Lift Grouting:
 - a. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 3" and 10 square inches, respectively.
 - b. Provide clean-out holes in the first course of masonry, and over all bond beams, door headers, or other openings. Use a high pressure water jet to remove excess mortar and drippings from grout core and from reinforcement.
 - c. Do not plug clean-out holes until condition of area to be grouted has been accepted.
 - d. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
 - e. Limit grout lifts to a maximum height of 5 feet and grout pour to a maximum height of 20 feet, for single wythe hollow concrete masonry walls, unless otherwise indicated.
 - f. Place horizontal beam reinforcement as the masonry units are laid.
 - g. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing indicated.
4. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Premove dust, dirt, mortar droppings, loose pieces of masonry, and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close clean-out holes and brace closures to resist grout pressures.

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5. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
6. Place grout by pumping into grout spaces.
7. Place grout in lintels or beams over openings in one continuous pour.
8. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.
9. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

E. Anchoring:

1. Anchor reinforced masonry work to supporting structure as indicated.
2. Anchor reinforced unit masonry walls to non-reinforced masonry where they intersect, unless shown otherwise.

3.05 QUALITY CONTROL:

A. Masonry Prisms shall be made and tested in accordance with Section 04 20 00 – Unit Masonry.

1. If the coefficient of variation of the compression samples tested exceeds 12%, obtain compressive strength by multiplying average compressive strength of specimens by

$$1 - 1.5 \frac{(v - 0.12)}{(100)}$$

where v is the coefficient of variation of sample tested.

B. Prism Strength:

1. Compressive Strength, f'm. The compressive strength of reinforced concrete masonry, f'm, as determined by prism tests shall be as indicated below:

Class of Reinforced Unit Masonry	28 Day Compressive Strength, f'm
----------------------------------	----------------------------------

- | | |
|---------------------------------|----------|
| a. Single Wythe Grouted Masonry | 3000 psi |
|---------------------------------|----------|

END OF SECTION 04 71 13

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SECTION 05 12 13 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, apply to work of this section.

1.02 DESCRIPTION OF WORK

- A. Extent of structural steel work is shown on drawings including schedules, notes and details which show size and location of members, typical connections, and type of steel required. Furnish all labor, materials, services, equipment and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel defined below. Include all supplementary parts, members and connections necessary to complete the structural steel work, regardless of whether all such items are specifically shown or specified on the drawings.
- B. Structural steel shall be defined as that work prescribed in Section 2.1 of the AISC Code of Standard Practice and the following items: shelf angles, angle frames for openings in floors and roofs, support frames for elevator machines not otherwise furnished by the elevator manufacturer, steel floor framing supporting elevator equipment, all steel supports for elevator guide rails, steel crane and rails and stops, miscellaneous metal deck support and edge angles, shop welded metal studs, all connection material, temporary construction bracing, and all other structural steel shown or specified on the drawings to be part of the work. Labor shall include shop painting as specified, field touch-up painting, and grouting of base plates and bearing plates.
- C. Miscellaneous metal fabrications, architecturally exposed structural steel, metal stairs, steel joists, and metal deck are specified elsewhere in these Specifications.

1.03 QUALIFICATIONS

A. Fabricator:

The structural steel fabricator shall have not less than 5 years experience in the successful fabrication of structural steel similar to this project. Evidence of compliance with this section shall be submitted to the Architect/Engineer.

The structural steel fabricator shall have not less than 5 years experience in the successful fabrication of structural steel including not less than three projects using trusses.

B. Erector:

The structural steel erector shall have not less than 5 years successful experience in the erection of structural steel of a similar nature to this project. Evidence of compliance with this section shall be submitted to the Architect/Engineer.

The structural steel erector shall have not less than 5 years successful experience in the erection of structural steel including not less than three projects using trusses.

1.04 QUALITY ASSURANCE

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The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

A. Codes and Standards:

Comply with provisions of following, except as otherwise indicated:

1. All federal (OSHA), state and local laws which govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below.
2. AISC "Code of Standard Practice for Steel Buildings and Bridges", adopted September 1, 1986, except delete the following sentence from Section 4.2.1 of the Code: "This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as a part of his preparation of these shop drawings."
3. AISC "Specification for Structural Steel Buildings", including Commentary, effective June 1, 1989, and supplements thereto as issued. (All steel framing except single-span composite beams.)
4. AISC "Allowable Stress Design Specification for Structural Steel Buildings" ninth edition, including Commentary, effective September 1, 1986. (Single-span composite beams.)
5. AISC "Specification For The Design of Steel Hollow Structural Sections", effective April 15, 1997.
6. AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (Research Council on Structural Connections), November 13, 1985.
7. AWS D1.1 "Structural Welding Code - Steel".
8. "Steel Structures Painting Manual", Volumes 1 and 2, Steel Structures Painting Council.

B. Qualifications for Welding Work:

Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code - Steel".

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
2. If recertification of welders is required, retesting will be Contractor's responsibility.

C. Source Quality Control:

Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the Owner's testing laboratory. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance

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with specified requirements. The Contractor shall promptly remove and replace materials or fabricated components which do not comply.

D. Question about Contract Documents:

The Contractor shall promptly notify the Architect/Engineer whenever design of members and connections for any portion of the structure are not clearly indicated or when other questions exist about the Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.

E. Testing Laboratory Services:

See Testing Laboratory Services section of these Specifications for requirements relating to structural steel.

Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents.

1.05 SUBMITTALS

A. Product Data:

Submit producer's or manufacturer's specifications and installation instructions for following products; include laboratory test reports and other data to show compliance with specifications (including the specified standards):

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washers.
3. Shrinkage-resistant grout.
4. Unfinished bolts and nuts.
5. Welding electrodes (each type).
6. Structural steel primer paint.
7. Shear studs.

B. Shop Drawings:

1. General Requirements:

Submit shop drawings prepared under supervision and sealed by a Professional Engineer licensed in the State of Florida, including complete details and schedules for fabrication and assembly of structural steel members, and details, schedules, procedures and diagrams showing sequence of erection. Shop drawings not complying with the above requirements will not be reviewed. Structural steel shop drawings shall include the following minimum information:

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- a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Holes, flange cuts, slots and openings shall be made as required by the structural drawings, all of which shall be properly located by means of templates.
- b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

2. Preliminary Connection Review with Steel Fabricator:

The fabricator shall submit details of proposed connections for Engineer's review prior to preparation of detailed shop drawings. Proposed variations in details shown on the drawings will be considered and such variations must have preliminary approval prior to the preparation of detailed shop drawings.

3. The fabricator alone shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural members.
4. All fabricated material and connections shall fit within architectural constraints.
5. Structural steel members for which shop drawings have not been reviewed and approved shall not be fabricated.
6. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed and approved.

C. Calculations:

The design of all steel connections for the project shall be performed under the direct supervision of a Professional Engineer, registered in the State of Florida, employed by the fabricator. The fabricator's engineer shall submit complete design calculations for each connection. Such calculations shall show details of the assembled joint with all bolts and welds required. Where predesigned connections are taken directly from tables in the AISC Manual, calculations need not be submitted provided the job design conditions precisely match those assumed in the tables, all data extracted from the tables is clearly identified with the table number, and all such connections are so indicated in the calculations submitted. All design calculations shall be sealed by the fabricator's registered professional engineer. Shop drawings submitted without complete design calculations will not be approved.

D. Surveys:

The General Contractor shall employ a registered professional engineer or land surveyor for accurate erection of structural steel.

1. Initial Survey:

The surveyor or engineer shall check elevations of concrete and masonry bearing surfaces and anchor bolt locations prior to erection and submit any discrepancies to

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the Engineer prior to the start of erection. Corrections or compensating adjustments to the structural steel shall be made and approved prior to the start of erection.

2. Final Survey:

Upon completion of erection of the steel frame, and before the start of work by other trades that may be supported, attached, or applied to the frame, a final survey shall be made and a report submitted certifying compliance with specified tolerances.

E. Test Reports:

Submit copies of reports of tests conducted on all material and on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results. See Testing Laboratory Services section of these Specifications for additional requirements.

F. Substitutions:

1. Substitutions for the member sizes, type(s) of steel connection details or any other modifications proposed by the Contractor will be considered by the Architect/Engineer only under the following conditions:

- a. That the request has been made and accepted prior to the submission of shop drawings. All substitutions shall be clearly marked and indicated on the shop drawings as a substitute.
- b. That there is a substantial cost advantage or time advantage to the Owner; or that the proposed revision is necessary to obtain the required materials or methods at the proper times to accomplish the work in the time scheduled.
- c. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect/Engineer, including cost reductions or savings in time to complete the work.
- d. That the contractor by virtue of submitting the substitution, agrees to compensate the engineer for reviewing the substitution, at the rate of 3.0 times direct personnel expense (DPE) plus expenses.
- e. In no case shall such revisions result in additional cost to the Owner.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Architect/Engineer.

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- D. Furnish all fuel, maintenance, and equipment required for hoisting and placement of materials under this contract.
- E. Process, pay for and maintain all permits and certificates of on-site inspection required for derricks, cranes and hoisting equipment. No derrick, crane or hoisting equipment shall be operated without a certificate of operation and a certificate of on-site inspection, as required by governing authorities.
 - 1. Wherever the erection equipment is supported by the structure, the Contractor shall be responsible for the retention of a licensed professional engineer to determine the adequacy of the member supporting the erection equipment in relation to the loads imposed thereon. The Contractor shall submit to the Architect/Engineer, for review, the loads which will be imposed by the erection equipment on the building structure. Where the imposed load exceeds the allowable stresses, the Contractor shall be responsible for any additional materials, supports, bracing, connections and similar measures required to support the imposed load of the equipment while in use, subject to review by the Architect/Engineer.
 - 2. In addition to the above, all hoisting equipment shall be installed, operated and maintained in accordance with all applicable regulations of authorities having jurisdiction.

1.07 JOB CONDITIONS

The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel:

All hot rolled steel plates, shapes, and bars shall be new steel conforming to ASTM Specification A36 "Standard Specification for General Requirements for Rolled Steel Plates, Shapes, and Bars for Structural Use".

Structural steel shall comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:

- 1. Structural Steel Shapes, Plates and Bars - High Strength Steel, ASTM A572 Grade 50 "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality".
- 2. Tube Sections - ASTM A500 Grade B.
- 3. Pipe Columns – ASTM A53
- 4. Connection Material:

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Unless noted otherwise on the drawings, column stiffener plates and doubler plates at moment connections shall be the same grade of steel as the beam connecting the column (highest grade if more than one grade is used). All other connection material except as noted otherwise on the drawings including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel unless a higher or matching grade of steel with the members connected is required by strength or stiffness calculations and provided the resulting sizes are compatible with the members connected.

B. Structural Steel Surfaces:

For fabrication of work which will be exposed to view in the completed structure, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

C. Structural Bolts and Threaded Fasteners:

Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:

1. ASTM A325 Type 1, "High-Strength Bolts for Structural Steel Joints".
2. ASTM A490 Type 1, "Heat Treated Steel Structural Bolts, 150 KSI Minimum Tensile Strength".
3. Threaded Round Stock:
 - a. ASTM A36
 - b. ASTM A572 Grade 50 (to 2 inches in diameter)

4. Bolts and Nuts, High Strength Bolts:

Bolts and nuts for all high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A563, "Standard Specification for Carbon and Alloy Steel Nuts".

5. Washers:

All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F436, Specification for Hardened Steel Washers. Beveled washers for American Standard Beams and channels shall be square or rectangular, shall taper in thickness (16 2/3% slope) with an average thickness of 5/16". When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled washer shall be used.

6. Galvanized Bolts:

- a. Provide bolts, nuts and washers that are hot dip galvanized according to ASTM A153, Class C when used to connect steel called for on the drawings or in the specifications as hot dip galvanized after fabrication.

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- b. Provide mechanically galvanized bolts, nuts and washers for A490 bolts (do not hot dip galvanize A490 bolts) connecting steel called for on the drawings or in the specifications as hot dip galvanized after fabrication. Cold galvanizing compound shall be "Z.R.C. Cold Galvanizing Compound" as manufactured by Z.R.C. Chemical Products.

7. Load Indicator Washers and Bolts:

- a. Shop Bolting and Field Bolting. All bolting of high strength friction bolts shall use load indicator washers or load indicator bolts such as "LeJeune Bolts" as manufactured by LeJeune Bolt Company or "Load Indicator Bolts" as manufactured by Bethlehem Steel Corp.

8. Bolt Lubrication:

All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed. Bolts or nuts shall be wax dipped by the bolt supplier or "Castrol Industrial Stick Wax" shall be used with all bolts in the shop or field.

9. New Bolts:

All bolts shall be new and shall not be reused.

D. Electrodes for Welding:

Comply with AWS D1.1, "Structural Welding Code - Steel". Electrodes for various welding processes shall be as specified below:

1. SMAW: E70XX low hydrogen
2. SAW: F7X-EXXX
3. GMAW: ER70S-X
4. FCAW: E7XT-X

Electrodes shall be compatible with parent metal joined.

E. Shear Connectors (Headed Studs):

Shear connectors and their installation shall meet all requirements specified in Section 7 of AWS D1.1 "Structural Welding Code-Steel", including but not limited to the following:

1. Mechanical Requirements. Studs shall be made from cold drawn bar stock conforming to ASTM A 108, "Specification for Steel Bars, Carbon Cold Finished, Standard Quality", Grades 1010 through 1020 semi-killed or fully-killed. Tensile strength shall be 60,000 psi minimum with 20% minimum elongation in 2 inches and 50% minimum area reduction when tested in accordance with applicable sections of ASTM A370, "Mechanical Testing of Steel Products".
2. Design. The design of the studs shall be suitable for arc welding to steel members with automatically timed stud welding equipment.

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3. Ferrule. An arc shield (ferrule) of heat resistant ceramic shall be furnished with each stud. After welding, all arc shields shall be removed from each shear connector.
4. Dimensions. Studs shall be of uniform diameter, heads shall be concentric and normal to the shaft, and the weld end shall be chamfered. Standard dimensions and tolerances shall be as specified in AWS D1.1.

Sizes of shear connectors shall be as specified on the drawings.

F. Anchor Bolts:

1. All anchor bolts shall be made from threaded round stock conforming to ASTM Specifications as specified below as appropriate for the types and at the locations as specified on the drawings:
 - a. ASTM A36
 - b. Galvanized bolts shall be used with all galvanized base plates
2. Nuts:
All nuts with anchor bolts shall be hex head conforming to ASTM A563.
3. Washers:
Washers for all base plates shall be 1/4" thick plates extending minimum 1" from edge of base plate holes on each side with holes 1/16 inch larger than the nominal bolt diameter. Washers shall conform to ASTM A36 steel.

G. Structural Steel Primer Paint:

Primer paint shall be one of the following types with the indicated surface preparation:

1. Alkyd Zinc Chromate Metal Primer Bar-Ox 41837 Gray as manufactured by Devco (SSPC-SP6 Commercial Blast Cleaning).
2. Modified Alkyd Rust Inhibitive Primer 4-56 as manufactured by Tnemec Company, Inc. (SSPC-SP6 Commercial Blast Cleaning).
3. Enviro-Guard Heavy Duty Primer Red 1-2900 as manufactured by Southern Coatings (SSPC-SP6 Commercial Blast Cleaning).

Refer to Architect's drawings and specifications for final paint finish requirements of structural steel. Primer paint shall be compatible with final paint requirements. Paint shall conform to all federal, state, and local regulations and shall have a VOC content not to exceed 3.5 lbs./gallon.

H. Non-Shrink Grout:

Provide grout type(s) as specified on the drawings:

1. Non-Metallic Non-Shrink Grout:

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Premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents, and fluidity improving compounds. Conform to Corps of Engineers Specification for Non-Shrink Grout, CRD-C621. Provide minimum strengths as determined by grout cube test at 28 days as follows:

- a. 6,000 PSI for elements supported by concrete 3000 psi and less.
- b. 8,000 PSI for elements supported by concrete greater than 3000 psi and less than or equal to 4000 psi.
- c. 10,000 PSI for elements supported by concrete greater than 4000 psi.

Acceptable non-shrink grouts are listed below:

"Vibropruf #11" by Lambert Corp.
"Supreme" as manufactured by Gifford-Hill Co.
"Crystex" as manufactured by L&M Construction Chemicals, Inc.
"Masterflow 928" as manufactured by Master Builders
"Five Star Grout" as manufactured by U.S. Grout Corp.

I. Hot Dip Galvanizing:

1. Scope:

Hot dip galvanize after fabrication all structural steel items and their connections permanently exposed to the outside, whether specified on the drawings or not. Such items include, but are not limited to:

- a. Shelf angles.
- b. Parapet wall supporting members.
- c. Screen wall supporting member.
- d. Window washing support members.
- e. All embedded plates in concrete.
- f. Garage guardrail steel and connections.
- g. Cooling tower support steel.
- h. Building skin support steel exposed to moisture outside the exterior waterproofing surface.

Examine the architectural and structural drawings for other items required to be hot dipped galvanized.

Galvanize all nuts, bolts, and washers used in the connection of such steel. Field welded connections shall have welds protected with "Z.R.C. Cold Galvanizing Compound" as manufactured by Z.R.C. Products Company.

2. Surface Preparation:

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All steel to be hot dip galvanized shall undergo the following surface preparation as specified by the Steel Structures Painting Council (SSPC), Volume 2.

- a. Removal of grease, oil, grime and all foreign contaminants by thorough cleaning with an alkaline or organic solvent followed by thorough rinsing in cold water.
- b. Scale removal by pickling in diluted sulfuric or hydrochloric acid. Pickling shall be followed by a rinse in warm water and a second rinse in cold water. As an alternative to pickling, the steel may be white metal blast cleaned according to SP5 of the SSPC Specification.
- c. Dipping in a flux solution of zinc ammonia chloride followed by drying at room temperature.

J. Cold Galvanizing:

Cold galvanizing compound shall be "ZRC Cold Galvanizing Compound" as manufactured by ZRC Chemical Products and applied according to manufacturers instructions.

2.02 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings. Fabricator shall coordinate joint fit-up procedures with erector. Provide camber in structural members where indicated. The General Contractor shall coordinate provision of all erection bolts, lifting lugs or other devices required for erection with the fabricator and the erector.
2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
3. Clearly mark the grade of steel on each piece, distinguishable in the field from floor surfaces, for purpose of field inspection and confirmation of grade of steel.
4. Milled surfaces of built-up sections shall be completely assembled or welded before milling.
5. Fitted stiffeners shall be fabricated neatly between flanges, and the ends of stiffeners shall be milled or ground to secure an even bearing against abutting surfaces. All milled or ground joints shall bear throughout their contact length.
6. Ends of columns and truss members at splices and at other bearing connections shall be finished level and true. Filler plates used at finished surfaces shall be finished at same time as column, beam, etc.

B. Dimensional Tolerances:

Dimensional tolerances of fabricated structural steel shall conform to Section 6.4 of the AISC Code of Standard Practice.

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C. Camber:

1. Camber of structural steel members is indicated on the drawings.
2. Where possible, camber of beams shall be applied by a cold bend process.
3. The local application of heat may be used to introduce or correct camber, curvature, or straightness provided the temperature of the heated area, as measured by temperature crayons or other approved means, does not exceed 1200°F.
4. Where indicated on the drawings in a camber diagram, cantilever or double cantilever beams shall be cambered for the main span and cantilever end separately, either by a staged cold bending process or by the application of heat.
5. Cambers indicated on the drawings are intended to be final cambers at time of erection. The fabricator shall account for camber loss in the initial camber operation.
6. Beams detailed without specified camber shall be fabricated so that after erection any natural camber due to rolling or shop fabrication is upward.
7. Specified camber for beams at time of erection shall be within a tolerance of minus zero to plus one-eighth inch for each ten feet of member length.
8. Specified camber for trusses and plate girders shall be built into the fabrication process with a tolerance of minus zero to plus 10% of the specified camber.

D. Splices in Structural Steel:

Splicing of structural steel members in the shop or the field is prohibited without prior approval of the Engineer. Any member having a splice not shown and detailed on approved shop drawings will be rejected.

E. Compression Joints:

Compression joints which depend on contact bearing as part of the splice capacity shall have the bearing surfaces of individual fabricated pieces prepared to a common plane by milling, sawing, or other suitable means.

F. Cutting:

Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.

G. Holes for Other Work:

Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members as shown on the contract documents, and/or the final shop drawings.

1. Provide specialty items as indicated to receive other work.

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2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

H. Lifting and Erection Devices:

The fabricator shall be responsible for designing, detailing and furnishing all lifting devices and erection aids required for erection. Such devices shall be removed after erection if they interfere with architectural finish requirements.

I. Special Fabrication Requirements for Welded Connections in Large Tension Members and Moment Connected Members:

1. Scope: Requirements specified herein shall apply to all welded connections in tension members and moment connected members utilizing rolled shapes in Groups 3, 4, and 5 and built up shapes with plates 1 1/2" and thicker.
2. Material Verification: The fabricator shall verify that all special material requirements in Part II of this specification are met.
3. Preheat and Interpass Temperatures: Strictly adhere to all preheat and interpass temperatures specified in Table 4.2 of AWS D 1.1.
4. Weld Sequencing: Sequence individual passes of multipass welds to minimize the restraint produced against the contraction of subsequent passes. For wide flange shape members with double bevel flanges, weld the inside flanges first, then the outside flanges, and lastly the web.
5. Edge Preparations: Grind off all notches and gouges in edges prepared by flame cutting. Access holes produced by flame cutting should be started by using a drilled hole to avoid sharp reentrant corners from which a crack could propagate.
6. Web Splice: Use a welded web splice plate in lieu of a penetration web weld for wide flange shapes.

2.03 WELDING

A. Code:

All shop and field welding shall conform to all requirements in the "Structural Welding Code - Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWS).

B. Welder Certification:

All shop and field welders shall be certified according to AWS procedures for the welding process and welding position used.

C. Minimum Size and Strength:

1. Fillet Welds: Minimum size of fillet welds shall be as specified in Table J2.4 in the AISC Manual of Steel Construction.

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2. Partial-Penetration Groove Welds: The minimum effective throat thickness of partial-penetration groove welds shall be as specified in Table J2.3 in the AISC Manual of Steel Construction.
3. Minimum Strength of Welded Connections: Unless noted otherwise on the drawings, all shop and field welds shall develop the full tensile strength of the member or element joined. All members with moment connections, noted on the drawings with "MC", shall be welded to develop the full flexural capacity of the member, unless noted otherwise on the drawings.

D. Filler Metal Requirements:

Weld metal shall be as specified in AISC Manual of Steel Construction Table J2.5.

E. Submittal of Welding Process and Sequence:

The steel fabricator and erector, as applicable, shall submit for Engineer review the welding process, sequence, and preheat requirements for all members requiring partial or complete penetration groove welding.

F. Welding Procedures:

1. Built-up sections assembled by welding shall be free of warpage and all axes shall have true alignment.
2. Welds not specified shall, if possible, be continuous fillet welds developing the minimum strength, as specified above, using not less than the minimum fillet welds as specified by AISC.
3. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
4. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
5. Before welding is started, the fabricator shall submit for the approval of the Owner's Testing Laboratory in consultation with the Architect/Engineer, written joint welding procedures for all joints to be welded. After approval, the welding procedures shall be followed without deviation unless specific approval for change is obtained from the Owner's Testing Laboratory and the Architect/Engineer.
6. At moment connections where beams are groove welded directly to columns or girders in the field, welds shall be made after installation of erection bolts to draw the pieces together and before the shear connection bolts are tightened. Where loose moment plates are used, such plates shall be groove welded to columns prior to connecting these plates to the beams.
7. Before welding, particular attention shall be paid to surface preparation, fit up and cleanliness of surfaces to be welded.
8. Minimum preheat and interpass temperatures for structural steel welding shall be as specified in the American Welding Society Structural Welding Code, except that no

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welding shall be performed when the ambient temperature is lower than 0 degrees F. The temperature shall be measured from the side opposite that upon which the preheat is applied.

9. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.
10. All elements of weldments shall be welded together to full strength of the elements as specified hereinafter using "V" or "J" grooving except as otherwise indicated on the structural drawings. All welds shall be continuous and of full penetration unless fillet welds can develop the minimum required strength as specified above. Welds made without the aid of a backup bar shall have their roots chipped, ground or gouged out to sound metal from the second side, before welding is done from the second side.
11. Welds shall be sound throughout. There shall be no crack in any weld or weld pass. Welds shall be considered sound if they conform to AWS requirements, as confirmed by non-destructive testing.
12. Welds shall be free from overlap.
13. Craters shall be filled to the full cross section of the welds.
14. For high-strength low-alloy steels, follow welding procedures as recommended by steel producer for exposed and concealed connections.
15. Fabricator and erector shall coordinate welding responsibility at all welded joints.

G. Stress Relieving:

All welding sequences shall be such as to reduce the residual stresses due to welding to a minimum value. If high residual stresses are present, stress relieving of joints shall be required. Welded connections shall be detailed and designed to minimize the accumulation and concentration of through-thickness strains due to weld shrinkage.

2.04 BOLTING

A. Minimum Bolt Diameter:

Minimum bolt diameter shall be 3/4 inch.

B. Connection Type:

Unless noted otherwise on the drawings or in the General Notes, all bolted connections shall be bearing type connections using standard holes (hole diameter nominally 1/16 inch in excess of nominal bolt diameter) with threads included in the shear planes.

C. Shear Connection of Welded Moment Connected Pieces:

All shear connections of welded moment connected pieces shall be friction type connections using high strength bolts.

D. Simple Beams:

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Simple shear connections shall be capable of end rotations of unrestrained beams as specified in Section J1.2 of the AISC Specification.

E. Oversize, Short Slotted and Long Slotted Holes:

The dimensions and washer requirements of oversize, short slotted, and long slotted holes shall conform to the high strength bolting specification previously cited.

F. Allowable Working Stresses:

The allowable working stresses of bolts shall be as specified in the AISC Specification Table J3.2 and Tables 2 and 3 of the high strength bolting specification previously cited.

G. Fastener Tension:

1. High strength bearing bolts shall be tightened using an impact wrench to a snug tight condition.
2. High strength friction bolts shall be tightened to achieve the required bolt tension as specified in the high strength bolt specification previously cited.

The snug tight condition shall be defined as the tightness attained with a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.

H. Washers:

Washers under the bolt head and/or nut shall be used as required by the bolt specification previously cited.

I. Tightening of High Strength Friction Bolts by Use of a Direct Tension Indicator:

1. All field bolting of high strength friction bolts shall use load indicator washers with hardened washers as specified by the manufacturer.
2. Shop bolting of high strength friction bolts shall use load indicator washers as specified above or load indicator bolts.

J. A307 or high strength bolts used in bearing-type connections shall not be used in combination with welds for stress transmission in the same faying face of any connection, as specified in AISC Specification Section J1.10.

K. Bolt Lubrication:

All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed. Bolts or nuts shall be wax dipped by the bolt supplier or "Johnson's Stick Wax 140" shall be used with all bolts in the shop or field.

L. Impact Wrenches:

Properly sized and lubricated air impact wrenches with adequate air pressure shall be utilized for all bolt installation.

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M. New Bolts:

All bolts shall be new and shall not be reused.

N. Minimum Strength of Bolted Connections:

Unless noted otherwise on the drawings, all shop and field bolted connections shall develop, as applicable, the full tensile or compressive strength of the member. All members with bolted moment connections, noted on the drawings with "MC", shall be bolted to develop the full flexural capacity of the member, unless noted otherwise on the drawings.

2.05 CONNECTIONS

A. Typical connection details are indicated on the drawings.

B. Design Procedure:

Exception is taken to the second sentence of Section 4.2.1 of the AISC Code of Standard Practice for Bridges and Buildings, and the following provisions shall be substituted and made a binding part of the project specifications:

1. Connection types to be used are indicated on the drawings (Type 2 "Simple", Type 1 "Rigid Frame" or "Moment Connected"). Forces to be used in the design are described below.
2. The design of all steel connections for the project shall be performed under the direct supervision of a registered professional engineer in the state where the project is located, employed by the fabricator.
3. The fabricator's registered professional engineer shall submit complete design calculations for each connection. Such calculations shall show details of the assembled joint with all bolts and welds required. Where predesigned connections are taken directly from the AISC Manual, calculations need not be submitted provided the job design conditions precisely match those assumed in the AISC manual, all data extracted from the tables is clearly identified with the table number, and such connections are so indicated in the calculations submitted.
4. All design calculations shall be sealed by the fabricator's registered professional engineer.
5. Shop Drawings submitted without complete design calculations will not be approved.

C. Design Intent:

It is the intention of the plans and specifications that shop connections be welded or bolted and that field connections be bolted, unless detailed otherwise on the drawings.

D. Preliminary Connection Review:

The fabricator shall submit details of proposed typical connections for Engineer review prior to preparation of detailed shop drawings. Proposed variations in details shown on the drawings shall be considered and such variations must obtain preliminary approval prior to preparation of detailed shop drawings.

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E. Type 2 Simple Beam Connections:

1. All typical beam simple connections shall be standard double angle or single angle framed beam connections using bolts as specified.
2. Single plate "shear tab" connections may be used provided there is no axial force in the beam and they are designed strictly according to the procedure outlined in "Engineering for Steel Construction" as published by AISC and the paper appearing in the 3rd Quarter, 1984 Engineering Journal "Single Plate Framing Connections with Grade 50 Steel and Composite Construction" as published by AISC.
3. Seated Beam Connections and Stiffened Seated Beam Connections shall not be used unless indicated on the drawings or unless Engineer approval is obtained to verify capacity of supporting member for the resulting eccentricity. The fabricator must verify and bear responsibility that the use of such connections does not interfere with architectural or MEP requirements.
4. Simple Beam Design Capacity:

Unless a larger reaction is shown otherwise on the plans, minimum design forces shall be as follows:
 - a. Non Composite Beams: Support a reaction R equal to one half the total uniform load capacity from the table of Uniform Load Constants in the AISC Manual Part 2 for given shape, span, and grade of steel.
 - b. Minimum reaction capacity shall be 12.0 kips and each connection shall contain not less than two bolts.
5. Connections at the ends of plate girders shall be double angle framed beam connections using high strength bearing bolts with threads included in the shear planes. Connections shall be designed using the forces shown on the drawings.

F. Type I Moment Connections:

1. Field Bolted Moment Connection:

Unless noted otherwise on the drawings, all typical moment connected beams shall be field bolted to the supporting member with plates or structural tees (WT) using high strength friction bolts with threads included in the shear plane developing the full moment capacity of the beam. Web shear connections shall be made with double angles using high strength friction bolts and threads included in the shear plane.
2. End Plate Moment Connection:

All moment connected beams to columns shall be end plate shop welded field bolted moment connections using A325 bearing type bolts with threads included in the shear plane. Unless shown otherwise on the drawings the connection shall develop the full moment capacity of the beam and the reaction indicated below.
3. Design Reactions for Moment Connected Beams:

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Unless shown otherwise on the drawings, shear connections for moment connected beams shall be designed using 1.5 times the simple beam reactions defined above.

4. Design and Furnishing of Reinforcement in Moment Connected Joints:

As part of the design responsibility outlined above, the fabricator shall design and furnish all additional reinforcement in moment connected joints to resist the design forces specified on the drawings or in the General Notes. Column sections shall be investigated for web shear, web yielding, web buckling, and tension. Stiffeners and/or doubler plates shall be furnished as required by the AISC Specification.

G. Column Splices:

1. Bolted Compression Splice:

Unless indicated otherwise on the drawings all column splices shall be bolted compression splices using high strength bearing bolts. Splice and filler plate sizes, thicknesses, and number of fasteners shall be as shown in Appendix C of "Detailing for Steel Construction" as published by AISC. At contractor's option, splice plates may be shop welded to supporting column. It shall be the fabricators responsibility to examine the architectural drawings to verify that splice plates and fasteners do not violate architectural finish requirements.

2. Welded Compression Splice:

As an alternative to a bolted compression splice as specified above, or where indicated on the drawings, column splices may be field welded at the flange and web using minimum size partial penetration groove welds as specified by AISC Table J2.3.

3. Welded Tension Splice:

Where indicated on the drawings, provide welded tension splices using penetration welds at the flange with web splice plates (fillet welded). Minimum weld size shall conform to AISC Table J2.3.

4. Pipe and/or Tube Column Splice:

Pipe and/or tube column splices shall be partial penetration field welded using minimum weld sizes as specified in AISC Table J2.3.

5. Bearing and Fit-Up of Column Compression Joints:

Compression joints of all columns shall have bearing surfaces finished to a common plane by milling, sawing, or other suitable means. Lack of contact bearing must not exceed 1/16" or corrective measures as defined by AISC Specification M4.4 shall be required.

H. Base Plates and Bearing Plates:

1. Finish:

All base plates and bearing plates shall be finished in accordance with AISC Specification M2.8.

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2. Attachment to Column:

Unless shown otherwise on the drawings, all base plates and bearing plates shall be welded all around to the column with minimum fillet welds as specified in AISC Table J2.4.

3. Setting Base Plates:

Base plates shall be set to the elevation indicated on the drawings and leveled using steel shims (plastic shims will not be allowed) or by three leveling screws with weldments at the plate edges. Plates shall be grouted using high strength non-shrink non-metallic grout after all protruding plates have been trimmed. Tighten anchor bolts after supported members have been positioned and plumbed.

4. Anchor Bolt Holes in Base plates:

Hole sizes in base plates shall be made oversize as follows:

Bolt Size	Hole Size
3/4" Dia. to 1" Dia. incl.	- Dia. + 5/16"
Over 1" Dia. to 2" Dia incl.	- Dia. + 1/2"
Over 2" Dia.	- Dia. + 3/4"

I. Struts and Braces:

1. Connections for all struts, hangers, and braces shall have connections designed to develop the full allowable tensile strength of the member.
2. Compression members composed of two or more rolled shapes separated from one another by intermittent fillers shall be connected to one another at such fillers at intervals so that the slenderness ratio l/r of either shape, between the fasteners, does not exceed the governing slenderness ratio of the built-up member. The least radius of gyration, r , shall be used in computing the slenderness ratio of each component part.

J. Bearing of Compression Members:

Ends of columns and all other compression members at splices and at other bearing connections shall be finished to bear so as to provide complete true bearing.

K. Stiffeners:

Provide stiffeners finished to bear under all load concentrations on supporting members, on all members framing over columns, at beam column joints (as required by the AISC Specification) and where shown on the drawings.

2.06 SURFACE PREPARATION AND PAINTING

A. Specification:

Surface preparation, paint, and painting practices shall conform to the "Steel Structures Painting Manual", Volumes 1 and 2, as published by the Steel Structures Painting Council (SSPC).

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B. Scope:

The following steel shall be shop painted after fabrication:

- a. All steel that will not be fireproofed or that will not be hot-dip galvanized
- b. Elevator divider beams
- c. Steel stairs
- d. All building skin support steel including braces back to the floor system, not specified to be hot-dip galvanized.

Surfaces which are to be fireproofed with spray-on fireproofing or embedded in concrete (paint initial 2" of embedded areas) shall not be shop painted. Do not paint top flanges of composite beams nor surfaces of members where welding (within 2" of welds) or high strength friction bolting will occur. Do not paint contact milled bearing surfaces and surfaces of corrosion resistant steel.

Coordinate all shop painting of structural steel with architect's painting requirements as specified on the architectural drawings and in the specifications.

C. Surface Preparation - Unpainted Steel:

All structural steel that is not specified to receive a shop coat of primer paint shall be cleaned of oil and grease using solvent cleaners and cleaned of dirt and other foreign material by sweeping with a fiber brush or other suitable means.

D. Surface Preparation and Primer Paint - Shop Painted Steel:

All structural steel specified to be shop primed shall have paint applied in strict accordance with manufacturers instructions using prescribed surface preparation but not less than specified. Paint shall be applied immediately after surface preparation at a rate to provide a uniform dry film thickness of not less than 1.5 mils. Painting methods shall be used which result in full coverage of joints, corners, edges, and all exposed surfaces. Two coats shall be applied to surfaces which are inaccessible after assembly or erection. The color of the second coat shall be changed to distinguish it from the first coat.

Coordinate shop primer paint requirements with architectural drawings and specifications.

E. Touch-Up Painting:

The General Contractor shall provide for cleaning and touch-up painting of welds, bolted connections, and abraded areas. Paint shall be applied to exposed areas using same materials and surface preparation as used for shop painting. Paint shall be applied by brush or spray with minimum dry film thickness of 1.5 mils.

PART 3 - ERECTION

3.01 ERECTION

A. Inspection:

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Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Architect/Engineer in writing of conditions detrimental to proper and timely completion of the work.

B. Surveys:

The General Contractor shall employ a registered professional engineer or land surveyor to insure accuracy in structural steel erection as specified in Part I.

C. Erection Tolerances:

Erection tolerances of anchor bolts, embedded items, and all structural steel shall conform to the AISC Code of Standard Practice.

D. Temporary Shoring and Bracing:

1. Design and provide adequate shoring and bracing to safely withstand all loads to which the structure may be subjected during the construction process. Provide additional structural members and increase member sizes and/or connections shown on the drawings as required to accommodate the erection method and equipment.
2. Provide any temporary erection bracing and supports as required to hold structural steel framing securely in position until the permanent bracing or other steel has been installed and concrete for floor slabs has obtained 75% of its design strength.
3. Where architectural or MEP requirements do not allow for any temporary supports, members, erection devices, or connections to be left in place permanently or where such items affect the final structural behavior, they shall be removed by the erector. All costs associated therewith shall be included in the bid price.
4. The design of all temporary shoring and bracing is the responsibility of the General Contractor.

E. Anchor Bolts:

Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish 1/8" minimum steel templates for presetting bolts and other anchors to accurate locations. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Use only steel wedges or shims.

F. Base Plates and Bearing Plates:

Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to wet cure. For proprietary grout materials, comply with manufacturer's instructions.

G. Splices:

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Splices will be permitted only where indicated on the contract drawings and approved shop drawings. Fastenings of splices of compression members shall be done after the abutting surfaces have been brought completely into contact within AISC tolerances. Bearing surfaces and surfaces that will be in permanent contact are to be cleaned before the members are assembled.

H. Field Assembly of Structural Steel:

1. As erection of the steel progresses, the work shall be fastened securely to take care of all dead load, wind and erection stresses. Particular care shall be exercised to ensure straightness and tautness of bracing immediately upon raising a steel column.
2. Provide temporary planking and working platforms as necessary to effectively complete work.
3. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances. The Contractor shall coordinate with Erector and Fabricator regarding possible discrepancies in member lengths between temperature at time of fabrication and temperatures during erection, and shall make necessary adjustments to ensure plumbness within AISC tolerances at 60°F. Compensate for cumulative welding draw, construction loadings, sequential applications of dead loads, or any other predictable conditions that could cause distortions to exceed tolerance limitations.
4. On exposed welded construction, remove erection bolts, fill holes with plug welds or filler and grind smooth at exposed surfaces.
5. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces receiving field welds.
6. Comply with all bolting and welding requirements of Part 2 of this specification section.

I. Field Modifications to Structural Steel:

Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Architect/Engineer, and approval of the method of correction shall be obtained. Approved corrections shall be made at no additional cost to the Owner. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.

J. Miscellaneous Framing:

Provide supplemental structural steel support framing for metal deck where normal deck bearing is interrupted by column flange plates or other framing members and other floor openings whether shown or not on either the architectural, mechanical, or structural drawings.

K. Removal of Erection Aids and Devices:

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The erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.

L. Touch-Up Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas that have been shop painted. Apply paint to exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
2. All field welded galvanized connections shall have welds protected with "Z.R.C. Cold Galvanizing Compound" as manufactured by Z.R.C. Products Company.

M. Shear Connector Installation:

1. Steel Plates Embedded in Concrete:
 - a. Studs shall be welded using automatically timed stud welding equipment.
 - b. Plates must be unpainted and free of heavy rust, mill scale, dirt, sand or other foreign material which will interfere with the welding operation. Shop prime all plates and studs after welding unless plates are exposed to the outside in which case the assembly shall be hot dip galvanized after welding.

N. Clean Up:

Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.

END OF SECTION 05 12 13

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SECTION 05 22 00 - STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes steel joists for floor and roof framing. Types of joists required include the following:
 - 1. K-Series Open Web Steel Joists.
- B. Refer to Division 3 Sections for installation of anchors set in concrete.
- C. Refer to Division 4 Sections for installation of anchors set in masonry.
- D. Refer to Section 05 12 13 for structural steel bearing angles or plates and bridging attachments to structure.
- E. Refer to Section 05 12 13 for inspection of joist connections.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications."
- C. Shop drawings showing layout of joist members, special connections, joining and accessories. Include mark, number, type, location and spacing of joists and bridging.
 - 1. Provide templates or location drawings for installation of anchor bolts and metal bearing plates.
- D. Design Calculations: Provide design calculations signed and sealed by a Florida registered engineer to verify design for uplift and special joists.

1.4 QUALITY ASSURANCE

- A. General: Provide joists fabricated in compliance with Steel Joist Institute (SJI) "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with American Welding Society (AWS) "Structural Welding Code - Steel," AWS D1.1.
- C. Inspection: Inspect joists in accordance with SJI "Specifications."

1.5 DELIVERY, STORAGE AND HANDLING

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- A. Deliver, store and handle steel joists as recommended in SJI "Specifications." Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI "Specifications" for chord and web sections.
- B. Steel Bearing Plates: ASTM A-36.
- C. Unfinished Threaded Fasteners: ASTM A-307, Grade A, regular hexagon type, low carbon steel.
- D. Steel Prime Paint: Manufacturer's standard.

2.2 FABRICATION

- A. General: Fabricate steel joists in accordance with SJI "Specification."
- B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
- C. Extended End: Provide extended ends on joists where indicated, complying with SJI "Specifications" and load tables.
- D. Ceiling Extension: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.
- E. Top Chord Extension: Provide top chord extensions ("S" type) on joists where indicated, complying with SJI "Specifications" and load tables.
- F. Bridging: Provide horizontal or diagonal type bridging for joists, complying with SJI "Specifications" and as shown on project drawings.
- G. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.
- H. Shop Painting: Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.
 - 1. Apply one shop coat of steel prime paint to joists and accessories, by spraying, dipping, or other method to provide a continuous dry paint film thickness or not less than 0.50 mil.
 - 2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.

PART 3 - EXECUTION

3.1 ERECTION

- A. Place and secure steel joists in accordance with SJI "Specifications," final shop drawings, and as herein specified.

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- B. Anchors: Furnish anchor bolts, steel bearing plates, and other devices to be built into concrete and masonry construction.
 - 1. Provide unfinished threaded fasteners for anchor bolts, unless high strength bolts indicated.
- C. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.
- D. Provide temporary bridging, connections and anchors to ensure lateral stability during construction.
 - 1. Where "open-web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.
- E. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
- F. Fastening Joists: Comply with the following:
 - 1. Field weld joists to supporting steel framework and steel bearing plates where indicated in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.
 - 2. Bolt joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used.
 - a) Use unfinished threaded fasteners for bolted connections, unless otherwise indicated.
- G. Inspection: Joist end connections and bridging connections are to be inspected per AISC requirements and as noted in Section 05 12 13.
- H. Touch-up Painting: After joist installation, wire brush welded areas, abraded or rusty surfaces, and clean with solvent. Paint field-applied bolt heads and nuts and prepared surfaces on joists and steel supporting members. Use same type of paint as used for shop painting.

END SECTION 05 22 00

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SECTION 05 30 00 - METAL DECKING

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 work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Scope: Roof Decking. See structural drawings for additional requirements. The structural drawings and notes shall govern if there are any conflict with these specifications.

1.3 QUALITY ASSURANCE

- A. Codes and Standard: Comply with provisions of the following codes and standards, except as otherwise shown or specified:
 - 1. AISI: "Specification for the Design of Cold-Formed Steel Structural Members".
 - 2. AWS: "Structural Welding Code".
 - 3. SDI: "Design Manual for Floor Decks and Roof Decks".
- B. Qualification of Field Welding: Quality welding process and welding operators in accordance with AWS "Standard Qualification Procedure".
 - 1. Welded decking in place is subject to inspection and testing. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptance work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.
- B. Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories. Original construction documents shall not be duplicated for use as shop drawing submittals.

PART 2 - PRODUCTS

2.0 MATERIALS

2.1 Steel for Galvanized Metal Deck Units: ASTM A-446, Grade A

- A. Miscellaneous Steel Shapes: ASTM A-36.
- B. Sheet Metal Accessories: ASTM A-526, commercial quality, galvanized.

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- C. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).
- D. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.
- E. General: Form deck units in lengths to span 3 or more supports, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated.
- F. Roof Deck Units: Provide deck configurations complying with SDA "Roof Deck Specifications", of metal thickness, depth and width as shown. Decking shall be equal to Wheeling "Type B", galvanized or accepted.

PART 3 - EXECUTION

3.1 3.1 INSPECTION

- A. Installer must examine areas and conditions under which metal decking is to be installed 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 Installer.

3.2 INSTALLATION

- A. General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
4. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

B. Fastening Deck Units

1. Fasten roof deck units to steel supporting members by not less than 3/4" diameter fusion welds or elongated welds of equal strength, spaced not more than 6" o.c. at supports, and at closer spacing where required for lateral force resistance or where indicated.
2. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
3. Use welding washers where recommended by deck manufacturer.
4. Lock side laps of adjacent deck units between supports, at intervals not exceeding 24" o.c.

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- C. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.
- D. Reinforcement and Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.
- E. Hanger Slots or Clips: Provide UL approved punched hanger slots between flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.
 - 1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
 - 2. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends, and not more than 12" from walls at sides, unless otherwise shown.
 - 3. Provide manufacturer's standard hanger attachment devices.
- F. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.
- G. Touch-Up Painting: Cleaning and touch-up painting of field welds, abraded areas and rust spots, as required after erection.

3.3 Field Inspection of Welding:

- A. The owner's testing lab will conduct visual inspection on all welds. The general contractor will coordinate with Orange County Project Manager for scheduling of all field inspections.

END SECTION 05 30 00

SECTION 05 40 00 - COLDFORMED METAL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

- A. Extent of coldformed metal framing used as structural support for exterior cladding and/or used as non-load bearing support for any areas is shown on the drawings.
- B. Types of coldformed metal framing units include the following:
 - 1. Exterior structural wall construction
 - 2. Interior non-load bearing construction

1.03 QUALITY ASSURANCE

- A. Component Design: Compute structural properties of studs in accordance with "Specification for Design of Cold-Formed Steel Structural Members" dated September 3, 1980, as published by the American Iron & Steel Institute (AISI).
- B. Codes and Standards:
 - 1. "Structural Welding Code - Sheet Steel", AWS D1.3 as published by the American Welding Society (AWS).
 - 2. "Recommended Practices for Resistance Welding Coated Low Carbon Steels", AWS C1.3, as published by the American Welding Society.
- C. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units which have been approved by governing authorities having jurisdiction.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product information and installation instructions for each item of coldformed framing and accessories.
- B. Shop Drawings: Submit shop drawings for all coldformed metal framing used to support exterior cladding and used as non-loadbearing support for any floor or roof areas. Shop drawings shall indicate placing of all framing members showing type, size, gage, number, location and spacing. They shall also indicate supplemental strapping, bracing, splices, bridging, accessories and details required for proper installation. Shop drawings must indicate type of fastening system used along with size and number of fasteners.

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1. Welded connections shall show size and length of welds for all connections.
2. Screwed connections shall show type, size, and number of screws for all connections. Submit manufacturer's data giving strength values for screws used.

Shop drawings submitted must be prepared under the supervision of and sealed by a registered professional engineer in the State of Florida. The Engineer of record will not be responsible for coldformed metal framing erected without approved shop drawings.

- C. Calculations: Submit calculations for all coldformed metal framing used to support exterior cladding and used as non-loadbearing support for any floor or roof areas. Calculations shall indicate sizing of members supporting the loads as indicated on the drawings and the design of connections indicating method of connection and
1. size and length of all welds for welded connections.
 2. type, size, number and capacity of all screwed connections.
 3. Calculations, Drawings and Details must be prepared and sealed by a registered engineer in the State of Florida.

1.05 DELIVERY AND STORAGE

- A. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

PART 2 - PRODUCTS

2.01 SYSTEM COMPONENTS

- A. With each type of metal framing indicated on the Architectural or Structural Drawings, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners and accessories as recommended by the manufacturer for applications indicated, as needed to provide a complete metal framing system.

2.02 GRADES OF STEEL

- A. For 16-gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 50,000 psi and conform to ASTM A 446 and/or A 570.
- B. For 18-gage and lighter units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 33,000 psi and conform to ASTM A 446 and/or A 570.

2.03 FINISH

- A. Provide galvanized finish to all metal framing components complying with ASTM A 525 for minimum G60 coating.

2.04 TYPES

- A. Cee "C"-Shape and Exterior Cladding Studs: Manufacturer's standard load-bearing steel studs of size, shape, and gage indicated, with 1.625" flange and flange return lip.

Subject to compliance with requirements, manufacturers offering Cee "C"-shaped, load-bearing steel studs which may be incorporated in the work include, but are not limited to, the following:

1. Allied Structural Industries.
2. Bostwick Steel Framing Co.
3. Chicago Metallic Corp.
4. Inryco/Milcor.
5. Marino Industries Corp.
6. Metal Art Studing.
7. Monex Corp.
8. Texas Lightsteel Products, Inc.
9. U.S. Gypsum.
10. Wheeling Corrugating Co.

2.05 FABRICATION

- A. General: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.

- B. Connections:

1. Type: Connection of coldformed metal components shall be
 - a. screwed (for all exterior conditions)
 - b. screwed (for interior walls only)
2. Design Forces: Connections of members shall develop the full allowable tensile force of the members connected unless calculations are submitted substantiating lower forces.
3. Welded Connections: Connection of coldformed metal components shall be made using arc welding or resistance welding methods. All welding shall be performed in accordance with the latest recommended procedures and practices of the American Welding Society, AWS C1.3 "Recommended Practices for Resistance Welding Coated Low Carbon Steels" and AWS D1.3 "Specification for Welding Sheet Steel in Structures". Welding process along with weld sizes and lengths necessary to develop the member forces specified shall be shown on the shop drawings. Protection of the weld area after welding shall be accomplished using a zinc-rich galvanizing repair paint.
4. Screwed Connections: Connection of light gage metal components shall be made using self-drilling self-tapping screws. Screw type and size along with the number of screws required to resist the member forces specified shall be shown on the shop drawings. Screw type and installation shall be approved by the

International Conference of Building Officials (ICBO). All screws shall be zinc or cadmium plated.

5. Wire tying of framing components in structural applications shall not be permitted.
6. See Structural Drawing for required loads and wind pressures for components of flashing.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Pre-Installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

3.02 INSTALLATION

- A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless otherwise indicated.
- B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" o.c. spacing for nail or powder-driven fasteners, or 16" o.c. for other types of attachment. Abutting pieces of track shall be securely spliced together. Provide fasteners at corners and ends of tracks.
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements. Splices in axially loaded and non-loaded bearing exterior cladding stud systems shall not be permitted.
- D. Provide four (4) studs at each intersecting wall and three (3) studs at each corner.
- E. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
- F. Install supplementary framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.
- G. Installation of Wall Stud System: Studs shall be seated firmly against the track webs allowing load transfer by direct bearing without complete dependence on the connection to the track. Connect studs to top and bottom runner tracks by either

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welding or screw fastening as indicated on the drawings at both inside and outside flanges.

- H. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.
- I. Frame both sides of expansion and control joints, with separate studs; do not bridge the joint with components of stud system.
- J. Horizontal Bridging:
 - 1. Install horizontal bridging in all non-loadbearing exterior cladding stud systems, spaced (vertical distance) at not more than 4'-6" o.c. Weld at each intersection.
- K. Sheathing Attachment: Where shown on Architectural Drawings provide attachment of interior and exterior sheathing and wall material to each stud in accordance with Section 5 (Bracing Requirements) of the AISI Specification.
- L. Wall Braces: Provide wall braces ("kickers") as required or as shown on the Architectural Drawings, but not less in size and gage than that of wall stud being braced and not spaced greater than every fourth stud, and first stud from all corners, whether shown on the drawings or not. Provide connection at each end of brace to develop strength of brace. Connections to concrete shall be made with power-driven fasteners or expansion bolts having approval by the International Conference of Building Officials (ICBO) and shall be in strict accordance with manufacturers instructions and only if intended for coldformed metal attachment. Connections to coldformed metal and structural steel shall be as specified in section on Connections.
- M. Field Painting: Touch-up shop-applied protective coatings damaged during handling and installation. Use compatible primer for prime coated surfaces; use galvanizing repair paint for galvanized surfaces.

END OF SECTION 05 40 00

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SECTION 05 41 00
FORMED METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Metal Base.
 - 2. Accessory Materials.
 - 3. Formed Metal Corner Guards

1.3 SUBMITTALS

- A. Product Data for metal base.
- B. Coordination Drawings: For formed-metal fabrications housing items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
- C. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square samples of metal of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing formed-metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Source Limitations: Obtain formed-metal fabrications through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver formed-metal fabrications wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
- B. Store products on elevated platforms in a dry location.

PART 2 - PRODUCTS

2.1 FABRICATORS

- A. Product and Fabricators – the following fabricators will be accepted for the formed metal fabrications and metal base material:
 - 1. Vickers Metal Works, Inc.

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2. Embury Company.
3. Custom Fabricators, Inc.

- B. Other Acceptable Fabricators: subject to compliance with requirements of these specifications. Submit appropriate substitution form for review by the OAR and Architect.

2.2 SHEET METAL

- A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Stainless Steel Metal Base: ASTM A 666, Type 316, stretcher-leveled standard of flatness, 14 gauge minimum. Satin Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.

2.3 MISCELLANEOUS MATERIALS

- A. Solid Backer Material for Stainless Steel Metal Base; fabricate metal base material over ¾-inch thick A-C plywood core material. Fully adhere metal banding to core and break-form to conceal all edges. Exposed fasteners will not be permitted. Finish on metal base as specified above. Provide for locations indicated. Submit shop drawings for approval before fabrication.
- B. Joint Sealants for Concealed Joints: One-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1085 and formulated with minimum of 75 percent solids.
- C. Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide concealed fasteners for interconnecting formed-metal fabrications and for attaching them to other work, unless otherwise indicated.
- D. Structural Anchors: Chemical anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble formed-metal fabrications in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Coordinate dimensions and attachment methods of formed-metal fabrications with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.
- D. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install formed-metal fabrications.

PART 3 - EXECUTION

FORMED METAL FABRICATIONS

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3.1 INSTALLATION

- A. Locate and place formed-metal fabrications level, plumb, and in alignment with adjacent construction.
- B. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- C. Install concealed gaskets, joint fillers, insulation, and flashings, as the Work progresses, to make exterior formed-metal fabrications weatherproof.
- D. Corrosion Protection: Coat concealed surfaces of aluminum, zinc-coated, and nonferrous metals that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 ADJUSTING

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.3 PROTECTION

- A. Protect finishes of formed-metal fabrications from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 05 41 00

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SECTION 05 81 01 - EXPANSION JOINT COVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including Contractual and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Floor expansion joint cover assemblies.
 - 2. Wall expansion joint cover assemblies.
 - 3. Ceiling expansion joint cover assemblies.
 - 4. Soffit expansion joint cover assemblies.
 - 5. Expansion joint cover system.
- B. To the extent shown on drawings, and specified herein.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
 - 1. Product data for each type of expansion joint cover assembly specified, including manufacturer's product specifications, installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.
 - 2. Shop drawings showing fabrication and installation of expansion joint cover assembly including plans, elevations, sections, details of components, joints, splices, and attachments to other units of Work.
 - 3. Samples for initial selection purposes in the form of manufacturer's color charts, actual units, or sections of units showing full range of colors, textures, and patterns available for each exposed metal and elastomeric material of expansion joint cover assembly indicated.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain expansion joint cover assemblies specified in this Section from one source from a single manufacturer. Coordinate compatibility with expansion joint cover assemblies specified in other sections.
- B. Fire-Test-Response Characteristics: Where indicated, provide expansion joint cover assemblies identical to those assemblies whose fire resistance has been determined per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or ASTM E 119, including hose stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Not less than the rating of adjacent construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturers and Model Numbers: Subject to compliance with requirements,

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products that may be incorporated in the Work include, but are not limited to, those specified.

B. Special Cover Mark Numbers, Model and Manufacturer – Basis of Design:

1. Ceiling Joint: EK-K1; 1-inch wide; MM Systems.
2. Wall Joint: SF-200; Construction Specialties, Inc.
3. Expansion Joint Cover Corner Piece Type 3: ESC-500; Construction Specialties, Inc.”

C. Expansion Joint Cover System, Model and Manufacturer - Basis of Design:

1. Series FS 75 Migutran S; Migua, Westborough, MA.

2.2 MATERIALS

A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6, sheet and plate.

1. Protect aluminum surfaces to be placed in contact with cementitious materials with a protective coating.

B. Stainless Steel: ASTM A 167, Type 304 with 2B finish, unless indicated otherwise, for plates, sheet, and strips.

C. Extruded Preformed Seals: Single or multicellular elastomeric profiles as classified under ASTM D 2000, designed with or without continuous, longitudinal, internal baffles. Formed to fit compatible frames, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

D. Preformed Sealant: Manufacturer's standard elastomeric sealant complying with ASTM C 920, Use T, factory-formed and -bonded to metal frames or anchor members; in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

1. Joints 2 Inches Wide and Less: Withstand plus or minus 35 percent movement of the joint width without failure.
2. Joints Greater Than 2 Inches to 4 Inches Wide: Withstand plus or minus 50 percent movement of the joint width without failure.

E. Fire Barriers: Designed for indicated or required dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Tested in maximum joint width condition with a field splice as a component of an expansion joint cover per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or ASTM E 119, including hose stream test of vertical wall assemblies by a nationally recognized testing and inspecting agency acceptable to authorities having jurisdiction.

F. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 EXPANSION JOINT COVER ASSEMBLIES

A. General: Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated. Provide units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

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- B. Moisture Barrier: Provide manufacturer's continuous, standard, flexible vinyl moisture barrier under covers at locations indicated.
- C. Fire-Rated Joint Covers: Provide expansion joint cover assemblies with manufacturer's continuous, standard, flexible fire barrier seals under covers at locations indicated to provide fire-resistive rating not less than the rating of adjacent construction.
- D. Coverless Fire Barrier: Provide manufacturer's continuous standard flexible fire barrier seals at locations indicated to provide fire-resistive rating not less than the rating of adjacent construction.
- E. Metal Floor-to-Floor Joint Cover Assemblies: Provide continuous extruded metal frames of profile indicated with seating surface and raised floor rim or exposed trim strip to accommodate flooring and concealed bolt and anchors embedded in concrete. Provide assemblies formed to receive cover plates of design indicated and to receive filler materials (if any) between raised rim of frame and edge of plate. Furnish depth and configuration to suit type of construction and to produce a continuous flush wearing surface with adjoining finish floor surface.
- F. Floor-to-Wall Joints: Provide one frame on floor side of joint only. Provide wall side frame where required by manufacturer's design.
 - 1. Angle Cover Plates: Attach angle cover plates for floor-to-wall joints to wall with countersunk, flat-head exposed fasteners secured to drilled-in-place anchor shields, unless otherwise indicated, at spacing recommended by joint cover manufacturer.
- G. Wall, Ceiling, and Soffit Joint Cover Assemblies: Provide interior wall and ceiling expansion joint cover assemblies of same design and appearance. Provide exterior wall and soffit expansion joint cover assemblies of same design and appearance. Provide wall expansion joint cover assemblies compatible with floor expansion joint cover assemblies design and appearance.

2.4 METAL FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes to products in factory after fabrication. Protect finishes on exposed surfaces before shipment.
- B. Aluminum Finishes: Mill finish.
- C. Stainless Steel Finishes: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
 - 1. Bright, Cold-Rolled Unpolished Finish: AISI No. 2B finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Manufacturer's Instructions: In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for phases of Work, including preparing substrate, applying materials, and protecting installed units.
- B. Coordinate and furnish anchorages, setting drawings, templates, and instructions for installation of expansion joint cover assemblies to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

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- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

3.2 INSTALLATION

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install expansion joint covers. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling. Set floor covers at elevations to be flush with adjacent finished floor materials. Locate wall, ceiling, and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches on center.
- B. Continuity: Maintain continuity of expansion joint cover assemblies with a minimum number of end joints and align metal members mechanically using splice joints. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials (if any) to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- C. Extruded Preformed Seals: Install seals complying with manufacturer's instructions and with minimum number of end joints. For straight sections provide preformed seals in continual lengths. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer. Apply adhesive, epoxy, or lubricant-adhesive approved by manufacturer to both frame interfaces before installing preformed seal. Seal transitions according to manufacturer's instructions.
- D. Elastomeric Sealant Joint Assemblies: Seal end joints within continuous runs and joints at transitions according to manufacturer's directions to provide a watertight installation.
- E. Fire Barriers: Install fire barriers, including transitions and end joints, according to manufacturer's instructions so that fire-rated construction is continuous.

3.3 CLEANING AND PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

END OF SECTION 05810

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and General conditions provisions of the contract including contractual conditions, and division 1 specifications.

1.2 SUMMARY

This Section includes the following:

1. Wood furring, grounds, nailers, and blocking.
2. Plywood backing panels.

To the extent show on drawings and specified herein.

1.3 DEFINITIONS

Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.4 SUBMITTALS

Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.

Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.

Warranty of chemical treatment manufacturer for treatment.

Research or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence the following products' compliance with building code in effect for Project.

4. Fire-retardant-treated wood.

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1.5 QUALITY ASSURANCE

Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by a single producer.

Roof Related Rough Carpentry: Comply with the requirements of FM 1-49, latest edition, for construction of roof related rough carpentry.

1.6 DELIVERY, STORAGE, AND HANDLING

Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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:

1. Wood-Preservative-Treated Materials:
 - a. Hickson Corp.
 - b. Hoover Treated Wood Products, Inc.
 - c. Osmose Wood Preserving, Inc.
2. Fire-Retardant-Treated Materials, Interior Type A:
 - a. Hickson Corp.
 - b. Hoover Treated Wood Products, Inc.
3. Fire-Retardant-Treated Materials, Exterior Type:
 - a. American Wood Treaters, Inc.
 - b. Hoover Treated Wood Products, Inc.

2.2 LUMBER, GENERAL

Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

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Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:

1. SPIB - Southern Pine Inspection Bureau.
2. WWPA - Western Wood Products Association.

Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

3. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.

Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

4. Provide dressed lumber, S4S, unless otherwise indicated.
5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

1. Do not use chemicals containing chromium or arsenic.
2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:

3. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
4. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
5. Wood framing members less than 18 inches above grade.
6. Wood floor plates installed over concrete slabs directly in contact with earth.

Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40-lb/cu. ft.

Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

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2.4 FIRE-RETARDANT-TREATED MATERIALS

General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Research or Evaluation Reports: Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model code research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.
2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

Interior Type A: For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:

3. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency.
4. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.
5. Contact with treated wood does not promote corrosion of metal fasteners.

Exterior Type: Use for exterior locations and where indicated.

Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

2.5 DIMENSION LUMBER

General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.

2.6 BOARDS

Concealed Boards: Where boards will be concealed by other work, provide lumber with 19 percent maximum moisture content and of following species and grade:

1. Species and Grade: Mixed southern pine, No. 2 per SPIB rules.
2. Species and Grade: Hem-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules.
3. Species and Grade: Spruce-pine-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules.
4. Species and Grade: Western woods, Standard per WCLIB rules or No. 3 Common per WWPA rules.
5. Species and Grade: Any species above.

2.7 MISCELLANEOUS LUMBER

General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

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Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

Grade: For dimension lumber sizes; provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.8 STRUCTURAL-USE PANELS FOR BACKING

Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick.

2.9 FASTENERS

General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Provide 300 Series stainless steel fasteners where in contact with pressure treated materials.
2. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide stainless steel fasteners.

Power-Driven Fasteners: CABO NER-272.

Lag Bolts: ASME B18.2.1.

Bolts: Stainless steel bolts.

Nails: TYPE 316 stainless steel annular or ring shank.

2.10 ISOLATION MATERIALS

A. "PERMA BARRIER"

1. Wrap all treated wood which is in contact with metal framing or structural steel with peel and stick "Perma Barrier" by Grace to isolate and prevent contact between materials.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

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Apply field treatment complying with AWPAC M4 to cut surfaces of preservative-treated lumber and plywood.

Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Florida Building Code 2010.
2. Wind Pressures and Loads listed on structural drawings.

Use common annular or ring shank stainless steel nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

Joint Installation: Layer to layer board joints no less than 4' apart and all layered blocking at corner conditions be woven.

3.3 CHEMICAL REACTANT MATERIAL CONTACT.

- A. In contract, do not install P.T. Wood in contact with carbon steel, aluminum galvanized steel. Wrap P.T. Wood Material in Perma Barrier or similar self adhering modified Bitumen membrane before installation.

END OF SECTION 06 10 00

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SECTION 06 22 01 - ARCHITECTURAL WOODWORK

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provision of the Contract, including General and Supplementary conditions and General Requirements, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. The extent of each type of architectural woodwork is shown on drawings and in schedules.
- B. Architectural woodwork is defined to include (in addition to items so designated on drawings) miscellaneous exposed wood members commonly known as "Finish Carpentry" or Millwork", except where specified under another section of these specifications.
- C. The types of architectural woodwork include, but are not necessarily limited to the following: Plastic laminate finished casework; plastic laminate countertops, base and wall cabinets.

1.3 QUALITY ASSURANCE

- A. Quality Standards: Except as otherwise shown or specified, comply with specified provisions of the following: Architectural Woodwork Institute (AWI) "Quality Standards".
- B. Quality Marking: Mark each unit of architectural woodwork with mill's or fabricator's identification and grade mark, located on surfaces which will not be exposed after installation.
- C. Arrange for the fabrication and installation of architectural woodwork, with sequence matched laminates to be produced by a single firm.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each item of factory-fabricated woodwork.
- B. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components. Submit shop drawings for the following: Cabinets; counters; shelves.
- C. Samples: submit the following samples for each species and cut or pattern of architectural woodwork: Plastic laminate, 12" square; exposed cabinet hardware, one unit of each type and finish.
- D. Samples: Submit one (1) sample for each type of hardware accessory.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

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1.6 JOB CONDITIONS

- A. Conditions: Installer shall advise Contractor of temperature and humidity requirements for woodwork installation areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.
- B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.- percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND FABRICATION METHODS

- A. General: Except as otherwise indicated, comply with the following requirements for architectural woodwork not specifically indicated as prefabricated or prefinished standard products.
- B. Wood Moisture Content: Provide kiln-dried lumber with an average content range of 9% to 13% for exterior work and 6% to 11% for interior work. maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed the following.
- C. Interior Wood Finish: 8% to 13% for damp regions (as defined by AWI).
- D. Exterior Trim: 9% to 14% for damp regions (as defined by AWI).
- E. Veneer: Plain sawed/sliced Red Oak.
- F. Veneer Matching: To be determined by fabricator, for best visual effect, depending upon flitch width and grain character. Refer questions of best visual effect to Architect for resolution as work progresses.
- G. Plastic Laminate: Comply with NEMA LD-3; type, thickness, color, pattern, and finish as indicated for each application.
- H. Quality Standards: For following types of architectural woodwork; comply with indicated standards as applicable.
- I. Design and Construction Features: Comply with details shown for profile and construction of architectural woodwork; and, where not otherwise shown comply with applicable Quality Standards, with alternate details as fabricator's option.
- J. Pre-Cut Openings; Fabricate architectural woodwork with pre-cut openings, wherever possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutouts and, where located in counter tops and similar exposures, seal edges of cutouts with a water-resistant coating.
- K. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawings details as required for accurate fit.
- L. Where sequence of measuring substrates before fabrication would delay the project, proceed

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with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork, for accurate fit.

2.2 ARCHITECTURAL WOODWORK TYPES

A. Plastic Laminate Finished Casework:

1. Premium Grade; Custom Grade.
2. Plastic Laminate for Horizontal Surfaces:
3. 0.050" thickness, General Purpose type (high pressure).

B. Plastic Laminate for External Vertical Surfaces:

1. 0.028" thickness; general Purpose Type (high pressure).

C. Plastic Laminate for Postforming:

1. 0.042" thickness; postforming type (high-pressure).

D. Plastic Laminate for Cabinet Linings:

1. 0.020" thickness, cabinet lintel type (high pressure).

E. Plastic Laminate for Concealed Panel Backing:

1. 0.020" thick, backer type (high pressure).

F. Plastic Laminate Colors and Patterns:

1. Color: Wilson Art or approved equal. Submit sample for final approval by the owner user or and as selected by owner from standard color selection (or approved equal).
2. Fabricate exposed edges of casework, including edges of doors and drawers when open, with matching plastic laminate, except as otherwise indicated. Provide dust panels of 1/4" thick plywood or tempered hardboard above compartments and drawers, except where located directly below countertops.

G. Plastic Laminate Countertops:

1. General:
 - a. Except as otherwise indicated, provide separate plastic laminate countertops (installed on other casework or other support system as indicated) to comply with requirements for casework for plastic laminate finish.

2.3 FINISH FOR ARCHITECTURAL WOODWORK

A. General: The entire finish of architectural woodwork is work of this Section, regardless of whether shop applied or applied after installation.

B. Shop Finishing: To the greatest extent possible, finish architectural woodwork at shop or factory. Defer only final touch-up, cleaning and polishing for time after delivery and installation.

C. The priming and prefinishing (if any) of architectural woodwork required to be performed at the

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shop or factory is specified as work of this section.

- D. Preparations for Finishing: Comply with AWI Quality Standards, Section 1500 for sanding, filling, countersunk fasteners, back priming and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.
- E. Transparent Finish General: AWI Finish System No. 3e, Premium Grade, open grain finish.
- F. Shop Application: Sealer.
- G. Final Finish: Sanding; followed by 2 coats of clear alkyd-urea conversion varnish, rubbed to medium sheen.

2.4 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for units which are specified as "Door Hardware" in Section 8 or in other sections of these specifications.
- B. Hardware Standards: Except as otherwise indicated, comply with ANSI A-156.9 "American National Standard of Cabinet Hardware".
- C. Quality Level: Type 2 (Institutional), unless otherwise indicated.
- D. Cabinet Hardware Schedule: Install complete all specific hardware and accessories or approved equal required for architectural woodwork as follows:
 - 1. Drawer Slide, Grant 3320, extra heavy duty, or approved equal
 - 2. Pull, Stanley 4484, US 26 D, or approved equal
 - 3. Hinges, Stanley 332, US 26 D, or approved equal
 - 4. Catches, 41, Stanley, Magnetic, or approved equal
 - 5. Standard, Knape & Vogt 255, flush mounted, or approved equal
 - 6. Support, Knape & Vogt 239, adjustable shelves, or approved equal
- E. Cabinet Door Hardware: Provide hinges, catches and pulls of types indicated, to properly accommodate each door size and style.
- F. Locks: Where indicated, provide standard pin-type or disc-type (5 pins or discs) tumbler locks keyed individually except as otherwise indicated.
- G. Shelf Supports: Where shelving is indicated as "adjustable", provide slotted-type standards and brackets of type needed to properly support shelves with uniform 40-lb. per sq. ft. loading.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examination: The Installer must examine substrates and conditions under which work is to be installed, and notify Contractor in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

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3.2 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installation.
- B. Pre-Installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor, Architect and other Owner Representatives (if any), installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work, and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be properly maintained.
- C. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.
- D. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.3 INSTALLATION

- A. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops); and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offsets in revealed adjoining surfaces.
- B. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- C. Casework: Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of casework with transparent finish.
- D. Countertops: Anchor securely to base units and other support systems as indicated.

3.4 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

- A. Repair damaged and defective woodwork wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean hardware, lubricate and make final adjustments for proper operation.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.
- D. Complete the finishing work specified as work of this Section, to whatever extent not completed at shop or prior to installation of woodwork.
- E. Protection: Installer of architectural woodwork shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END SECTION 06 22 01

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.02 DESCRIPTION OF WORK

- A. The extent of thermal insulation work is shown on the drawings, by the generic name of by its abbreviation. The applications of thermal insulation specified in this Section include the following:
 - 1. Loose cavity wall insulation.
 - 2. Batt-type building insulation.
 - 3. Foam cavity wall insulation.
 - 4. Semi-rigid board insulation.
 - 5. Mineral wool blanket sound attenuation.
 - 6. Fire batt insulation.

1.03 QUALITY ASSURANCE

- A. Thermal Conductivity: The thicknesses shown are for the thermal conductivity (k-value at 75°F) specified for each material. Provide adjusted thicknesses as directed for the equivalent use of material having a different thermal conductivity.
- B. Fire and Insurance Ratings: Comply with the fire-resistance, flammability, and insurance ratings indicated and comply with governing regulations as interpreted by authorities.

1.04 SUBMITTALS

- A. Manufacturer's Data, Thermal Insulation: Submit six (6) copies of manufacturer's specifications and installation instructions for each type of insulation required. Include data substantiating that materials comply with specified requirements.

1.05 PRODUCT HANDLING

- A. Protection from Deterioration: Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

1.06 JOB CONDITIONS

- A. Examination of Substrates: The installer must examine the substrate and the conditions under which the insulation work is to be performed, and

notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the insulation work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Loose Granular Perlite Insulation: Expand aggregate; FS HH-I-574; k-value of 0.37; treated with silicone for water-repellency where used in exterior wall construction.
- B. Loose Granular Vermiculite Insulation: Exfoliated micaceous aggregate; FS HH-I-585, Type I or II; k-value of 0.50; treated for water-repellency where used in exterior wall construction.
- C. Mineral/Glass Fiber Blanket/Batt Insulation: Inorganic fibers formed into flexible resilient blankets or semi-rigid resilient sheets: ASTM C665 Type I and ASTM E136: Density as indicated, but 1.0 lb. minimum; k-value of 0.27 where thickness is indicated, or k-value and thickness as required to provide "R" value as indicated. Manufacturer's standard lengths and widths as required to coordinate with spaces to be insulated:
 - 1. Certain Teed – Thermal Batt Insulation unfaced.
 - 2. Johns-Manville – Thermal Batt Insulation unfaced.
 - 3. Owens-Corning – Thermal Batt Insulation unfaced.
- D. Foam Insulation: Basis of Design. Core-Fill 500 foam insulation, 60 lbs. density developing a "R" value for 8" CMU of 14.2 and a "U" value of 0.07. Flame spread not to exceed 25. Smoke developed of not more than 450 as per ASTM E84. As manufactured by Tailored Chemical Products.
 - 1. Other acceptable manufacturers subject to compliance with requirements, products may be incorporated in the work include, but are not limit to the following.
 - a. Air Krete, Inc., Weed Sport, NY
 - b. Thermco, Mt. Pleasant, Idaho
- E. Miner/glass fiber board insulation inorganic fibers with a thermosetting resin binder into semi-rigid boards: ASTM C612, type IA and IB: Density as indicated, 3.0 PCF; K-value 23. Owens-Corning type 703, unfaced, or approved substitution.
- F. Mineral Wool Blanket/Batt Insulation: Inorganic fibers formed into flexible resilient blankets. Classified non-combustible ASTM E136, ASTM C665, Type I sound attenuation fire batt insulation/MW/mineral wool. Owens-Corning, sound attenuation fire batt insulation/mineral wool, or approved substitution.

2.02 MISCELLANEOUS MATERIALS

- A. Bronze/Stainless-Steel Screen.
- B. Mechanical Anchors: Type and size shown or, if not shown, as recommended by insulation manufacturer for type of application, condition of substrate and cavity.
- C. Grout
- D. Galvanized expanded wire.

PART 3 EXECUTION

3.01 PREPARATION OF SUBSTRATE

- A. Provide bronze/stainless-steel screen (inside) where openings must be maintained for drainage or ventilation.

3.02 INSTALLATION

- A. General: Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available, or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work. Do not install insulation in wet conditions.
- B. Cavity-Wall and Masonry-Cell Insulation: Pour granular insulation into cavities as shown, to completely fill the void spaces. Maintain inspection ports to show presence of insulation at the extremities of each pour area. Close ports after complete coverage has been confirmed. Limit fall of insulation to one story in height, but not to exceed 20'-0".
- C. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Apply a single layer of insulation of the required thickness, unless otherwise shown or required to make up the total thickness.
- E. Install foam product following the manufacturer's recommendations for mixing, installing, and curing.
- F. Install board insulation creating a continuous layer of insulation.

3.03 GENERAL BUILDING INSULATION

- A. Pour granular insulation into spaces and onto surfaces as shown. Screed horizontal applications to uniform thicknesses indicated.
- B. Provide either perlite or vermiculite into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume to a density of approximately 2.5 lbs. per cubic foot.

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- C. Protect voids and cavities for concrete cells, columns, lintels, bond beam, and concrete beam forms free of insulation material. Clean completely of any loose fill insulation.
- D. Apply insulation units to the substrate by the method indicated, complying with the manufacturer's recommendations. If no specific method is indicated, bond units to substrate with mechanical anchorage to provide permanent placement and support of units.
- E. Stuff loose mineral fiber insulation into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume to a density of approximately 2.5 lbs. per cubic foot.
- F. Install Galvanized wire support over mineral fiber insulation on exposed installations horizontally on vertical between supports.

END OF SECTION 07 21 00

SECTION 07 22 00 - ROOF INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, Including Contractual Conditions and other Division 1 Specification Sections, apply to this Section.
- B. See Section 075216- SBS- Roofing for Florida Product Approval for roof system.

1.02 SUMMARY

- A. Section includes Installation of new multi-layer tapered roof insulation system tapered edge strips and crickets at and between drain sumps throughout the roof areas.

1.03 SPECIAL JOB CONDITIONS

- A. Surfaces to receive the new insulation shall be clean and thoroughly dry. Should surface moisture such as dew exist, the Contractor shall provide the necessary equipment to dry the surface prior to application. Do not dry with open flames.
- B. Prior to application of the insulation systems, dirt, debris and dust shall be removed from deck surfaces by vacuuming.

1.04 SUBMITTALS

- A. Submit full size (24" x 36") tapered insulation layout plan from insulation manufacturer including an outline of the roof area and locations of drains and major roof penetrations (i.e., HVAC units, mechanical screen and fan units.) Provide a profile of tapered sections. Indicate minimum and maximum thickness at perimeters, as well as average aged R-values for the proposed insulation system. The Contractor is cautioned to verify dimensions as well as existing roof penetration locations to ensure proper layouts and tapered insulation quantities.
- B. Certification from each insulation manufacturer stating the products proposed are accepted by the roof membrane manufacturer for the specified warranty. Do not submit materials without obtaining the membrane manufacturer's written acceptance.
- C. Include manufacturer's application instructions and technical data sheets or catalog cuts for each product proposed to meet the requirements of Part 2 of this Section.
- D. Shop Drawings: Drawing depicting insulation layout and fastener pattern in compliance with wind loads and pressures shown on drawing in conformance with Florida Approval Product for entire roof system.

PART 2 PRODUCTS

2.01 INSULATION

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- A. Isocyanurate insulation (base layer): rigid board skinned with factory-applied fiberglass bituminous felt, conforming to Federal Specification HH-I-530A, Type II, unfaced and C 1013-85, ASTM C1289, type II, having an average density of 2.0 lbs. per cubic foot, 4-feet x 4-feet x 1-1/2-inches thick, as manufactured by Manville, GAF, Celotex or an approved substitution.
- B. Cant strips and crickets: rigid perlite conforming to ASTM C 728, dimensions as follows:
 - 1. Cants: 4-inches wide at face and 1-1/2-inches thick
 - 2. Crickets: provide 1/2-inch per foot slope.
- C. Tapered insulation system: provide a complete isocyanurate system meeting the following minimum criteria:
 - 1. Maintain a minimum insulation thickness of 7"-inch throughout.
 - 2. Provide a minimum of R38-Value throughout all roof areas. To conform to Florida Energy Code requirements.
 - 3. Maintain constant perimeter height at edges of each roof section.
 - 4. Utilize existing and augmenting drains as designated on the drawings.
 - 5. Slope of 1/4-inch per foot; 1/2-inch per foot at drain sumps.

2.02 ASPHALT

- A. Asphalt: conforming to ASTM D312, Type III specifications for steep asphalt.

2.03 FASTENERS

- A. Insulation fasteners: self drilling, self tapping screws of sufficient length to penetrate only the underside of the upper flutes of the steel decking by 1-inch minimum and 1-1/4-inches maximum, with a fluorocarbon coating in conformance with FM 4470 specifications, installed through minimum 3-1/2-inches diameter, 26 gauge hot dipped galvanized steel stress plates, such as Dekfast as manufactured by Construction Fasteners, Inc. or approved substitution. Comply with Florida product approval for fastener requirements.
- B. Fastener pattern sized per loads shown on structural drawing wind pressure diagram for field, edge and corner.

2.04 COVERBOARD

- A. Cover board 5/8" Georgia pacific Dens Deck Prime Cover Board or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Insulation systems shall be installed on properly installed, clean, dry surfaces. Broom base sheet clean prior to insulation installation.
- B. Insulation boards shall be free of defects including, but not limited to, broken corners, improperly adhered skins, excessive moisture, dimensional irregularities and the like. Defective insulation boards shall be marked and immediately removed from the site.
- C. The minimum dimension on cut insulation boards shall be 12-inches, with a minimum surface area of 2 square feet.

3.02 INSULATION INSTALLATION

- A. Isocyanurate insulation shall be mechanically attached to the steel roof decks using the specified and recommended fasteners. Stagger end joints to the middle of the long dimension of the adjacent insulation boards. Fasteners shall be installed at a rate of 1 fastener per 2 square feet of area. Refer to FM Data Sheet I-28 for insulation fastening pattern. Fastener spacing shall be halved a minimum of 8-feet in each direction from building corners. Fasteners shall be driven straight and perpendicular to the insulation.
- B. Install cover board layers of tapered isocyanurate insulation, crickets, and cants in moppings of hot steep asphalt, applied at the rate of 30 pounds per square.
- C. Stagger joints of the isocyanurate insulation at the midpoint in the long dimension. Stagger joints between insulation layers 12-inches minimum.
 - 1. Stagger successive layers of insulation 12" vertically and laterally to ensure board joints do not coincide with joints from layers above and below.
- D. Place boards carefully to prevent bitumen from being forced between joints and onto top surface of board. Boards with asphalt found on the fiberboard insulation or tapered edge strip (membrane receiving surface) shall be immediately removed. "Walk-in" boards immediately upon their installation. Poorly adhered boards shall be removed and replaced.
- E. Utilize tapered edge strips and filler boards at drain sump locations. Step taper from the surrounding insulation system down to the drain bowl locations. Provide a 8-foot x 8-foot minimum drain sump.
- F. Install Insulation board with mechanical fastener as required by Florida Approval to comply with wind loads requirements on drawings.
- G. For insulation and cover boards located partially within the defined perimeter and/or corners, install fastener for the entire board as required by largest load specified.

END OF SECTION 07 22 00

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SECTION 07 26 16 - BELOW-GRADE VAPOR BARRIERS

PART 1 GENERAL

1.01 SUMMARY

A. Products supplied under this section:

1. Vapor barrier and installation accessories for installation under concrete slabs, foundations and thickened edges.

B. Related sections:

1. Section 03 30 00 Cast-in-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E1745- 11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
2. ASTM E1643- 11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.03 SUBMITTALS

A. Quality control/assurance:

1. Summary of test results per paragraph 9.3 of ASTM E 1745.
2. Manufacturer's samples and literature.
3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.
4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 PRODUCTS

2.01 MATERIALS

A. Vapor barrier shall have all of the following qualities:

1. Maintain permeance of less than 0.01 Perms grains/(ft² · hr · inHg) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum

B. Vapor barrier products:

1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.

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2. Approved equal meeting all performance and submittal requirements.

2.02 ACCESSORIES

A. Seams :

1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com, or approved equal.

B. Penetrations of Vapor barrier:

1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com, or approved equal.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com, or approved equal.

C. Perimeter/edge seal:

1. Stego Crete Claw by Stego Industries LLC, (887) 464-7834 www.stegoindustries.com, or approved equal.
2. StegoTack Tape (double sided) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com, or approved equal.
3. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com, or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
1. Level and compact base material.
 2. Application of Termitite.

3.02 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier under footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.
 3. Seal vapor barrier to slab perimeter/edge using Stego Crete Claw and remove dirt, debris, and mud from Crete Claw prior to concrete placement.
 4. Overlap joints 6 inches and seal with manufacturer's tape.
 5. Apply tape/Crete Claw to a clean and dry vapor barrier.
 6. Seal all penetrations (including pipes) per manufacturer's instructions.
 7. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
 8. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION 07 26 16

SECTION 07 27 00 – VAPOR IMPERMEABLE AIR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Self-adhering vapor impermeable air barrier.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Samples: For the following products:
 - 1. 12-by-12-inch square of membrane material.
- C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- D. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

- C. Preinstallation Conference: Conduct conference at Project site. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply materials within the range of ambient and substrate temperatures recommended by the materials manufacturer. Do not apply to a damp or wet substrate.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

PART 2 - PRODUCTS

2.1 SELF-ADHERING MEMBRANE IMPERMIABLE AIR AND VAPOR BARRIER

- A. Product and Manufacturer – Basis of Design: Perm-A-Barrier Wall Membrane; W.R. Grace & Co., Grace Construction Products.
 - 1. Thickness: 3/64-inch.
- B. Or Approved Equal

2.2 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by the materials manufacturer for intended use.
- B. Primer: Type as recommended by the manufacturer for existing substrates indicated.
 - 1. Solvent Type: Water
 - 2. VOC Content: Not to exceed 10 g/l
 - 3. Application Temperature: above 25 degrees Fahrenheit
 - 4. Freezing Point: 21 degrees Fahrenheit
 - 5. Product Permabarrier WB Primer manufactured by Grace Construction Products, or approved equal.

- C. Sealant: Two part, Elastomeric, trowel grade material designed for use with self adhered membrane and tapes as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Install membrane over surfaces devoid of depression, joints. Installation of membrane over voids joints without filling shall be approved in writing by membrane manufacturer.

3.3 SELF-ADHERING MEMBRANE SHEET APPLICATION

- A. Install self-adhering sheets according to manufacturer's written instructions and recommendations.
- B. Apply primer to substrates in accordance with manufacturer's instructions and recommendations. Limit priming to areas that will be covered in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive membrane. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps in shingle fashion. Overlap and seal seams and stagger end laps to ensure watertight installation.
- D. Seal exposed edges of sheets at terminations. Perimeter of patches or membrane not properly shingled shall receive an application of GCP liquid membrane (LM).
- E. Repair tears, voids, and lapped seams in membrane. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.
- F. Correct deficiencies in or remove sheet materials that does not comply with requirements, repair substrates, and reapply sheet membrane.

3.4 PROTECTION AND CLEANING

- A. Protect self-adhering membrane from damage and wear during remainder of construction period.

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- B. Protect installed materials from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 27 00

SECTION 07 52 16 - SBS-MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Work Shall include, but limited to, the following:
 - 1. Preparation of steel roof deck, and all flashing substrates.
 - 2. Insulation and Cover-board. See section 07 22 00
 - 3. Anchor/Base Sheet mechanically fastened.
 - 4. SBS-modified bitumen base ply (s) (heat-welded).
 - 5. SBS-modified bitumen Cap sheet (heat-welded).
 - 6. SBS-modified bitumen membrane flashings.
 - 7. Sheet metal flashings and sheet metal roof edge system.
 - 8. All related materials and labor required to complete specified roofing necessary to receive specified manufacturer's warranty.
- B. System Description: All SBS membrane systems shall be a hot-mopped, multi-layer, homogenous roofing sheet assembly with a granular surfacing on the cap sheet layer. All roofing sheets shall be made with identical SBS blend formulations and manufactured using the same process for sheet construction.

1.02 CODE COMPLIANCE

- A. Roofing membrane system shall meet the requirements of the Florida Building Code 2010.
 - 1. Provide product evaluations and installation requirements indicating compliance.
 - 2. Provide a system with Florida Product Approval and wind load requirements shown on the drawings. FL3915-R-16 System No SC-121

1.03 RELATED SECTIONS:

- A. Drawings and General conditions provisions of the contract including contractual conditions, and Division 01 00 00 General Requirements.
- B. Section 07 62 00 sheet metal flashing and trim and section 07 22 00 roof insulation.

1.04 DEFINITIONS

- A. ASTM D 1079-Definitions of Term Relating to Roofing, Waterproofing and Bituminous Materials.
- B. The National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, Fifth Edition Glossary.

1.05 PRE-INSTALLATION CONFERENCE

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- A. Preliminary Roofing Conference: Refer to Division 1 for additional requirements. Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the preinstallation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.
- B. Preapplication Roofing Conference: Refer to Division 1 for additional requirements. Approximately 2 weeks prior to scheduled commencement of roofing installation and associated work, meet at Project site with Installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work including mechanical work, Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with work performance, including Owner's insurers, test agencies, and governing authorities, where applicable.
 - 1. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 2. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structural members.
 - 3. Review loading limitations of deck during and after roofing.
 - 4. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
 - 5. Review governing regulations and requirements for insurance, certifications, and inspection and testing, if applicable.
 - 6. Review temporary protection requirements for roofing system during and after installation.
 - 7. Review roof observation and repair procedures after roofing installation.
 - 8. Record discussions of conference, including decisions and agreements or disagreements reached, and furnish a copy for each attendee. If substantial disagreements exist at the conclusion of the conference, determine how disagreements will be resolved and set a date for reconvening the conference.

1.06 REFERENCES

- A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Reference Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.
- B. AMERICAN STANDARD OF TESTING METHODS (ASTM):
 - 1. ASTM C 726 - Standard Specification for Mineral Wool Roof Insulation Board.
 - 2. ASTM C 728 - Standard Specification for Perlite Thermal Insulation Board.

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3. ASTM C 836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
4. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
5. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
6. ASTM C 1278 - Standard Specification for Fiber-Reinforced Gypsum Panel.
7. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Insulation Board.
8. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing.
9. ASTM D 312- Standard Specification for Asphalt Used in Roofing.
10. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
11. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
12. ASTM D 3019 - Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos-Fibered, and Non-Asbestos-Fibered.
13. ASTM D 3746 - Standard Test Method for Impact Resistance of Bituminous Roofing System.
14. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
15. ASTM D 4601 - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
16. ASTM D 5147 - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
17. ASTM D 5849 - Standard Test Method for Evaluating Resistance of Modified Bituminous Roofing Membrane to Cyclic Fatigue (Joint Displacement)
18. ASTM D 6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
19. ASTM D 6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
20. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
21. ASTM D 6298 - Standard Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface.
22. ASTM D 7379 - Standard Test Methods for Strength of Modified Bitumen Sheet Material Laps Using Cold Process Adhesive.
23. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.

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24. ASTM E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

C. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):

1. ANSI/SPRI/FM 4435/ES-1 Wind Design Standard for Edge System Used with Low Slope Roofing System.
2. ANSI/SPRI FX-1, Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
3. ANSI/SPRI IA-1, Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.
4. ANSI/FM 4474- American National Standard for Evaluating the Simulated Wind Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures.

D. FACTORY MUTUAL (FM):

1. FM 4450 - Approval Standard - Class I Insulated Steel Roof Decks.
2. FM 4470 - Approval Standard - Class I Roof Covers.
3. FM-120 Field, FM-300 Corner, FM-195 Perimeter

E. NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA).

F. SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION INC. (SMACNA) Architectural Sheet Metal Manual.

G. UNDERWRITERS LABORATORY (UL):

1. UL 790 Standard Test Methods for Fire Tests of Roof Coverings.
2. UL 1256 – Fire Test of Roof Deck Constructions.

1.07 SUBMITTALS

- A. Product Data Sheets: Submit manufacturer's product data sheets, installation instructions and/or general requirements for each component.

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1. Modified bitumen sheets
 2. Asphalt
 3. Base sheets
 4. Primers
 5. Cement
 6. Modified bitumen adhesive
 7. Fasteners
 8. Pourable Sealer filler
 9. Sealants
 10. Lap bleed finishing granules
 11. Walk Pads
- B. Material Safety Data Sheets: Submit manufacturer's Material Safety Data Sheets (MDS) for each component.
- C. Sample/Specimen Warranty from the manufacturer and contractor.
- D. Shop Drawings: Provide roof plan and applicable roof system detail drawings.
- E. Shop Drawings: Provide fastener patterns, schedule and Certification Letter verifying that the assembly meets or exceeds the wind load requirements of this specification, and the structural drawings. Wind pressure requirements.
1. Provide signed and sealed calculation and drawing by a Florida Registered Engineer.
- F. Installer Certification: Submit written certification from roofing system manufacturer certifying that the applicator is authorized by the manufacturer to install the specified materials and system.
- G. Manufacturer certificates: signed and sealed roofing system manufacturer certifying that the roofin system complied with requirements specified in the "performance requirements" article.
- H. Qualification Data: forms 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 Architects and OAR , and other information specified.
- I. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
- J. Research/Evaluation Repots: Evidence of roofing system' compliance with building code FM requirements and Design load /pressure in effect for the Project.
- K. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.
- L. Warranty: Sample copy of roofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

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- M. Inspection Report: copy of roofing system manufacturer's inspection report of completed roof installation.
- N. Submit manufacturer's certification for asphalt delivered to site.

1.08 CLOSEOUT SUBMITTALS

- A. Warranty: Provide manufacture's and contractor's warranties upon substantial completion of the roofing system.

1.09 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:

- 1. Manufacture shall have 20 years of experience manufacturing SBS-modified bitumen roofing materials.
- 2. Trained Technical Field Representatives, employed by the manufacturer, independent of sales.
- 3. Provide reports in a timely manner of all site visit reports.
- 4. Provide specified warranty upon satisfactory project completion.

B. INSTALLER QUALIFICATIONS:

- 1. Installer shall be authorized by the manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
- 2. Applicators shall have completed projects of similar scope using same materials as specified herein.
- 3. Contractor shall provide full time, on-site superintendent or foreman experienced with the specified roof system through satisfactory project completion.
- 4. Applicators shall be skilled in the application methods for all materials.
- 5. Contractor shall maintain a daily record, on-site, documenting material installation and related project conditions.
- 6. Contractor shall maintain a copy of all submittal documents, on-site, available at all times for reference.

1.10 DELIVERY, STORAGE AND HANDLING

- 1. Refer to each product data sheet or other published literature for specific requirements.
- 2. Deliver materials and store them in their unopened, original packaging, bearing the manufacturer's name, related standards, and any other specification or reference accepted as standard.
- 3. Protect and store materials in a dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location. During cold weather, store materials in a heated location, removed only as needed for immediate use.
- 4. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least 4 in or more above ground level.

Carefully cover storage with “breathable” tarpaulins to protect materials from precipitation and to prevent exposure to condensation.

5. Carefully store roof membrane materials delivered in rolls on-end with selvage edges up. Store and protect roll storage to prevent damage.
6. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials shall be removed from job site and replaced with new, suitable materials.

1.11 SITE CONDITIONS

1. The installer/ contractor shall be responsible for complying with all project-related safety and environmental requirements.
2. Heat-welding shall include heating the specified membrane ply using propane roof torches or electric hot-air welding equipment. The contractor shall determine when and where conditions are appropriate to utilize heat-welding equipment. When conditions are determined by the contractor to be unsafe to proceed, equivalent SBS-modified bitumen materials and methods shall be utilized to accommodate requirements and conditions.
3. Refer to NRCA CERTA recommendations, local codes and GOAA's requirements for hot work operations.
4. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified liquid-applied, or semi-solid roofing materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions.
5. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified hot asphalt-applied materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions. .
6. The contractor shall refer to product Material Safety Data Sheets (MDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.
7. Monitor substrate temperature and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials. Materials and methods shall be adjusted as necessary to accommodate varying project conditions. Materials shall not be installed when conditions are unacceptable to achieve the specified results.

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8. Precipitation and dew point: Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of roofing materials. Ensure all roofing materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.
9. Heat-Welding Application: Take all necessary precautions and measures to monitor conditions to ensure all environmental conditions are safe to proceed with the use of torches and hot-air welding equipment. Combustibles, flammable liquids and solvent vapors that represent a hazard shall be eliminated and primers shall be fully dry before proceeding with heat-welding operations. Refer to NRCA CERTA recommendations.

1.12 PERFORMANCE REQUIREMENTS

A. WIND UPLIFT RESISTANCE:

1. Performance testing shall be in accordance with ANSI/FM 4474, FM 4450, FM 4470, UL 580 or UL 1897.
 - a. Roof System Design Pressures: Calculated in accordance with ASCE 7, or applicable standard, for the specified roof system attachment requirements:
 - 1) FM-120-Field, FM-300 Corner,
FM-195 Perimeter, -112.5 MDF PSF

B. FIRE CLASSIFICATION:

1. Performance testing shall be in accordance with UL 790, ASTM E108, FM 4450 or FM 4470 to meet the ¼" :12 roof slope requirement.
 - a. Meets requirements of UL Class A or FM Class A.
2. Performance testing shall be in accordance with UL 1256, FM 4450 or FM 4470 to meet the specified requirements for interior flame spread and fuel contribution.
 - a. Meets requirements of UL 1256, or FM Class 1.

C. ROOF SLOPE:

1. Finished roof slope for SBS modified bitumen surfaces shall be ¼ inch per foot (2 percent) minimum for roof drainage.

D. IMPACT RESISTANCE:

1. Performance testing for impact resistance shall be in accordance with FM 4450, FM 4470, ASTM D3746 or CGSB 37-GP 56M to meet the specified impact resistance requirements.
 - a. Meets requirements for FM-SH (Severe Hail), ASTM D3746, or CGSB 37-GP 56M.

E. ROOF EDGE SYSTEM SECUREMENT:

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- a. Performance testing in accordance with ANSI/SPRI ES-1.
- b. Performance testing meets requirements for specified roof system design pressures.

1.13 WARRANTY

- A. Manufacturer's No Dollar Limit (NDL), Labor and Material Warranty. The manufacturer shall provide the owner with the manufacturer's labor and material warranty covering products and contractor workmanship for 10, 15, 20 years from the date the warranty is issued. Warranty to include manufacturer's 110 mph wind rider for complete roofing system. Include warranty written warranty single source, "wrap around", materials, labor and workmanship warranty, without monetary limitation (no dollar amount), signed by roofing manufacturer agreeing to promptly repair leaks in roof membrane system, including roofing membrane, flashing systems resulting from defect in material, for warranty period listed in specifications.
- B. The contractor shall guarantee the workmanship and shall provide the owner with the contractor's warranty covering workmanship for a period of 2 years from completion date.

1.14 FM GLOBAL SUBMITTALS

- A. Provide all completed FM Global forms and testing field verification for review by FM Global prior to ordering and installing roof system.
- B. All materials shall bear FM Global seal of approval.
- C. All assemblies proposed shall comply with FM "RoofNav" tested assembly.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. SINGLE SOURCE MANUFACTURER: All SBS modified bitumen membrane and flashing sheets shall be manufactured by a single supplier with 20 years or more manufacturing history in the US.
- B. PRODUCT QUALITY ASSURANCE PROGRAM: Manufacturer shall be an ISO 9001 registered company. A 'Quality Compliance Certificate (QCC) for reporting/confirming the tested values of the SBS-Modified Bitumen Membrane Materials will be supplied upon request.
- C. ACCEPTABLE MANUFACTURER:
 - 1. SOPREMA, located at: 310 Quadral Dr.; Wadsworth, OH 44281; Tel: 800-356-3521; Tel: 330-334-0066; Website: www.soprema.us.
 - 2. Acceptable Alternate Manufacturers: or approved substitution.
 - 3. Florida Product approval FL3915-R 16, System No SC 121
- D. APPROVALS

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1. FM Label: All materials shall be identified with FM Approved Markings.
2. Assembly shall have "RoofNav" assembly number meeting all specified requirements.

2.02 ROOFING SYSTEM

A. ROOFING SYSTEM BASIS OF DESIGN: SOPREMA

2.03 SBS-MODIFIED BITUMEN MEMBRANES

A. BASE SHEET/MECHANICALLY ANCHORED

1. SopraBase 614
2. Soprema #15 HD with Soprafix 2" Sean Plat, spacing per Product approval and or engineered shop drawings. Installed within the 4 " width heat welded laps.

B. BASE PLY/FLASHING BASE PLY

1. BASE PLY/FLASHING BASE PLY, HEAT-WELDED:
2. SOPREMA Sopralene Flam 180: SBS-modified bitumen membrane

C. CAP SHEET:

1. CAP SHEET/ FLASHING CAP SHEET, HEAT-WELDED:
 - a. SOPREMA Sopralene Flam 250 FR GR: SBS-modified bitumen membrane Cap Sheet with a burn-off film bottom surface and mineral granule top surface. Non-woven polyester reinforced. UL Class A for specified roof slope requirements.
 - 1) Thickness: 154 mils (3.9 mm)
 - 2) Width: 39.4 in (1 m)
 - 3) Length: 32.8 ft (10 m)
 - 4) Meets or exceeds ASTM D6164, Type II, Grade G.
 - 5) Granule Surfacing:
 - a) White mineral granules.

D. FLASHING CAP SHEET:

1. FLASHING CAP SHEET, HEAT-WELDED:
 - a. SOPREMA Sopralene Flam 250 FR GR Gravel: SBS-modified bitumen membrane Cap Sheet with a burn-off film bottom surface and mineral granule top surface. Non-woven polyester reinforced. UL Class A for specified roof slope requirements.

- 1) Granule Surfacing:
 - a) White mineral granules.

E. FLASHING BASE PLY

1. FLASHING BASE PLY, HEAT-WELDED:

- a. SOPREMA Sopralene Flam 250 FR GR: SBS-modified bitumen membrane

2.04 ACCESSORIES

A. PRIMERS:

1. SOPREMA Elastocol 500 Primer: Asphalt cut-back primer. Primer for the preparation of roof membrane and flashing substrates for asphalt, heat-welded, hot asphalt and cold adhesive-applied applications.
 - a. Meets or exceeds ASTM D41
 - b. VOC content: 350 g/L or less.
2. SOPREMA Elastocol Stick Zero Primer: Zero VOC, self-adhered membrane primer. Zero VOC solvent-based primer for the preparation of roof membrane and flashing substrates for self-adhered SBS membrane and self-adhered SBS flashing applications.
3. SOPREMA Elastocol Stick (Formerly Elastocol 600c) Primer: Self-Adhered membrane primer. SBS polymer, resin and, solvent-based primer for the preparation of roof membrane and flashing substrates for self-adhered SBS membrane and self-adhered SBS flashing applications.
4. SOPREMA Elastocol 350 (Formerly Aquadere) Primer: Polymer emulsion primer, meeting low VOC requirements for the preparation of roof membrane and flashing substrates for asphalt, torch and, cold adhesive-applied applications.

B. GENERAL PURPOSE ROOFING CEMENT AND MASTIC

1. SOPREMA Sopramastic: SBS Mastic. Fiber-reinforced, roofing cement, packaged in 5 gallon pails. General purpose roofing cement for low-slope roofing used for sealing membrane T-joints and membrane edges along terminations, transitions and at roof penetrations.
 - a. VOC Content: 190 g/L or less.
 - b. Meets or exceeds ASTM D4586, Type I, Class II.
2. SOPREMA Sopramastic: SBS Mastic. Fiber-reinforced, roofing cement, packaged in 10.4 oz caulk tubes. General purpose roofing cement for low-slope roofing used for sealing membrane T-joints and membrane edges along terminations, transitions and at roof penetrations.

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- a. VOC Content: 190 g/L or less.
 - b. Meets or exceeds ASTM D4586, Type I, Class II.
- C. GENERAL PURPOSE SEALANT
- 1. SOPREMA Sopramastic SP1: General purpose, gun-grade, elastomeric sealant for sealing vertical joints/cracks.
 - a. VOC Content: 20 g/L or less.
 - b. Meets or exceeds ASTM C920, Type S, Grade NS, Class 50.
- D. WALKWAYS
- 1. SOPREMA Soprawalk: SBS-modified bitumen membrane sheet with a sanded bottom surface and mineral granule top surface. Non-woven polyester reinforced.
 - a. Thickness: 200 mils (5.0 mm)
 - b. Width: 39.4 in (1 m)
 - c. Length: 26 ft (7.9 m)
 - d. Granule Surfacing:
 - i. Black, Grey, Tan mineral granules.
- E. MINERAL GRANULES:
- 1. SOPREMA Granules: No. 11, mineral coated colored granules, color to match cap sheet, supplied by membrane cap sheet manufacturer.
 - a. SOPREMA Granules
 - b. SOPREMA SG Granules
 - 2. Provide loose granules for use over bleed out of felts.
- F. SHEET METAL FLASHING:
- 1. Contractor shall furnish all sheet metal flashings, counter flashings, roof edge system, and all other related sheet metal flashings and associated fasteners necessary to flash and counter flash the specified roofing system.
 - 2. Sheet metal flashing materials and fasteners shall be compatible with adjacent materials, to accommodate all project related exposures.
 - 3. Pre-Finished (ADONI 280) Sheet Metal Flashing Material: Aluminum.
 - 4. Roof Edge System: Tested per ANSI/SPRI ES-1 to meet or exceed design pressures at roof edge.

PART 3 EXECUTION

3.01 EXAMINATION

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- A. Examination includes visual observations, qualitative analysis, and quantitative testing measures as necessary to ensure conditions remain satisfactory throughout the project.
- B. The contractor shall examine all roofing substrates including, but not limited to: insulation materials, roof decks, walls, curbs, rooftop equipment, fixtures, and wood blocking.
- C. The applicator shall not begin installation until conditions have been properly examined and determined to be clean, dry and, otherwise satisfactory to receive specified roofing materials.
- D. During the application of specified materials, the applicator shall continue to examine all project conditions to ensure conditions remain satisfactory to complete the specified roofing system.

3.02 PREPARATION

- A. Before commencing work each day, the contractor shall prepare all roofing substrates to ensure conditions are satisfactory to proceed with the installation of specified roofing materials. Preparation of substrates includes, but is not limited to, substrate repairs, securement of substrates, eliminating all incompatible materials, and cleaning.
- B. Where conditions are found to be unsatisfactory, work shall not begin until conditions are made satisfactory to begin work. Commencing of work shall indicate contractor's acceptance of conditions.

3.03 PRIMER APPLICATION

- A. Apply the appropriate specified primer to dry, compatible substrates as required to enhance adhesion of new specified roofing materials.
- B. Apply primer using brush, roller, or sprayer at the rate published on the product data sheet.
- C. Fully prime substrates using brush, roller, or sprayer at the application rate published in the product data sheet
- D. Asphalt Primer: Apply ELASTOCOL 500 primer to dry compatible masonry, metal, wood and other required substrates before applying asphalt and heat-welded membrane plies. Primer is optional for most solvent based solvent-based SBS adhesives and cements, refer to product data sheets.
- E. Self-Adhered Membrane Primer: Apply ELASTOCOL STICK to dry, compatible substrates as required to enhance adhesion of self-adhered membrane plies. Ensure self-adhered membrane primer is tacky to-the-touch, but not wet. Primer should not transfer to the finger tips when touched.
- F. Do not proceed applying self-adhered membrane if primer is wet. If self-adhered membrane primer becomes fully dry and loses all tack, re-prime the substrate as necessary to achieve membrane adhesion.

- G. Project conditions vary throughout the day. Monitor changing conditions, monitor the drying time of primers, and monitor the adhesion of the membrane plies. Adjust primer and membrane application methods as necessary to achieve the desired results.

3.04 HEAT WELDING

- A. The Contractor is responsible for project safety. Where conditions are deemed unsafe to use open flames, manufacturer's alternate membrane application methods shall be used to install SBS modified bitumen membrane and flashings. Acceptable alternate installation methods include hot asphalt, cold adhesive-applied, self-adhered membranes and mechanically fastened plies. Hot-air welding equipment may be used in lieu of roof torches to seal membrane side and end laps where heat welding the laps is necessary. Refer to NRCA CERTA, local codes and building owner's requirements for hot work operations.
- B. Single or multi-nozzle, hand-held propane roof torches shall be used to install heat-welded membrane and flashing plies. Multi-nozzle carts (dragon wagons) may also be utilized to install membrane plies. Seven (7) nozzle carts are recommended for more uniform heat application in lieu of five (5) nozzle carts.

3.05 SBS MASTIC AND GENERAL PURPOSE ROOFING CEMENT APPLICATION

- A. Apply SOPREMA Sopramastic general purpose SBS mastic and roofing cement to seal drain leads, metal flanges, seal along membrane edge at terminations, and where specified and required in detail drawings.
- B. Do not use general purpose SBS mastics and roofing cement where flashing cement applications are required. Do not use SBS mastics and roofing cement beneath SBS-modified bitumen membrane and flashing plies.
- C. Apply general purpose SBS mastic and elastic roofing cement using caulk gun, or notched trowel at 2.0 – 2.5 gallons per square on each surface. Application rates vary based on substrate porosity and roughness. Tool-in as necessary to seal laps
- D. Embed matching granules into wet cement where exposed.

3.06 MECHANICALLY FASTENED ANCHOR/BASE SHEET APPLICATION

- A. Follow material product data sheets and published general requirements for installation instructions.
- B. Ensure environmental conditions are satisfactory, and will remain satisfactory, during the application of the sheet.
- C. Unroll the membrane onto the roof surface. Allow the sheet to relax prior to installing the fasteners.
- D. Starting at the low point of the roof, lay out the membrane to ensure the plies are installed perpendicular to the roof slope, shingled to prevent back-water laps.

- E. Cut rolls to working lengths as required conforming to roof conditions. .
- F. Align sheet at side-laps to produce a consistent overlap required for wind uplift resistance approvals.
- G. As uniform tension is being applied, fasten the sheet beginning at the center of the sheet and work towards the end-laps, removing all wrinkles and buckles as fastening progresses.
- H. Install specified base sheet fasteners along the center line of side-laps, and intermediate rows staggered between side-laps, and fasten all end-laps.
- I. Fasten base sheet as required for specified wind uplift resistance. Install additional fasteners in roof perimeter and corners as specified.

3.07 HEAT-WELDED, FULLY ADHERED MEMBRANE APPLICATION

- A. Follow material product data sheets and published general requirements for installation instructions.
- B. Ensure environmental conditions are satisfactory, and will remain satisfactory, during the application of the heat-welded membrane.
- C. Ensure all primers are fully dry before beginning heat-welding operations.
- D. Unroll membrane onto the roof surface and allow to relax prior to installing the membrane.
- E. Starting at the low point of the roof, lay out the membrane to ensure the plies are installed perpendicular to the roof slope, shingled to prevent back-water laps.
- F. Ensure all roofing and flashing substrates are prepared and acceptable to receive the heat-welded membrane.
- G. Cut rolls to working lengths to conform to roof conditions, and lay out to always work to a selvage edge.
- H. Ensure specified side-laps and end-laps are maintained. End-laps should be staggered 3 ft apart.
- I. As the membrane is un-rolled, apply heat to the underside of the membrane until the plastic burn-off film melts away. Continuously move the torch back-and-forth across the underside of the roll to melt the bitumen on the underside of the sheet, while continuously unrolling sheet.
- J. While unrolling and heating the sheet, ensure a constant flow hot bitumen approximately $\frac{1}{4}$ to $\frac{1}{2}$ in flows ahead of the roll as it is unrolled, and there is $\frac{1}{8}$ to $\frac{1}{4}$ in bleed out at all laps.
- K. Adjust the application of heat to the underside of the membrane and to substrate as required for varying substrates and environmental conditions.
- L. At the 6 in end-laps, melt the plastic burn-off film from the top surface or embed granules, where present, using a torch or hot-air welder.

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- M. At end-laps, cut a 45 degree dog-ear away from the selvage edge, or otherwise ensure the membrane is fully heat-welded watertight at all T-joints.
- N. Each day, physically inspect all side and end-laps, and ensure the membrane is sealed watertight. Where necessary, use a torch or hot-air welder and a clean trowel to ensure all laps are sealed.
- O. Inspect the installation each day to ensure the plies are fully adhered. Repair all voids, wrinkles, open laps and all other deficiencies.
- P. Offset cap sheet side and end-laps away from the base ply laps so that Cap Sheet laps are not located within 18 in of base ply laps.

3.08 FLASHING APPLICATION, HEAT WELDED

- A. Refer to SBS manufacturer's membrane application instructions, flashing detail drawings, and follow product data sheets and other published requirements for installation instructions. Refer to manufacturer's membrane flashing detail drawings.
- B. The contractor is responsible for project safety. Refer to NRCA CERTA recommendations and building owner requirements for hot work operations.
- C. Where required to seal substrates for fire safety, install specified adhered, self-adhered or fastened backer ply to the substrate. Ensure backer-ply covers and seals all substrates requiring protection from exposure to torch operations.
- D. Ensure all flashing substrates that require primer are primed, and the primer is fully dry.
- E. Unroll the flashing base ply and flashing Cap Sheet onto the roof surface to their complete length. Once relaxed, cut the membrane to the required working lengths to accommodate the flashing height, cants and the required over-lap onto the horizontal roof surface.
- F. Cut the flashing membrane from the end of the roll in order to always install flashings to the side-lap line or selvage edge line.
- G. Lay out the flashing base ply and flashing Cap Sheet to offset all side-laps a minimum of 12 inches so that side-laps are never aligned on top of the ply beneath. Shingle the flashing ply laps to prevent back-water laps.
- H. Install non-combustible cant strips at transitions where required.
- I. Ensure correct membrane and flashing sequencing to achieve redundant, multiply, watertight flashings.
- J. ROOF MEMBRANE BASE PLY:
 - 1. Before installing flashings, install the roof membrane base ply in the horizontal field of the roof, and extend the base ply up to the top of the cant, where present, at roof terminations, transitions and penetrations.
- K. FLASHING BASE PLY:

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1. Install the flashing base ply starting at the top leading edge of the vertical flashing substrate, down over the cant and onto the horizontal surface of the roof a minimum of 3 inches beyond the of base of the cant. Cut the base ply at corners to form 3 inch side-laps. Install gussets to seal corner transitions.
2. Install one or more flashing base ply(s) at all roof terminations, transitions and penetrations.

L. ROOF MEMBRANE CAP SHEET:

1. Install the roof membrane Cap Sheet in the horizontal field of the roof over the flashing base ply up to the roof termination, transition or penetration, and up to the top of cants where present.
2. Using a chalk line, mark a line on the membrane Cap Sheet a minimum of 4 inches from the base of the cant onto the roof. Where granules are present, embed the Cap Sheet granules using a torch and trowel or granule embedder to prepare the surface to receive the flashing Cap Sheet.

3.09 SHEET METAL FLASHING APPLICATION

- A. Refer to sheet metal flashing detail drawings, and follow product data sheets and published general requirements for installation instructions.
- B. Follow the most recent edition of the SMACNA Architectural Sheet Metal Manual for fabrication and installation requirements.

3.10 WALKWAYS

- A. At areas outlined on the drawings, and around the perimeter of all rooftop equipment and at all door and stair landings, install walkway protection.
- B. Cut walkway from end of rolls. No piece shall be less than 24 in.
- C. Provide a 2 in space between sheets for drainage.

3.11 CLEAN-UP

- A. Clean-up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

END OF SECTION 07 52 16

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General conditions provisions of the contract including contractual conditions, and division 1 specifications.

1.02 SUMMARY

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

1.03 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.

1.04 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 architects and Owners, and other information specified.

1.05 QUALITY ASSURANCE

- A. Quality Control Standard: Sheet Metal & Air Conditioning Contractor's National Association (SMACNA), latest edition, and the Florida Building Code.

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- 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 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 Architect.
 - 2. Notify Architect 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 Architect'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.

1.06 WARRANTY: All warranted work under this section will be part of warranty coverage under section 07 52 16.

1.07 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

2.01 ALUMINUM COPING:

- A. HICKMAN: "PermaSnap 2" with product Florida Product approval # 7424, prefinished to be selected by Architect to match existing, straight coping profile.
- B. Or approved equal

2.02 ALUMINUM REGLET

- A. HICKMAN: Concealed mount reglet .032 thickness, color dove gray, A-09.

2.03 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 B 209, 3003-H14, with a minimum thickness of 0.040 inch, unless otherwise indicated.
 - 2. Extruded Aluminum: ASTM B 221, 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 A 167, 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.

2.04 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.
- 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.

2.05 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 application but never less than thickness of metal being secured.
- J. Dissimilar Metals
 - 1. Dissimilar metals will be isolated from each other by painting or by other approved system/material isolator.

2.06 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: See Paragraph 2.01
- D. Base Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.025 inch minimum thickness, (24 gauge).
- E. Counterflashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.025 inch minimum thickness, (24 gauge).
- F. Flashing Receivers: Fabricate from the following material:
 - 1. Stainless Steel: 0.025 inch minimum thickness (24 gauge).
- G. Equipment Support Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.025 inch thick, (24 gauge).
- H. Concealed Flashing and Thru-Wall Flashing: Fabricate from the following material:
 - 1. Stainless Steel: 0.025 inch thick; mill finish, (24 gauge).

2.07 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: to be selected by the Architect to match existing.

PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- 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 07 62 00

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SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General conditions provisions of the contract including contractual conditions, and division 1 specifications.

1.02 SUMMARY

- A. Section Includes:
1. Penetrations in fire-resistance-rated walls.
 2. Penetrations in horizontal assemblies.
 3. Penetrations in smoke barriers.
- B. Firestopping shall be designed and constructed in accordance with the Florida Building Code and Uniform Fire Safety Standards as adopted by the State Fire Marshall.

1.03 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.
- B. 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.
- C. 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:
1. Penetrations located outside wall cavities.
 2. Penetrations located outside fire-resistive shaft enclosures.
 3. Penetrations located in construction containing fire-protection-rated openings.
 4. Penetrating items larger than 4-inch (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.

5. Penetrating rated wall construction.
- D. 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.
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. 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.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- E. 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.

1.04 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.

1.05 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.
- 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:
 - 1) "UL in "Fire Resistance Directory."
- E. Pre-installation Conference: Conduct conference at Project site.

1.06 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 multi-component 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.

1.07 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.

1.08 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.
- 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

2.01 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:
 - 1. Hilti Construction Chemicals, Inc.
 - 2. Nelson Firestop Products.
 - 3. 3M Fire Protection Products.

2.02 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:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.03 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.

2.04 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 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

3.01 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.

3.02 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.

3.03 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.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 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.
 - 1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.05 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".
 - 2. Permanent Phenolic Label screwed to wall.
 - a. Contractor's name, address, and phone number.
 - b. Through-penetration firestop system designation of applicable testing and inspecting agency.
 - c. Date of installation.
 - d. Through-penetration firestop system manufacturer's name.
 - e. Installer's name.

3.06 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.

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SECTION 07 84 20 - FIRE-RESISTIVE JOINT 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. This Section includes fire-resistive joint systems for the following:
 - 1. Floor-to-floor joints.
 - 2. Floor-to-wall joints.
 - 3. Head-of-wall joints.
 - 4. Wall-to-wall joints.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For joints in the following constructions, provide fire-resistive joint 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 in which fire-resistive joint systems are installed:
 - 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 floor assemblies.
 - 4. Exterior curtain-wall assemblies and fire-resistance-rated floor assemblies.
- B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.
 - 1. Load-bearing capabilities as determined by evaluation during the time test.
- C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by UBC Standard 26-9 and UL 2079.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed and relationships to adjoining construction. Include fire-resistive joint

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system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fire-resistive joint systems for each kind of joint and construction condition indicated through one source from a single manufacturer.

B. Preconstruction Compatibility and Adhesion Testing: Submit to fire-resistive joint system manufacturers, for testing indicated below, samples of materials that will contact or affect fill materials.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.

- a. Perform tests under environmental conditions replicating those that will exist during installation.

2. Submit no fewer than nine pieces of each type of material, including joint substrates, forming materials, and miscellaneous materials.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain fire-resistive joint system manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Fire-resistance 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 fire-resistive joint systems acceptable to authorities having jurisdiction.

2. Fire-resistive joint systems are identical to those tested per UL 2079. Provide rated systems complying with the following requirements:

- a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.

- b. Fire-resistive joint systems correspond to those indicated by referencing system designations listed by the following:

- 1) UL in its "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer,

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date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

- B. Store and handle materials for fire-resistive joint 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 fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up fire-resistive joint 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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 - 1. Fire-Resistive Joint Systems:
 - a. A/D Fire Protection Systems Inc.
 - b. DAP Inc.
 - c. Firestop Systems Inc.
 - d. Hilti, Inc.
 - e. ISOLATEK International.
 - f. Nelson Firestop Products.
 - g. 3M Fire Protection Products.
 - h. Tremco, Inc.
 - i. Specified Technologies, Inc.
 - 2. Perimeter Fire-Containment Systems:
 - a. Specified Technologies Inc.
 - b. United States Gypsum Company.

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2.2 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL

- A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- B. Accessories: Provide components of fire-resistive joint systems, including forming materials that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

2.3 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where UL-classified fire-resistive joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

2.4 PERIMETER FIRE-CONTAINMENT SYSTEMS

- A. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. 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 fire-resistive joint 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 fill materials of fire-resistive joint system 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

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remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. 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 fire-resistive joint systems and to prepare inspection reports.
 - 1. Inspecting agency will state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- B. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistive joint systems.
- C. If deficiencies are found, repair or replace fire-resistive joint systems so they comply with requirements.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint 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 fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

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SECTION 07 90 00 - PREFORMED, PRE-COMPRESSED SELF EXPANDING SEALANT SYSTEM

PART 1 – GENERAL

1.01 Work Included

- A. The work shall consist of furnishing and installing waterproof, fire rated expansion joints in accordance with the details shown on the plans and the requirements of the specifications. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system.
- B. Related Work
 - Division 4 - Masonry
 - Division 7 - Thermal & Moisture Protection
 - Division 7 - Sealants, Caulking and Waterproofing
 - Division 7 - Joint Firestopping

1.02 Submittals

- A. General – Submit the following according to Division 1 Specification Section.
- B. Standard Submittal Package – Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.
- C. Sample of material is required at time of submittal.
- D. All products must be identified by a UL listing number and must be listed in the UL and ULC Online Certification Directories as proof that they have been tested according to UL 2079 and manufactured under UL's "Follow Up" service.
- E. Submit UL-issued Certificate of Compliance as proof product has been tested by UL and passed ANSI/UL 2079.
- F. All products must be certified by independent laboratory test report to exceed the requirements of curtain wall performance tests ASTM E330, E283-04, and E331. Product must meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals - equal to 200 mph winds (ASTM E330-02-procedure A).
- G. All products must be certified by independent laboratory test report to ASTM E90-09 and to meet or exceed an STC 62 in STC 68 wall and OITC 52 rating in an OITC 52 wall.
- H. All products must be certified by independent laboratory test report to be free in composition of any waxes or wax compounds using FTIR and DSC testing.
- I. All products shall be certified in writing to be: a) capable of withstanding 150°F (65°C) for 3 hours while compressed down to the minimum of movement capability dimension of the basis-of-design product (-25% of nominal material size) without evidence of any bleeding of impregnation medium from the material; and b) that the same material after the heat stability test and after first being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+25% of nominal material size) within 24 hours at room temperature 68°F (20°C).

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1.03 Product Delivery, Storage and Handling

- A. Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's installation instructions.

1.04 Basis-of-Design

- A. All joints shall be designed to meet the specified performance criteria of the project as manufactured by: (USA & International) EMSEAL JOINT SYSTEMS, LTD 25 Bridle Lane, Westborough, MA 01581-2603, Toll Free: 800-526-8365. (Canada) EMSEAL, LLC 120 Carrier Drive, Toronto, Ontario, Canada M9W 5R1 Toll Free: 800-526-8365. www.emseal.com
- B. Alternate manufacturers must demonstrate that their products meet or exceed the design criteria and must submit certified performance test reports performed by nationally recognized independent laboratories as called for in section 1.02 Submittals. Submittal of alternates must be made three weeks prior to bid opening to allow proper evaluation time.

1.05 Quality Assurance

- A. The General Contractor will conduct a pre-construction meeting with all parties and trades involved in the treatment of work at and around expansion joints including, but not limited to, concrete, mechanical, electrical, HVAC, landscaping, masonry, curtain wall, waterproofing, fire-stopping, caulking, flooring and other finish trade subcontractors. All superintendents and foremen with responsibility for oversight and setting of the joint gap must attend this meeting. The General Contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to expansion joints and that their work cannot impede anticipated structural movement at the expansion joints, or compromise the achievement of watertightness or life safety at expansion joints in any way.
- B. Warranty – Manufacturer's standard warranty shall apply.
- C. LEED Building Performance Requirements:
 - 1) The VOC of the silicone must not exceed 40 grams/liter.
 - 2) Products must be proved to be certified by independent test report to exceed the requirements of curtain wall performance tests ASTM E330, E283-04, and E331. Product must meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals - equal to 200 mph winds (ASTM E330-02-procedure A).
 - 3) Products must be proved to have been certified by independent test report in accordance with ASTM C518-04 and demonstrate an R-Value per 1-inch (25mm) of depth of not less than 1.03 at as-installed nominal joint size compression.
 - 4) Products must be proved to have been certified by independent test report to ASTM E90-09 and to meet or exceed the STC and OITC rating for the project.
 - 5) Product must be proved by independent test report to have air permeability not to exceed 0.02 L/(s.m²) at 75 Pascals as required by the Air Barrier Association of America (ABAA) and in accordance with ASTM E283-04.

PART 2 – PRODUCT

2.01 General

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- A. Provide watertight, energy-efficient, 2 or 3 hour fire rated, exterior and interior joints in vertical-plane walls (above-grade). Typical locations include applications for exterior wall joints and interior wall joints where a 2 or 3 hour fire rating is required or desired. System shall perform waterproofing, fire-rating, movement-accommodation functions as well as contribute to thermal insulation and sound attenuation as the result of a single installation and without the addition of ancillary fire-blankets, mineral wool, coverplates, etc.
- B. Provide EMSHIELD WFR2 as manufactured by EMSEAL JOINT SYSTEMS LTD and as indicated on drawings for vertical expansion joint locations.
- C. Sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, 2 hour-rated, sealant system. Sealant system shall be comprised of the following components:
 - 1.) fire-retardant-impregnated foam pre-coated on both sides with an intumescent fire-proofing material and pre-coated at the outer layers with waterproof silicone,
 - 2.) field-applied epoxy adhesive primer,
 - 3.) field-injected silicone sealant bands.
- D. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size. Standard sizes from 1/2" (25 mm) to 6" (250 mm). Depth of seal is 4" (100 mm) for WFR2.
- E. Silicone external color facings to be low-modulus, waterproof silicone factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating. Silicone coatings to be available in a range of not less than 26 standard colors for coordination with typical building materials. Separate colors may be chosen for each coated surface.
- F. Select the sealant system model appropriate to the movement and design requirements at each joint location that meet the project specification or as defined by the structural engineer of record.
- G. Manufacturer's Checklist must be completed by expansion joint subcontractor and returned to manufacturer at time of ordering material.

2.02 Fabrication

- A. EMSHIELD WFR2 by EMSEAL JOINT SYSTEMS LTD must be supplied precompressed to less than the joint size, packaged in shrink-wrapped lengths (sticks). Or Approved Equal
- B. Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with published installation instructions.

PART 3 – EXECUTION

3.01 Installation

- A. Preparation of the Work Area
 - 1. The General contractor shall provide properly formed and prepared expansion joint openings constructed to the exact dimensions and elevations shown on the contract

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drawings. Deviations from these dimensions will not be allowed without the written consent of the engineer of record.

2. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the size of the EMSHIELD WFR2 being installed plus at least ¼-inch (6mm) for the application of corner beads. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.
3. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.

3.02 Clean and Protect

- A. Protect the system and its components during construction. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

END OF SECTION

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SECTION 07 92 00 – JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General conditions provisions of the contract including contractual conditions, and division 1 specifications.

1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
 - a. Control and expansion joints in cast-in-place concrete.
 - b. Control and expansion joints between concrete slabs and masonry walls.
 - c. Control and expansion joints in unit masonry.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors and windows.
 - f. Other joints as indicated.
2. Exterior joints in the following horizontal traffic surfaces:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints between concrete slab, pavement to masonry walls
 - c. Tile control and expansion joints.
 - d. Joints between different materials listed above.
 - e. Other joints as indicated.
3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors.
 - f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - g. Other joints as indicated.
4. Interior joints in the following horizontal traffic surfaces:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - b. Control and expansion joint between floor slab and masonry wall.
 - c. Control and expansion joints in tile flooring.
 - d. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

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- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturers written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Preinstallation Conf: Include, manufacturer, installer, general contracting OAR and architect to review product, installation and warranty requirements.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: 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.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F.
 - 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing 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.

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1. Warranty Period: As specified, beginning from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide the following products indicated for each type in the sealant.
 1. One-Part Silicone Sealant: For poured-in-place concrete and concrete-to-masonry; one-part silicone sealant, having a joint movement capability of plus-or-minus 100% elongation, minus 50% compression, and Shore A durometer hardness of 15.
 - a. Product and Manufacturer: "No. 790"; Dow Corning Corp. or equal product as manufactured by General Electric Co.
 - b. Warranty: Manufacturer's standard 20 year warranty.
 2. One-Part Silicone Sealant: For masonry-to-aluminum, steel-to-aluminum, concrete-to-aluminum, steel-to-steel, and other metal-to-metal joints (including KYNAR coatings); one-part silicone sealant having a joint movement capability of plus-or-minus 50% elongation, and Shore A durometer hardness of 30.
 - a. Products and Manufacturers: Provide one of the following.
 - 1) "Dow Corning 795"; Dow Corning Corp.
 - 2) "Silpruf SCS 2000"; General Electric Co.
 - b. Warranty: Manufacturer's 5 year warranty.
 3. Two-Part, Pourable Urethane Sealant: For horizontal joints, exterior and interior; provide joint sealant with a joint movement capability of plus-or-minus 25%.
 - a. Products and Manufacturers: Provide one of the following.
 - 1) "Vulkem 245"; Tremco, Inc.
 - 2) "NR200 Urexpan"; Pecora Corp.
 - 3) "Sikaflex 2c SL"; Sika Corp.
 - 4) "THC-900"; Tremco, Inc.
 - b. Warranty: Manufacturer's extended 5 year warranty.
 4. One Part Gun Grade Polyurethane sealant, conforming to FS TT-S.00230G, Class A, Type II, ASTM CA20 Types, Grade NS, Class 25, USE T, NT, M, A, I Class II and O Product:
 - a. Products and Manufacturers: Provide one of the following.
 - 1) "Vulkem 116"; Tremco, Inc.
 - 2) "Sonolastic NPI"; Sonneborn.
 5. Two-Part Urethane Non-Sag Sealant: For general interior use; provide joint sealant with a joint movement capability of plus-or-minus 50%.

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- a. Products and Manufacturers: Provide one of the following:
 - 1) "Vulkem 922"; Tremco, Inc.
 - 2) "Dynatrol II"; Pecora Corp.
 - 3) "Sikaflex 2c NS"; Sika Corp.
 - 4) "NP II"; Sonneborne Building Products Division, ChemRex, Inc.
 - b. Warranty: Manufacturer's extended 5 year warranty.
6. One-Part Silicone - Sanitary Sealant: For Interior use at plumbing fixtures in toilets and janitor closets, and horizontal and vertical joints of dissimilar materials in toilets and other wet areas.
- a. Products and Manufacturers: Provide one of the following.
 - 1) "786"; Dow Corning Corp.
 - 2) "SCS 1700"; General Electric Co.
 - 3) "898"; Pecora Corp.
 - 4) "600"; Tremco, Inc.
 - b. Warranty: Manufacturer's extended 3 year warranty.
7. One-Part Latex Sealant: For interior use for horizontal and vertical joints around door frames, and joints between dissimilar materials.
- a. Products and Manufacturers: Provide one of the following.
 - 1) "AC-20"; Pecora Corp.
 - 2) "Sonolac"; Sonneborn Building Products Div., ChemRex, Inc.
 - 3) "Tremco Acrylic Latex 834"; Tremco, Inc.
 - b. Warranty: Manufacturer's standard warranty.

2.2 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.

2.3 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; 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. Backer Rod (Joint Fillers, Compressible Filler): Preformed, compressible, resilient, non-staining, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile

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strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.

1. Available Products: Subject to compliance with requirements, materials that may be incorporated into the Work include, but are not limited to the following:
 - a. Product and Manufacturer - Basis of Design: Sof Rod; Nomaco, Inc., Zebulon, NC.
- C. 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 Nonporous 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 nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent 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.
- B. Joint Priming: Prime joint substrates, unless otherwise recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.
 1. 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

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- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
 - 1. Install sealants by proven techniques and at the same time backings are installed.
 - 2. Place sealants so they directly contact and fully wet joint substrates.
 - 3. Completely fill recesses provided for each joint configuration.
 - 4. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- B. Backing Materials: 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.
 - 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.
- C. Bond-Breaker Tape: Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- D. Tooling of Nonsag 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 sealants from surfaces adjacent to joint.
 - 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 C 1193, unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Perform field-test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 - 2. Test Method: Test joint sealants by hand-pull method described below:
 - a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
 - b. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling

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specified maximum movement capability in extension; hold this position for 10 seconds.

- c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.
 3. 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.
 4. 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.
 5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
 6. 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.

3.5 CLEANING

- A. Clean off excess 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 substrates 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 the original work.

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SECTION 08 11 13 – STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel door and steel frames.
 - 2. Fire-rated door and frame assemblies.
 - 3. Provide Steel hollow metal door frames for all doors.
 - 4. Provide Steel Hollow Insulated Metal doors at all exterior installations.

1.3 DEFINITIONS

- A. Steel Sheet Thickness: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

- A. Product Approval: Provide product approval certifications in accordance with the Florida Building Code.
- B. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- C. Shop Drawings: Show the following:
 - 1. Elevations of each door design.
 - 2. Details of doors including vertical and horizontal edge details.
 - 3. Frame details for each frame type including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Coordination of glazing frames and stops with glass and glazing requirements.

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- D. Frame Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

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1.5 QUALITY ASSURANCE

- A. Code Compliance: Provide products complying with the requirements of the Florida Building Code.
- B. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: Test at atmospheric pressure.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 STEEL DOORS AND FRAMES

- A. Product and Manufacturer – Basis of Design: Refer to the Product Approval List.
 - 1. Product Approval: Refer to the Product Approval List.
- B. Other Acceptable Manufacturers: Manufacturers offering products that comply with the requirements indicated.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/ A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.
- D. All exterior restroom and shower room frames and doors shall be galvanized.

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2.3 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames: Minimum 16 gauge (0.053-inch-thick) steel sheet for:
 - 1. Door openings wider than 48 inches.
 - 2. Level 2 steel doors.
 - 3. Wood doors.
- C. Frames: Minimum 14 gauge (0.067-inch-thick) steel sheet for:
 - 1. Level 3 steel doors.
- D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- E. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.
- F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.4 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Frame Construction: Fabricate doors, panels, and frames from metallic-coated (hot dipped galvanized) steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
- C. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.
- D. Clearances for Fire-Rated Doors: As required by NFPA 80.
- E. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

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- G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x degrees F or better.
- H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
 - 1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.
 - 2. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- I. Door Frame Construction: Fabricate frames to shape shown.
 - 1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 - 2. Provide welded frames with temporary spreader bars for doors.
 - 3. On frames with access control hardware provide a tightly sealed mud box with a flexible conduit connection at each attachment point for electronic hardware. Provide a continuous raceway from the face of the door frame to a system junction box located near the door.
- J. Reinforcement: Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- K. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- thick steel sheet.
 - 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass panels in doors.
 - 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

2.5 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

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- B. Placing Frames: Comply with provisions in SDI 105. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors, masonry T-shaped anchors, and steel anchor bolt.
 - 2. Install fire-rated frames according to NFPA 80.

3.2 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08 11 13

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SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
 - 3. Factory machining for hardware.
 - 4. Provide and install flush wood doors to match existing wood doors of interior of North Half of the office building. All proposed interior doors will be Flush Wood Doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of cutouts.
 - 2. Indicate doors to be factory finished and finish requirements.
 - 3. Indicate fire ratings for fire doors.
- C. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
 - 2. Match stain color of existing wood office doors on the North end of the existing building.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors." AWI's "Architectural Woodwork Quality Standards Illustrated."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

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- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - 1. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist), or show telegraphing of core construction in face veneers.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Eggers Industries; Architectural Door Division.
 - c. Marshfield Door Systems
 - 2. Metal Louvers for Doors:

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- a. Air Louvers, Inc.
- b. Anemostat Door Products.
- c. Hiawatha, Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Grade: Premium, with Grade A faces.
2. Species and Cut: Red oak, plain sliced
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
7. Stiles: Same species as faces.

B. Doors for Opaque Finish:

1. Grade: Custom.
2. Faces for Interior Doors: Medium-density overlay or any closed-grain hardwood of mill option.
3. Opaque finish to match existing wood doors at facility.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade 1-LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

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4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

D. Raceways: Provide raceways for wiring of electric latch retraction for exit devices.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

1. Blade Type: Vision-proof, inverted V or Y.
2. Metal and Finish: Extruded aluminum with Class II, color anodic finish complying with AA-C22A32/A34.
 - a. Color: To be selected by the Architect from manufacturer's standard color selections.

B. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: As selected by the Architect from manufacturer's standard shapes.

C. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 0.0478-inch- thick, cold-rolled steel sheet; factory primed and approved for use in doors of fire rating indicated.

2.5 FABRICATION

A. General: Fabricate doors in sizes indicated for Project-site fitting.

1. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

B. Clearances: Additional means of gap covering shall be provided where either code required or the room use dictates privacy.

1. Fire-Rated Doors: As required by NFPA 80.
2. Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, and not more than 1/8 inch between meeting stiles of pairs of doors; 3/4 inch at bottom unless otherwise indicated.

C. Machining: Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

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D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.

1. Finish doors at factory.

B. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI System TR-6 catalyzed polyurethane.
3. Staining: Match existing facility doors.
4. Effect: Match existing facility doors.
5. Sheen: Match existing facility doors.

2.7 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces and edges of doors, including cutouts, with one coat of wood primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. INSTALLATION

D. Hardware: For installation, see Division 8 Section "Door Hardware."

E. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

F. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

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1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

G. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

H. Site-Finished Doors: Restore finish if fitting or machining is required.

3.2 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

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SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of access doors:
 - 1. Wall access doors.
 - 2. Fire-rated wall access doors.
 - 3. Ceiling access doors.
 - 4. Fire-rated ceiling access doors.
 - 5. To the extent required by other sections of work, provide and install doors where code requires access to electrical, mechanical, communications and fire protection junction boxes, disconnects, direct access for replacement of equipment, dampers and other misc items above Gypsum wall board or decorative metal panels.

1.3 SUBMITTALS

- A. Product Data: For each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required). Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.
- B. Shop Drawings: Showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Test Method for Vertical Installations: ASTM E152.
 - 2. Test Method for Horizontal Installations: ASTM E119.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

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1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under "Submittals" Article.

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:
1. J.L. Industries.
 2. Karp Associates, Inc.
 3. Milcor, Inc.
 4. Nystrom, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A366 commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.

2.3 ACCESS DOORS

- A. Insulated, Fire-Rated Access Doors: Self-latching units consisting of frame, trim, door, insulation, and hardware, including automatic closer, interior latch release, and complying with the following requirements:
1. Trimless Frame: Perimeter frame complying with the following requirements:
 - a. Metal: 0.0598-inch- thick steel sheet.
 - b. Frame Configuration: Flange integral with frame and overlapping face of adjoining gypsum board, with surface formed to receive joint compound.
 2. Door: 0.0359-inch- thick steel sheet, welded pan type.
 3. Hinges: Continuous type.
 4. Keyed Latches: Bolt type, operated by flush key device (keyed to match building system).
 5. Insulation: 2-inch- thick mineral-fiber insulation.
 6. Fire-Protection Rating for Walls: 1-1/2 hours with a temperature rise not exceeding 250 degrees F at the end of 30 minutes.
 7. Fire-Protection Rating for Ceilings: 2-hour non-combustible as required for constructed indicated.
- B. Non-insulated, Fire-Rated Doors for Walls: Self-latching units consisting of frame, trim, door, and hardware, including automatic closer, interior latch release, and complying with the following requirements:
1. Frame: 0.0598-inch-thick steel sheet.
 2. Door: 0.0598-inch-thick steel sheet.

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3. Hinge: Continuous type.
 4. Keyed Latches: Bolt type, operated by flush key device (keyed to match building system).
 5. Fire-Protection Rating for Walls: 1-1/2 hours.
- C. Trimless, Flush Access Doors for Gypsum Board: Units consisting of frame, concealed edge trim, door, hardware, and complying with the following requirements:
1. Frame: 0.0598-inch-thick steel sheet.
 2. Door: 0.0747-inch-thick steel sheet.
 3. Concealed, Gypsum Board Edge Trim: 0.0299-inch zinc-coated or galvanized-steel sheet with face flange formed to receive joint compound.
 4. Hinge: Concealed spring pin or continuous type.
 5. Keyed Latches: Bolt type, operated by flush key device (keyed to match building system).

2.4 FABRICATION

- A. General: Manufacture each access door assembly as an integral unit ready for installation.
- B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flange: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
 2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.
 3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.
- C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed. For cylinder lock, furnish 2 keys per lock and key all locks alike.

2.5 SIZE

- A. As shown on drawings or if not shown, size and quantity to provide clear access and allow removal and maintenance of equipment or computer via access hatch.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.2 INSTALLATION

- A. General: Comply with manufacturer's instructions for installing access doors.

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1. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.
2. Paint exposed surface of access doors and frames to match adjacent surface finish.

3.3 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

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SECTION 08 41 13
ALUMINUM STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 - Specification Sections apply to work of this section.
- B. Section 03 30 00 – Structural Concrete.
- C. Section 04 20 00 – Concrete Unit Masonry Work.

1.2 QUALITY ASSURANCE

- A. Provide aluminum entrances, storefront framing and curtain wall system by manufacturer(s) upon which drawings are based or by one of the following or approved equal:
- B. All frames shall be reinforced and fastened to meet wind loads as noted on structural drawing for wind pressure.
- C. System shall have NOA approval for system.

1.3 REFERENCES

- A. Aluminum association (AA)
 - 1. DAF-45 Designation System for Aluminum Finishes
- B. American Architectural Manufacturers Association (AAMA)
 - 1. 501.2 - Field Check of Metal Curtain Wall for Water Leakage
 - 2. 2605- Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 3. 606.1- Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
 - 4. 607.1- Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
 - 5. 608.1- Specifications and Inspection Methods for Electrolytically deposited Color Anodic Finishes for Architectural Aluminum.
 - 6. 701.2- Specifications for Pile Weather Stripping
 - 7. Manual # 10- Care and Handling of Architectural Aluminum from Shop to Site.
 - 8. SFM-1 –Aluminum Storefront and Entrance Manual
- C. American National Standards Institute (ANSI)
 - 1. A117.1 Safety Standards for the Handicapped

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2. Z97.1- Safety Glazing Materials Used In Buildings- Safety Performance Specifications and Methods of Test

D. American Society for Testing and Materials

1. A36- Structural Steel
2. A123- Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
3. B209- Aluminum and Aluminum- Alloy Sheet and Plate
4. B221- Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes
5. B308- Aluminum-Alloy 6061-TS Standard Structural Shapes, Rolled or Extruded
6. E283- Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors
7. E330- Test Method for Structural Performance of Exterior Windows , Curtain Walls and Doors by Uniform Static Air Pressure Difference
8. E331- Test Method for Water Penetration of Exterior Windows , Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS)

1. TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (for Galvanized Surfaces)
2. TT-P-645A- primer, Paint, Zinc Chromate, Alkyd Type

F. Steel Structures Painting Council (SSPC)

1. Paint 12 – Cold Applied Asphalt Mastic (Extra Thick Film)

1.4 SUBMITTALS

- A. Product Data: Submit 6 copies of manufacturer's specifications, standard details, and installation recommendations for components of aluminum storefronts required for project, including data that products have been tested and comply with performance requirements.
- B. Shop Drawings: Submit 6 copies shop drawings for fabrication and installation of aluminum entrances and storefronts, including elevations, detail sections of typical composite members, anchorages, reinforcement, expansion provisions, and glazing.
- C. Samples: Submit samples of each type and color of aluminum finish.
- D. Test and certificates 6 copies of Miami-Dade Notice of acceptance and 6 copies of Laboratory test conducted to obtain Miami-Dade acceptance or Florida Building Code Acceptance.

1.5 SYSTEM REQUIREMENTS

A. Performance Requirements:

1. Air Infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with Miami-

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Dade County Building Code Compliance Office (BCCO) protocol (PA-202) and ASTM E283 at differential static pressure of 6.24 psf.

2. Water Infiltration: No uncontrolled leakage when tested in accordance with Miami-Dade County Building Code Compliance Office (BCCO) protocol (PA-202) and ASTM E331 at test pressure of 13.5 psf.

B. Hurricane Resistance Requirements:

1. Large Missile Impact per Miami Dade County Building Code Compliance Office (BCCO) protocol (PA-201) Test Requirements.
2. Cyclic Load Test per Miami- Dade Building Code Compliance Office (BCCO) protocol (PA-203) Test Requirements.
3. Forced Entry Resistance per South Florida Building Code (SFBC) Section 3603.2(b) 5 test requirements.
4. Uniform Static Load Test per Dade Building Code Compliance Office (BCCO) protocol (PA 202 and ASTM –E331).

PART 2 - PRODUCTS

2.0 MANUFACTURER: Kawneer Company Inc., or approved equal.

2.1 PRODUCT:

A. IR 501, Dry and Wet Glazed Aluminum Storefront System, LMI. NOA No. 11-0915.06

2.2 MATERIALS AND ACCESSORIES

- A. Aluminum Members: 6063-TS of required finish; ASTM B-221 for extrusions. ASTM B-209.
- B. Fasteners: Aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum components per Miami-Dade approval.
- C. Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal.
- D. Concealed Flashing: Dead-soft stainless steel, 26 gauge minimum, type selected by manufacturer for compatibility.
- E. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A-386.
- F. Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC-PS-12, compounded for 30 mil thickness per coat.
- G. Weatherstrip accessories:
 1. SSA tape
 2. Exterior gasket

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3. Setting blocks
 4. Side blocks
 5. Sealant
 6. Structural seal
 7. Sealant tape
- H. Structural Vertical reinforcement in frames 1 ¼" x 4 9/16" x ¼" steel to meet wind load required.
1. ASTM A36 for Carbon Steel or ASTM B308 for Structural Aluminum.
 2. Steel components factory coated with alkyd type zinc chromate primer complying with FSTT-P-645.

2.3 FABRICATION

A. General:

1. Sizes and Profiles: Required sizes for door and frame units, including profile requirements, are shown on drawings. Any variable dimensions are indicated, together with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
 2. Details shown are based upon standard details by manufacturer indicated. Similar details by other manufacturers listed will be acceptable, provided they comply with other requirements, including profile limitations.
- B. Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator which will prevent corrosion.
- C. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
- D. Fasteners: Conceal fasteners wherever possible.
- E. Break-metal: Provide miscellaneous break metal in the shapes and profiles shown on drawings.

2.4 SILL FLASHING

- A. Clear anodized aluminum break metal fabricated in profile and bent as shown on the drawings.

2.5 FINISHES

A. Clear Anodized:

1. Conforming to AA-M12C22A31 and AAMA 607.1
2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of aluminum entrances and storefronts to meet Miami-Dade acceptance requirement.
- B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- C. Drill and tap frames and doors and apply surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- D. Set sill members and other members in bed of compound as shown, or with joint fillers or gaskets as shown to provide weathertight construction. Comply with requirements of Division 7 for compounds, fillers, and gaskets.
- E. Set internal drainage flashing install sealant, sealant tapes and gaskets for a watertight frame meeting Miami-Dade acceptance and requirements for water infiltration test ASTM E331 and PA202.
- F. Protection: Provide protection of aluminum frames from damage.
- G. Install frame after sill water proofing/damproofing membranes are installed.

3.2 ADJUST AND CLEAN

- A. Adjust operating hardware to function properly, without binding and to provide tight fit at contact points and weatherstripping.
- B. Clean completed system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces.

END SECTION 08 41 13

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SECTION 08 71 00 - FINISH HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All applicable provisions of the General Conditions are a part of this Section.

1.2 SCOPE

- A. Work covered by this Section of Specifications consists of furnishing and delivering to the job site for fitting and installation of all finish hardware complete, in accordance with this Section and applicable drawings and subject to terms and conditions of Contract.
- B. It is intended that the following list of hardware will cover all finish hardware to complete the project. Omissions and/or discrepancies shall be brought to the Architect's attention during the bidding period.
- C. No substitution for locksets will be allowed.

1.3 SUPPLIER

- A. Finish hardware shall be furnished by one approved by the Architect as having appropriate technical knowledge and experience to correctly interpret drawings and specifications. Supplier shall be prepared at all times during progress on installation to promptly provide competent and efficient Architectural Hardware Consultant (AHC) to approve its complete installation in order that all items shall be installed in the best manner and function properly. This will necessitate a job visit prior to final inspection.

1.4 DELIVERY

- A. All items of finish hardware shall be delivered to the project site or as otherwise specified or required, and shall be checked in for completeness and familiarization with the contractor. All items of Finish Hardware shall be packaged, numbered, labeled to identify each opening for which it is intended and to correspond with item numbers on the approved Hardware Schedule.

1.5 TEMPLATES

- A. All finish Hardware to be installed on or in metal doors and/or frames shall be manufactured to template. Template machine screws shall be furnished for all such materials. The supplier and Owner shall furnish Hardware Schedules as approved by the Architect and all necessary templates to metal door and frame fabricators for their coordination's use.

1.6 SUBMITTALS

- A. Submit complete typewritten Hardware Schedule in triplicate to the Architect for approval. After approval, provide required number of copies of approved Hardware Schedule for Distribution. No factory Order shall be placed for materials until approval has been given by the Architect.
- B. One current copy of a catalog cut shall be submitted with the Hardware Schedule for each item of hardware listed in the schedule.
- C. Each item in the Schedule shall be identified on the first page of the Schedule by the manufacturer's name.

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1.7 RESPONSIBILITY

- A. It shall be the supplier's responsibility to furnish hardware in accordance with the intent of this specification, the functional use of door. Where, by virtue of architectural design or by function, a change is necessary, hardware of equal design and quality shall be furnished upon written acceptance of the Architect.

1.8 LOCATIONS

- A. Hardware locations dimension shall be as follows: Distance from finish floor to center line of :
- | | |
|--|------|
| 1. Door Knob | 38" |
| 2. Door Pull | 42" |
| 3. Deadlock | 60" |
| 4. Exit Bolt Cross Bar | 38" |
| 5. Push Plate | 50" |
| 6. Butt Hinges | |
| 7. Bottom Hinges: Finish floor to bottom of Hinge | 10". |
| 8. Top Hinge: Head rabbet to top of Hinge | 5". |
| 9. Center Hinge: Equal distance between top and bottom hinges. | |
- B. 180 DEGREES OPENINGS: Other than those doors that are restricted to less than 180 degrees opening by building or by overhead holders or stops, all butts and/or closer arms shall be of sufficient size to allow full 180 degrees opening of doors.

PART 2 - PRODUCTS:

A. BUTTS:

Doors 1-3/4" thick:	Minimum 4-1/2" high.
Doors 1-3/8" thick:	Minimum 3-1/2" high.

1. Each door shall not have less than three hinges. Doors 8'-0" and higher shall have four (4) hinges whether specified under items or not.
2. All butts used with door closers shall be ball bearing. All exterior doors shall have ball bearing butts except as otherwise specified.
3. Accepted manufacturers are:

Stanley
McKinney
Approved Equal

B. FINISH:

- | | |
|----------------------------|---------|
| 1. Butts, Exterior | US26D |
| 2. Butts, Interior | US26D |
| 3. Locks | US26D |
| 4. Push, Pull, Kick Plates | US32D |
| 5. Closers | SBL, AL |

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6. Panic Devices US26D

7. Door Stops, Miscellaneous US26D

C. LOCKSETS:

Schlage (Primus) All Doors with Locks (No substitutions accepted)

D. CLOSERS: Closers shall be one of the following manufacturers or approved equal and shall be furnished in the manufacturers recommended printed size for the specified conditions unless otherwise noted in the hardware sets. Closers shall be full rack and pinion complete with back check. Springs shall be motor clock type. Furnish flush mount transom brackets where no transom bar exists. Furnish parallel arm where required.

MANUFACTURER

LCN
Von Duprin

SERIES

As required by function and mounting

E. DOOR TRIM: All push plates, pulls, pull plates, kick and/or armor plates shall be any one of the following manufacturer's products or approved equal in catalog number as set forth herein:

MANUFACTURER

Trimco

Brookline

H. B. Ives

PUSH PLATE PULL PLATE KICK PLATE

As required

As

required

by function.

by

function.

F. SILENCERS: All interior wood and metal door frames shall have door silencers type 20 or 21, three per single door, two per pair of doors.

G. DOOR HOLDERS: Holders shall be one of the following manufacturers or approved equal and shall be furnished in the manufacturer's recommended size for the specified condition unless otherwise noted in the hardware sets. All holders shall be automatic with adjustable holding force. Furnish flush mount transom brackets where no transom bar exists.

MANUFACTURER

Glynn-Johnson
Russwin
Checkmate
B. Ives

H. DOOR STOPS: Stops shall be one of the following manufacturers or approved equal:

MANUFACTURER

B. Ives
Glynn-Johnson
Quality

I. KEYING: All locks shall be master keyed per instructions of Orange County Locksmith.

J. FASTENING: All screws shall be of matching finish to their product and shall be the manufacturer's standard for that item.

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- K. Sex Bolts: Door closers, door holders, and exit devices installed on wood door shall be attached by means of thru-bolts and sex-nuts.

PART 3 – EXECUTION

3.1 HARDWARE SETS

Provide all locksets as manufactured by Schlage/ Primus. All doors shall have removable cores and be provided by the General Contractor.

GROUP 1

Door pair to have:

- 1 Dead bolt, Schlage (Primus), B762R, cylinder and thumbturn, Plate US26D, or approved equal.
- 1 Entrance lock, Schlage (Primus) ND50 PD, Rhodes Lever, US26D.
- 1 Primus Removable Core for occupancy.
- 3 Pair butts, Stanley, FBB 179, 4.5" x 4.5": N.R.P. or approved equal.
- 2 Closers, LCN 4210, hold open, or approved equal. (Application specific- see floor plan)
- 2 Sweep, Pemko, 18125AP, or approved equal.
- 1 Set Door gasket, Pemko 359A stop applied, or approved equal.
- 1 Astragal, Pemko 357 SP, or approved equal.
- 1 Astragal gasket, Pemko 357C, or approved equal.
- 2 Floor stops, Ives 441, or approved equal.
- 1 Door coordinate, Ives 469 and 469-1/2, or approved equal.
- 2 Extension flush bolts, US26D, Ives 457 and 458 UL listed (fixed door), or approved equal.
- 4 Kick Plate, Ives 8400 Us26D, or approved equal.
- 1 Dust proof floor strike, Ives 488, 26D (for fixed door), or approved equal.
- 2 Pulls, Ives 8121-5, 26D, or approved equal.
- 2 Push plates, Ives 8200, 26D, or approved equal.
- 1 Sill, Pemko 2005 AV36, or approved equal.

GROUP #2

Each door to have:

- 1-1/2 pair butts, Stanley, FBB 179 4.5" x 4.5", or approved equal.

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- 1 Lockset, Schlage (Primus), office ND53PD, office, Lever-Rhodes, US26D, or approved equal.
- 1 Primus Removable Core for occupancy.
- 1 Door stop, Ives 407, 26D, or approved equal.
- 1 Set silencers, or approved equal.

GROUP #3

Each door to have:

1-1/2 pair of butts, Stanley, FBB 179 4.5" x 4.5", NRP, or approved equal.

- 1 Lockset, Schlage (Primus), GND80PD, Storage Room, US26D, Lever-Rhodes, or approved equal.
- 1 Primus Removable Core for occupancy.
- 1 Deadbolt, Schlage(Primus) B762R, cylinder and thumbturn, plate, US26D, or approved equal.
- 1 Closer, LCN 4210 or approved equal.
- 1 Set Door gasket, Pemko 359A, stop applied or approved equal.
- 2 Kickplates, Ives 8400, US26D, or approved equal.
- 1 Floor stop, Ives, 441, or approved equal.
- 1 Threshold, Pemko 2005 AV36, or approved equal.
- 1 Rain Drip, Pemko - Door M100D only

GROUP #4

Each door to have:

1-1/2 pair butts, Stanley FBB 179, 4.5" x 4.5" N.R.P., or approved equal.

- 1 Lockset, Schlage (Primus), ND40S, Lever-Rhodes, US26D, or approved equal.
- 1 Primus Removable Core for occupancy.
- 1 Closer, LCN4210, US26D, or approved equal.
- 1 Door stop, Ives 407, Us26D, or approved equal.
- 1 Set silencers, or approved equal.
- 2 Kickplates, Ives, 8400, Us26D, or approved equal.

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GROUP #5

Each door to have:

- 3 Pair Butts FBB 4.5X4.5 NRP or approved equal.
- 1 Set of door closer/coordinator
- 1 Von Duprin – 9948L-NLF concealed vertical rod device with 338 and 385A or approved equal
- 2 Primus Removable Core for occupancy.
- 3 Exit Devices
- 2 Closers – LCN 420
- 4 Kick Plates – Ives, 8400, US 260 or approved equal
- 1 Threshold – Pemko 2716A or approve
- 2 Bottom Seal – Pemko 412-SL-B or equal
- 1 Set Perimeter seal Pemko 350-SR-C or approve equal
- 1 Astrigal – 352-R Pemko, clear anodized or approve equal
- 1 Drip Pemko or approve equal

3.2 INSTALLATION

- A. Mount hardware units at heights indicated in “Recommended Locations for Builders Hardware for Custom Steel Doors and Frames” by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by the Architect.
- B. Install each hardware item in compliance with the manufacturer’s instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way. Coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division 9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation of function of every unit. Replace units that cannot be adjusted to operate freely and smoothly as intended for the application made.

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END SECTION 08 71 00

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SECTION 08 80 00 – GLASS AND GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The general provision of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this section.
- B. Section 08410 – Aluminum Entrances and Store Front.

1.2 DESCRIPTION OF WORK

- A. The extent of glass and glazing work is indicated on drawings, and provisions of this section.
- B. The types of work or locations requiring glass and glazing include (but are not necessarily limited to) the following:
 - 1. Store front construction.
 - 2. Exterior entrances to be glazed.
 - 3. Interior doors to be glazed.

1.3 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 669	1975 (R 1989) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
ASTM C 920	1987 Elastomeric Joint Sealants
ASTM C 1036	1990 Flat Glass
ASTM C 1048	1990 Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM D 673	1988 Mar Resistance of Plastics
ASTM D 4802	1988 Poly(Methyl Methacrylate) Acrylic Plastic Sheet
ASTM E 774	1988 Sealed Insulating Glass Units
ANSI Z97.1	Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
ASTM C804 ASTM C864	Use of Solvent Release Type Sealants Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
ASTM C1172	Laminated Architectural Safety Glass.

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ASTM E84	Surface Burning Characteristics of Building Materials.
ASTM E283	Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
ASTM E330	Structural Performance of Exterior Windows Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
ASTM E546	Test Method for Frost Point of Sealed Insulating Glass Units.
ASTM E576	Test Method for Dew/Frost Point of Sealed insulating Glass Units in Vertical Position
ASTM E773	Test Method for Seal Durability of Sealed Insulating Glass Units.

Laminators Safety Glass Association – Standards Manual.

Sigma – Sealed Insulated Glass Manufacturers Association.

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1201	Safety Standard for Architectural Glazing Materials
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FLAT GLASS MARKETING ASSOCIATION (FGMA)

FGMA GM	1986 Glazing Manual
FGMA SM	1983 Sealant Manual

FEDERAL SPECIFICATIONS (FS)

FS L-P-391	(Rev. D) (Valid Notice 1) Plastic Sheets, Rods and Tubing, Rigid Cast, Methacrylate
FS TT-P-00791	(Rev. B) (Am. 2) Putty: Linseed-Oil Type, (For Wood-Sash-Glazing)

MILITARY SPECIFICATIONS (MIL)

MIL-R-900	(Rev. F) Rubber Gasket Material, 45 Durometer Hardness
MIL-P-46144	(Rev. C) (Am. 1) Plastic Sheet, Polycarbonate

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	1990 Fire Doors and Windows
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UNDERWRITERS LABORATORIES INC. (UL)

UL ABPMED	1989 (Supp. 1990) Automotive, Burglary Protection, and Mechanical Equipment Directory
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UL 752

1985 (R 1990) Bullet-Resisting Equipment,
Seventh Edition

1.4 PERFORMANCE REQUIREMENTS

- A. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.
- B. Glass to meet wind load requirements as noted on Structural drawings for required wind load per Florida Building Code 2010. See structural drawing for load requirements.

1.5 SUBMITTALS

- A. Section 01 33 00 – Shop Drawings, Samples and Product Data: Procedures for submittals.
- B. Product Data on Glass and Plastic Types: provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit three samples 12 x 12 inch in size, examplng glass and plastic units.
- E. Submit shop drawings for fabrication including all field conditions and special adaptations to meet field conditions.
- F. Provide letters from glass manufacturer which confirm and approve installation of the glass in proposed framing systems.
- G. Submittals, Shop Drawings, and Samples.
- H. Certificates: Certify that Products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.8 WARRANTY

- A. Provide a 3 year Product and installation warranty against product defect or improper installation.

1.9 JOB CONDITIONS

- A. Comply with manufacturer's instructions for shipping, handling, storing and protecting glass and glazing materials. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coatings (if any) on glass.

1.10 PRODUCT HANDLING

- A. Pre-Installation Meeting: Comply with General Requirements for pre-installation meeting of

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Glazier and other trades affected by glass installation.

- B. Inspection: Glazier must examine framing and substrate work to receive glass and glazing materials, and conditions under which glass is to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with glazing until unsatisfactory conditions have been corrected in a manner acceptable to Glazier.
- C. Weather: Do not proceed with glazing under adverse weather conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 FABRICATED GLASS UNITS

A. Hurricane Impact Laminated Glass

1. Glass Requirements

- a. Dupont Butacite PVB Interlayer (No. 10-0922.09)
- b. Saflex Multiple-Layer Glass Interlayer (No. 09223.05)
- c. Dupont Sentry Glass Interlayer (No. 10-041304)

2. Minimum Unit Requirements

- a. Visible light transmission of 51%
- b. Shading coefficient of .65

2.2 SETTING AND SEALING MATERIALS

A. Exterior Gasket:

- a. Tremco Part No. TR-14815 E (Kawneer No 127-126)
- b. EPDM Dense Rubber Extrusion with 70 Durometer Exterior Glazing Gasket ASTM D412, 1500 PSI; ASTM D395B, 22 HRS 158 degrees Fahrenheit.

B. Interior Gasket:

- a. Tremco Part No. TR-14270 E (Kawneer Part No. 127-121)
- b. Closed Cell (Sponge) EPDM Rubber Compound, complying with ASTM C5C9 Option II Specification Compression Deflection Limit 20-24 PSI.

C. Exterior Gasket:

- a. Tremco Part No. TR-14271 E (Kawneer Part No. 027-074)
- b. EPDM Dense Rubber Extrusion with 70 Durometer Glazing Gasket, complying with ASTM C864 Option II, ASTM D412 1600 PSI; ASTM D395B, 22 HRS 158 degrees Fahrenheit.

PART 3 EXECUTION

3.1 PREPARATION

GLASS AND GLAZING

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- A. Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the FGMA GM, FGMA SM, SIGMA A2801, SIGMA A3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

- A. Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the FGMA GM, FGMA SM, SIGMA A2801, SIGMA A3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place.

3.3 Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes. Wind loading, impact loading, without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air-tight, deterioration of glazing materials and other defects in the work.

3.4 Protect glass from edge damage during handling and installation, and subsequent operation of glazed components of the work.

3.5 Glazing channel dimensions as shown are intended to provide for necessary bite on glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. The Glazier is responsible for correct glass size for each opening, within tolerances and necessary dimensions.

3.6 Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified.

3.7 Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in channel at heel of jambs and head (do not leave voids in the sill channels), except as otherwise indicated and depending on light size, thicknesses and type of glass, and complying with manufacturer's recommendations.

3.8 Do not attempt to cut, seam, nip or abrade glass which is tempered or heat strengthened, including glass which is heat-treated as a result of a coating process.

3.9 Force Sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

3.10 Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

3.11 Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

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- 3.12 Gasket Glazing: Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in glazing system.
- 3.13 Structural Gasket Glazing: Cut zipper strips slightly long, to ensure tight closure. Lubricate zipper strip and use special tool to install zipper. Do not lubricate glazing channel or manufacturer's instructions, including the possible use of liquid sealants and weep holes.
- 3.14 Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- 3.15 Protect exterior glass from breakage immediately upon installation, by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass.
- 3.16 Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- 3.17 Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to deterioration of glazing materials and other work. Comply with manufacturer's instructions.
- 3.18 Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Comply with glass manufacturer's recommendations for final cleaning.
- 3.19 Hurricane Impact Laminated Insulated Glass
 - A. Care shall be taken during handling and storage of insulated laminated glass to ensure that glass damage will not occur. All laminated glass must be stored in a covered, cool dry and vented area. In addition all impact glass delivered shall be installed within a 30 day period to protect from damage to said units.
 - B. Improper storage of insulated laminated glass may result in damage to glass. Glass crates shall be blocked properly to prevent ripping. Consult manufacturer recommendations.
 - C. Do not allow exposed edges of laminated glass to come in contact with standing water. This may cause fissures to occur within the Polycarbonate interlayer as well as delamination of the unit. Do not allow edges of the laminated glass unit to contact hard surfaces during installation. Rolling blocks shall be utilized if units need to be cartwheeled on their corners. Please refer to the Flat Glass Marketing Association glazing manual to see an example of a rolling block.
 - D. Glazing Guidelines
 1. Care shall be taken during installation of laminated glass to ensure unit does not come in contact with frame. Improper handling may result in glass breakage. Laminated glass unit must be supported by a minimum of two silicone setting blocks or acceptable equal. It is recommended that setting blocks be installed at quarter points. Setting blocks shall 1.6 mm (1/16" less than the channel width to allow for adjustments. All setting blocks should have a hardness of 85+5 as registered on a durometer. Length of setting blocks shall be dependent upon glass area. Consult glass manufacturer for recommendations.
 2. Adequate edge clearance should be maintained between glass and frame. Manufacturer recommends a minimum of 6mm (1/4" edge clearance and 5mm (3/16") face clearance. Failure to maintain clearance may cause glass breakage due to glass to frame contact. If other manufacturer recommendations apply submit written information for review and

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acceptance.

3. Laminated glass requires that all impact glass be sealed in glazing pocket and free from water intrusion. This can be achieved by use of a lock strip gasket or an approved silicone cap bead. If a weep system is used it shall be the manufacturers responsibility to ensure a weather tight system to ensure no water comes in contact with the edge surface of the glass.

E. Protection and Cleaning

1. Glazing contractor shall protect product from damage during construction. Glazing contractor shall protect product from harmful contaminants including but not limited to acid, cement, lime, plaster, xylene and other harmful petroleum distillares. Failure to do so may void warranty.

END SECTION 08 80 00

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SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. The extent of the gypsum drywall and support framing work specified here in and shown on the drawings and in schedules, and is hereby defined to include gypsum board work with a tape and compound joint treatment system and other applied finishes know as "drywall finishing" work.

1.3 QUALITY ASSURANCE

- A. Fire-Resistant Rating: Where work is indicated for fire-resistant ratings, including those required to comply with governing regulations provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including U.L. and F.M. Comply with F.M. "Approval Guide" where applicable.
- B. Installer: Use a manufacturer accepted installer with experience in this trade.
- C. Industry Standard: Comply with applicable requirements of GA-216-00 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.
- D. Allowable Tolerances: With 1/8" offsets between planes of board faces and 1/4" in 8' -0" for plumb, level, warp and bow.
- E. Manufacturer: Obtain gypsum boards, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturer's of gypsum boards.
- F. Obtain metal support materials and fastener from a single manufacturer.
- G. Florida Building Code requirements for firestop/draftstopping of walls.

1.4 SUBMITTALS

- A. Manufacturer's Data: Submit (6) copies of manufacturer's product specifications and installation instructions for each gypsum drywall, metal support component, and DUROCK board, or accepted equal, including other data as may be required to show compliance with these specifications.

1.5 PRODUCT HANDLING

- A. Deliver materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

1.6 JOB CONDITIONS

- A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the

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conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

- B. Maintain ambient temperatures at not less than 55 degrees F. for the period of 24-hours before drywall finishing, during installation and until compounds are dry.

1.7 HAZARDOUS MATERIAL:

- A. **Do not** use asbestos materials, additives and reinforcement in any products, materials, or accessories required for the project.

PART 2 - PRODUCTS

2.1 METAL SUPPORT MATERIALS

- A. General: To the extent not otherwise indicated, comply with Gypsum Association Specification GA-203 "Installation of Screw-Type Steel Framing Members to Receive Gypsum board" (as specified and recommended) for metal system supporting gypsum drywall work.
- B. Studs: ASTM C 645; 25 gauge x 3-5/8" deep, except as otherwise indicated.
- C. Studs for Durock Walls: 20 gauge x 3-5/8" deep, G60 hot-dipped galvanized.
- D. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.
- E. Stud System Accessories: Provide stud manufacturer's standard clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system.
- F. Suspended Members: ASTM C-645; 20- gauge, hat-shaped and 18 gauge 2 1/2" Channels.
- G. Furring: ASTM C-645; 20 gauge, 1" 'Z' frame.
- H. Fasteners: Type and size recommended by furring manufacturer for the substrate and application indicated.
- I. One Hour Ceiling Assembly: As noted on drawings.

2.2 GYPSUM BOARD PRODUCTS

- A. GENERAL: To the extent not otherwise indicated, comply with GA-216, as specified and recommended.
 - 1. Exposed Gypsum Board: Also known as gypsum wallboard. Regular type with tapered long edges.
 - a) Sheet Size: 4' x8'.
 - b) Thickness: 5/8" except where otherwise indicated
 - c) Type "X": Provide where indicated (fire resistant).

- 2. Gypsum Backing Board: Regular type, with V-groove or square edges, except provide

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exposed gypsum boards with tapered edges where joint treatment is required.

- a) Thickness: 5/8" except where otherwise indicated.
- b) Thickness: 1/2" except where otherwise indicated.
- c) Type "X": Provide where indicated (fire resistant).

2.3 TRIM ACCESSORIES

A. GENERAL:

1. Manufacturer's standard galvanized steel beaded units with flanges for concealment in joint compound, including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.

2.4 JOINT TREATMENT MATERIALS

A. GENERAL:

1. C-475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
 - a) Joint Tape: Perforated type.
 - b) Joint Compound: Ready-mixed vinyl-type for interior use.
 - c) Grade: Two separate grades, one specifically for bedding tapes and filling depressions, and one for topping and sanding.

2.5 MISCELLANEOUS MATERIALS

A. GENERAL:

1. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.
2. Lamination Adhesives: Special adhesive for joint compound specifically recommended for laminating gypsum boards.
3. Gypsum Board Fasteners: Comply with GA-216-00.
4. Concealed Acoustical Sealant: Latex, acrylic, or acrylic-latex type; permanently elastic and paintable.

B. Tile Backer Board Materials:

1. Board: "DUROCK Interior Cement Board", 5/8" thick, 48" x 96", or accepted equal.
2. Joint: "DUROCK Interior Tape", or accepted equal.
3. Fasteners: DUROCK Steel Screws lengths as recommended for installation by manufacturer, or accepted equal.
4. Miscellaneous Materials: Provide auxiliary materials complete for "DUROCK" Board

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work of the type and grade recommended by the manufacturer of the "DUROCK" Board, or accepted equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL SUPPORT SYSTEMS

A. General:

1. To the extent not otherwise indicated, comply with GA-203, and manufacturer's instructions.
2. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.
3. Isolate stud system from transfer to structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
4. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work.
5. Space studs 16" O.C., except as otherwise indicated.
6. At all intersections use solid plate and sill members to provide firestop and draftstop as required by the building code.

B. Door Frames:

1. Install additional Jamb studs at door frames as indicated, but not less than 2 studs at each jamb. Space jack studs over door frames at same spacing as partition studs.
2. Wire -tie or clip furring members to main ceiling runners and to other structural supports as indicated.
3. Space wall furring members 16" o.c., except as otherwise indicated.
4. Nail or screw furring members to structural support where possible; otherwise wire-tie to clip as recommended by manufacturer.
5. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the work, and at locations required to support fixtures, equipment, handicap accessories, toilet accessories, heavy trim, furnishing and similar work which cannot be adequately supported directly on gypsum board alone.

3.2 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Pre-Installation Conference: Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed.

B. General Standards: In addition to compliance with GA-216, comply with manufacturer's instructions and requirements for fire-resistance UL rating.

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- C. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
- D. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.
- E. Cover both faces of steel studs with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls, which are properly braced internally.
- F. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft. and limited not less than 75% of full coverage.
- G. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.

3.3 FLOATING CONSTRUCTION

- A. Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.
- B. Where sound-rated drywall work is indicated (STC rating), including double-layer work and work on resilient furring, seal the work at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with manufacturer's recommendations for location of beads, and close off sound-flanking paths around or through the work, including sealing of partitions above acoustical ceilings.
- C. Space fasteners in gypsum boards in accordance with GA-216 and manufacturer's recommendations, except as otherwise indicated.

3.4 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. GENERAL: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.
 - 1. Install metal corner beads at external corners of drywall work. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install "L" type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of "L" type trim. Install "U" type trim where edge is exposed, revealed, gasketed, or sealant filled (including expansion joints).
 - 2. Install "J" type semi-finishing trim where indicated, and where exterior gypsum board edges are not covered by applied moldings. Install plastic edge trim where indicated on wall panels at juncture with ceilings. Install metal control joint (beaded-type) where indicated. Install "H" molding in exterior gypsum drywall work where control joints are indicated.

3.5 INSTALLATION OF DRYWALL FINISHING

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- A. GENERAL: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fasteners, heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, using type of compound recommended by manufacturer. Apply joint compound in two coats (not including prefill of openings in base), and sand after last coat.
1. Surface Wall Texture: Texture shall be in accordance with design specifications, Level 5, and shall be such that all irregularities in the drywall surface are imperceptible.
 2. Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing, including sound, fire, air and smoke-rated work.
 3. Installer shall advise Contractor of required procedures for protection of the gypsum drywall work from damage and deterioration during the remainder of the construction period.

3.6 INSTALLATION OF DUROCK BOARD

- A. Follow manufacturer instructions for installation and finishing. Use only manufacturer authorized materials and installation methods.

END SECTION 09 21 16

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SECTION 09 24 00 - PORTLAND CEMENT PLASTER

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.
- B. Section 07 13 00 Sheet Waterproofing

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Metal lath and accessories.
 - 2. Portland cement plaster.
 - 3. Stucco finishes.

1.3 SUBMITTALS

- A. Product Data: Submit product data for each product specified.
- B. Samples: Submit samples for initial selection in the form of manufacturer's color charts consisting of actual units or sections of units at least 12 inches square showing the full range of colors, textures, and patterns available for each type of finish indicated.
 - 1. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
 - 2. Include similar Samples of material for joints and accessories involving color selection.
- C. Samples: Submit samples for verification in units at least 12 inches square of each type of finish indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
- D. Material Certificates: Submit certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Where fire-resistance-rated portland cement plaster assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Mockups: Prior to installing plaster work, construct panels for each type of finish and application required to 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 Architect.

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2. Erect mockups 48 by 48 inches by full thickness in presence of Architect using materials, including lath, support system, and control joints, indicated for final Work.
3. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before start of plaster Work.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed portland cement plaster Work.
 - a. When directed, remove mockups from Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.
- B. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.
- B. Cold-Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.
- C. Warm-Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.
- D. Exterior Plaster Work: Do not apply plaster when ambient temperature is below 40 degrees F.
- E. Exterior Plaster Work: Protect plaster against freezing when ambient temperature is below 40 degrees F by heating materials and providing temporary protection and heat as required by ACI 306R.
- F. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

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 the following:

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1. Metal Accessories:
 - a. Dale//Incor Industries, Inc.
 - b. Fry Reglet Corporation.
 - c. Gordon, Inc.
 - d. MM Systems Corp.
 - e. United States Gypsum Co.
 - f. Western Metal Lath Co.

2.2 METAL SUPPORTS FOR SUSPENDED AND FURRED CEILINGS

- A. General: Size metal ceiling supports to comply with ASTM C 1063, unless otherwise indicated.
- B. Cast-in-Place and Postinstalled Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires; and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.
 1. Chemical anchor.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
- D. Rod Hangers: Mild steel, zinc coated.
- E. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Channels: Cold-rolled steel, minimum 0.0598-inch- thick base (uncoated) metal and 7/16-inch-wide flanges, and as follows:
- G. Carrying Channels: 2-inch- deep-by-19/32-inch- wide flanges, 590 lb/1000 feet.
- H. Furring Channels: 3/4 inch deep, 300 lb/1000 feet.
- I. Finish: ASTM A 653, G60 hot-dip galvanized coating for framing where indicated.
- J. Steel Studs for Furring Channels: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
 1. Thickness: As indicated.
 2. Depth: As indicated.
- K. Protective Coating: ASTM A 653, G40 galvanized coating.

2.3 LATH

- A. Expanded-Metal Lath: Comply with ASTM C 847 for material, type, configuration, and other characteristics indicated below.
 1. Material: Fabricate expanded-metal lath from sheet metal conforming to the following:

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- a. Galvanized Steel: Structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653, G60 minimum coating designation, unless otherwise indicated.
- 2. Diamond-Mesh Lath: Comply with the following requirements:
 - a. Configuration: Self-furring.
 - 1) Weight: 3.4 lb/sq. yd.
- B. Paper Backing: Comply with FS UU-B-790, Type I, grade and style as indicated below:
 - 1. Vapor-Retardant Paper: Grade B, Style 1 with flame-spread rating of 25 per ASTM E 84.

2.4 ACCESSORIES

- A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required. Zinc-alloy or plastic components, contractor's option.
 - 1. Zinc-Alloy Components: ASTM B 69, 99 percent pure zinc.
- B. Metal Corner Reinforcement: Expanded, large-mesh, diamond-metal lath fabricated from zinc-alloy or welded-wire mesh fabricated from 0.0475-inch- diameter, zinc-coated (galvanized) wire and specially formed to reinforce external corners of portland cement plaster on exterior exposures while allowing full plaster encasement.

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- C. Corner beads: Small nose corner beads fabricated from the following metal, with expanded flanges of large-mesh diamond-metal lath allowing full plaster encasement.
 - 1. Zinc Alloy: Minimum 0.0207 inch thick.
- D. Casing Beads: Square-edged style, with expanded flanges of the following material:
 - 1. Zinc Alloy: Minimum 0.0207 inch thick.
- E. Curved Casing Beads: Square-edged style, fabricated from aluminum coated with clear plastic, preformed into curve of radius indicated.
- F. Control Joints: Prefabricated, of material and type indicated below:
 - 1. Zinc Alloy: Minimum 0.0207 inch thick.
 - 2. Two-Piece Type: Pair of casing beads with back flanges formed to provide slip-joint action, adjustable for joint widths from 1/8 to 5/8 inch.
 - a. Provide removable protective tape on plaster face of control joints.
- G. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.

2.5 PLASTER MATERIALS

- A. Portland Cement: ASTM C1550-92, Type 1, natural color.
- B. Masonry Cement: ASTM C90-93, Type S, natural white color.
- C. Lime: ASTM C206-84 (1992), Type S, special finishing hydrating lime.
- D. Aggregate: ASTM C-33, FDOT certified, washed and graded natural sand.
- E. Water: Clean, potable, without deposits harmful to stucco.

2.6 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable.
- B. Steel drill screws complying with ASTM C 1002 for fastening metal lath to wood or steel members less than 0.033 inch thick.

2.7 PLASTER MIXES AND COMPOSITIONS

- A. General: Comply with ASTM C 926 for base, scratch, and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated.
- B. Base-Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume per sum of cementitious materials for each method of application and plaster base indicated. Adjust mix proportions to attain workability.

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- C. Three-Coat Work over Wire Lath: Apply 3-coat plaster over metal lath substrates (scratch/level, brown, and finish coats).
1. Nominal Thickness: 7/8-inch, unless otherwise indicated.
 2. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
 - b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
- D. Job-Mixed Finish Coats: Proportion materials for finish coats in parts by volume for cementitious materials and parts by volume per sum of cementitious materials to comply with the following requirements:
1. Proportions: In accordance with ASTM C926.
 - a. Nominal Thickness: 1/8-inch.

2.8 MIXING

- A. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF LATH AND FURRING, GENERAL

- A. Standards: Comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring," and with requirements of ASTM C 1063.
- B. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, handrails, furnishings, and similar work to comply with details indicated or, if not otherwise indicated, to comply with applicable written instructions of lath and furring manufacturer.

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- C. Isolation: Where lathing and metal support system abuts building structure and where partition or wall abuts overhead structure, sufficiently isolate from structural movement to prevent transfer of loading from building structure. Install slip- or cushion-type joints to absorb deflections but maintain lateral support.
 - 1. Frame both sides of control joints independently and do not bridge joints with furring and lathing or accessories.

3.2 PREPARATIONS FOR PLASTERING

- A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.
- B. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.

3.3 INSTALLATION OF PLASTERING ACCESSORIES

- A. General: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering.
 - 1. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
 - 1. Install lath-type external-corner reinforcement at exterior locations.
 - 2. Install cornerbead at interior and exterior locations.
- C. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Architect:
 - 1. As required to delineate plasterwork into areas (panels) as shown on drawings. If not shown on drawings the following maximum panel size apply:
 - a. Vertical Surfaces: 144 sq. ft.
 - b. Horizontal and other Non-vertical Surfaces: 100 sq. ft.
 - 2. At distances between control joints of not greater than 18 feet on center.
 - 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - 4. Where control joints occur in surface of construction directly behind plaster.
 - 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.4 PLASTER APPLICATION

- A. Plaster Application Standard: Apply plaster materials, composition, and mixes to comply with ASTM C 926.

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- B. Do not use materials that are caked, lumpy, dirty, or contaminated by foreign materials.
- C. Do not use excessive water in mixing and applying plaster materials.
- D. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed at any location on surface.
- E. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.
- F. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where interior plaster is not terminated at metal frame by casing beads, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
- G. Corners: Make internal corners and angles square; finish external corners flush with corner beads on interior work, square and true with plaster faces on exterior work.
- H. Finish Coats: Apply finish coats to comply with PCA Portland Cement Plaster (Stucco) Manual, and the following requirements:
 - 1. All Areas: Sand-float finish.
- I. Curing: Moist-cure plaster base and finish coats to comply with ASTM C 926, including written instructions for time between coats and curing in "Annex A2 Design Considerations."

3.5 CUTTING AND PATCHING

- A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.6 CLEANING AND PROTECTING

- A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09 24 00

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SECTION 09 30 00 - TILE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. The extent of tile work specified here in and as shown on drawings and in schedules.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Standards: Furnish tile conforming with Standard Grade requirements of T.C.A. 137.1, latest edition.
- B. When using setting and grouting materials manufactured under T.C.A. License, include identification together with formula on each container. Provide materials obtained from only one source for each type and color of tile.
- C. Proprietary Materials: Handle, store, mix and apply proprietary setting and grouting materials in compliance with manufacturer's instructions.

1.4 SUBMITTALS

- A. See Section 01 33 00 "Submittals"
- B. Manufacturer's Data: Tile Work: Submit 6 copies of manufacturer's technical information and installation instructions for all materials required, except bulk materials. Include certifications and other data as may be required to show compliance with these specifications.
- C. Provide sample color specified for final owner user approval.
- D. Samples; Tile Work: Submit 3 samples of each type and color of tile required, not less than 12" square on plywood or hardboard backing, and grouted. Also, submit one full-size sample of each tile accessory and two 6" long samples of marble threshold. Submit samples of trim and other units if requested by Architect. Review will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
- E. Extra Stock: Supply extra 25% of each tile used in clean marked cartons for Owner's emergency use.

1.5 DELIVERY AND STORAGE

- A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. American Olean, or accepted equal.

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- B. Daltile, or accepted equal.

2.2 MATERIALS

- A. Ceramic Mosaic Tile: Standard Grade ceramic mosaics conforming to ANSI A137.1 as manufactured by Daltile or accepted equal. 2"x2", color: "Mottled Medium Brown" or as selected by the Architect..
- B. Abrasive Tile: Provide abrasive finished tile at all shower floors.
- C. Temporary Coating: Furnish tile, which is to be grouted with furan or non-water-cleanable epoxy with manufacturer's standard wax coating to prevent damage to exposed tile surfaces by grouting operations.
- D. Trim Shapes: As required for complete installation of same material, size, color and finish of field tile.
- E. Observe following requirements:
 - 1. Walls: In-Corners square
 - 2. Walls: Bullnose cap on wainscot or base
 - 3. Floors: Cove base required
 - 4. Curbs: Bullnose and cove are required for smooth rounded surface.
- F. Ceramic Tile: Standard Grade ceramic tiles conforming to ANSI A137.1 as manufactured by Daltile or accepted equal. 4"x4", color "Almond 0135". Or as selected by Architect from standard color.
- G. Trim Shapes: As required for complete installation of same material, size, color and finish of field tile.
- H. Observe following requirements:
 - 1. Walls: In-Corners square
 - 2. Walls: Bullnose cap on wainscot or base
 - 3. Floors: Cove base required
 - 4. Curbs: Bullnose and cove are required for smooth rounded surface.
- I. Marble Thresholds: Provide sound Group "A" marble with an abrasive hardness of not less than 10.0 when tested in accordance with ASTM C-241. Furnish white marble for thresholds, unless otherwise indicated.
- J. Epoxy Grout: For floor tile, provide a 2-component epoxy resin and hardener complying with ANSI A-118.3.
 - 1. Manufacturer: Provide epoxy grout as manufactured by one of the following:
 - a) Syracuse Adhesive Company, or accepted equal.
 - b) Laticrete International, Inc., or accepted equal.
 - 2. Color to be "Straw 94" or as indicated on the drawings. Or as selected by Owner from standard colors.
- K. Shower liner: AFCO shower pan, copper fabric bonded to two layers of asphalt impregnated cotton fabric. (617) 623-7700. Or approved equal.

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PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine the areas and conditions under which tile work is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION

- A. Standards: Use Tile Council of America Inc. 1996 Handbook for Ceramic Tile Installation.
- B. General: Comply with ANSI standard installation specifications A-108.1 through A-108.7, except as otherwise indicated. Maintain minimum temperature limits and installation practices as recommended by proprietary mortar and grout materials manufacture.
- C. Extend tile work into recesses and under equipment and fixtures to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignments.
- D. Comply with the manufacturer's instructions for mixing and installation of proprietary materials. Neutralize and seal substrates in accordance with mortar or adhesive manufacturer's instructions.
- E. Setting Beds: Provide setting beds as shown. If not shown, provide one of the following, subject to the specified limitations. Use Portland Cement for setting beds for walls and floors on substrates where thickness permits.
- F. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tile on floor, base, walls and trim are the same size. Layout tile work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.
- G. Placement: Comply with applicable requirements of the specified standards for installation.
- H. Grout: Use epoxy grout where shown or scheduled. Use pre-grouted sheets where shown or scheduled. Field-grout perimeter of individual sheets with the same elastomeric material as used in the factory pre-grouted sheets.
- I. Expansion and Control Joints: Provide where shown and as detailed on drawings. Floor expansion control joint in floor slab shall align with tile expansion joints. Sealants for expansion and control joints are specified in the Sealant Sections of these specifications. Use sealant comparable with tile installation.
- J. Metal Edge Strips: Provide where shown and where exposed edge of ceramic tile flooring is to meet carpet, wood, or other resilient floor covering.
- K. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
- L. Unglazed tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush the surface with clean water before and after cleaning.

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- M. Finish Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.
- N. Protection: When recommended by the tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with Kraft paper or other heavy covering during the construction period to prevent damage and wear. Prohibit all foot and wheel traffic from using tiled floors for at least 3 days, preferably 7 days.
- O. Before final inspection, remove protective coverings and rinse neutral cleaner from all tile surfaces.

END SECTION 09 30 00

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SECTION 09 53 23 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division 1 Specification sections apply to work of this section.

1.2 SCOPE

- A. Install a new acoustical ceiling tile and suspension system as indicated on the drawings and as specified herein.
 - 1. Acoustical ceiling panels.
 - 2. Exposed grid suspension system.
 - 3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.

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.
- B. Samples: Minimum 6" x 6" samples of specified acoustical panel; 8"-long samples of exposed wall molding and suspension system, including main runner and 4' cross tees.
- C. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
- D. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of, and replaced with complying product at the expense of the Contractor performing the work.

1.4 JOB CONDITIONS

- A. Space Enclosure: Do not install interior acoustical ceilings until ambient conditions of temperature and humidity will be continuously maintained at values indicated for final occupancy. Store materials

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indoors as recommended by manufacturer in controlled conditions where temperature and humidity are continuously maintained at values required at final occupancy.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristics: As follows, tested per ASTM E84 and complying with ASTM E1264 for Class A products.
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less

PART 2 - PRODUCTS

2.1 CEILING UNITS

- A. Acoustical Panels:
 - 1. Provide lay-in panels with fine fissured textured to match existing 24" x 24". Material Fiber Acoustical Panels:
 - a. Surface Texture: to match "Cortega"
 - 2. Composition: Mineral Fiber
 - 3. Color: White
 - 4. Size: 24" x 24" x 3/4"
 - 5. Acoustic" NRC: 0.70
 - 6. Edge Profile: Square Lay-in
 - 7. Emissions Testing: Section 01350 Protocol, <13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
 - 8. Flame Spread: ASTM E1264; Class A (UL)
 - 9. Light Reflectance (LR): ASTM E1477; White Panel: Light Reflectance: 0.90
 - 10. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0°C) and 120°F (49°C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
 - 11. Antimicrobial Protection: BioBlock Plus - Resistance against the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
 - 12. Products/Manufacturer:
 - a. Basis of design :

Armstrong

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b. or approved equal:

US Gypsum
CertainTeed

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).
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: One of the following:

1. Basis of Design: Armstrong "Prelude XL" color white.
2. Or approved equal : US Gypsum
3. Or approved equal : CertainTeed

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.

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 be selected by Architect.

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.

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.
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.

3.3 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. Installed work will all be new system no repairs permitted.

END SECTION – 09 53 23

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SECTION 09 65 13 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wall base.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer.
- B. Install resilient products after other finishing operations, including painting, have been completed.

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1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 COLORS AND PATTERNS

- A. Colors and Patterns: As selected by Architect.

2.2 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
- B. Type (Material Requirement): TV (vinyl).
- C. Group (Manufacturing Method): I (solid, homogeneous) or II (layered).
- D. Style: Cove (with top-set toe) and straight (toeless).
- E. Minimum Thickness: 0.125 inch.
- F. Height: 4 inches.
- G. Outside Corners: Job formed or pre molded.
- H. Inside Corners: Job formed or pre molded.
- I. Surface: Smooth.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: 50 g/L.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

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- F. Premolded Corners: Install premolded corners before installing straight pieces.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Clean surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09 65 13

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SECTION 09 65 19 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including General and Supplementary conditions and General Requirements (if any), apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. The extent of resilient flooring and accessories specified herein and also shown on the drawings and in schedules.

1.3 QUALITY ASSURANCE

- A. Wherever possible, provide resilient flooring and accessories produced by a single manufacturer.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00, "Submittals".
- B. Provide a letter of certification from the manufacturer that material provided do not contain asbestos.
- C. Manufacturer's Data - Resilient Flooring: For information only, submit (6), six copies of manufacturer's technical data and installation instructions for each type of resilient flooring and accessory. Transmit a copy of each installation instructions to Installer.
- D. Samples - Resilient Flooring: Submit (6) sets of samples of each type, color and finish of resilient flooring and accessory required. Provide full-size tile units and 12" square samples of sheet flooring and 6" long sample of accessory. Include full range of flooring color and pattern variation. Sample submittals will be reviewed for color texture and pattern only. compliance with all other requirements is the exclusive responsibility of the contractor.
- E. Maintenance Instructions - Resilient Flooring: Submit (2) copies of manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring and accessories.
- F. Replacement Material - Resilient Floors: After completion of work, deliver replacement materials to the project site, as follows: Tile flooring, not less than one box for each 50 boxes, or fraction thereof, for each type, size and color installed. Furnish replacement materials from the same manufactured lot as the materials installed.

1.5 JOB CONDITIONS

- A. Continuously heat areas to receive flooring to 70 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required. Maintain 70 degrees F. temperature continuously during and after installation as recommended by flooring manufacturer, but for not less than 48 hours.
- B. Store tiles in space 24 hours before installation for material acclimation to environmental conditions of the space.

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PART 2 - PRODUCTS

2.1 COLOR AND PATTERNS

- A. Provide colors and patterns as shown or scheduled, or as selected by Architect from manufacturer's standards.

2.2 TILE FLOORING

- A. Vinyl Composition Tile (VCT): FS SS-T-312, Type IV, 12" x 12" x 1/8" manufacturer's standard gage for color/pattern selected.
- B. Manufacturer: Armstrong Imperial Texture or accepted equal color to be selected by the Architect or as listed on the drawings.

2.3 ACCESSORIES

- A. Resilient Base: (VB) Provide vinyl base complying with FS SS-W-40, Type II, with matching end stops and performed or molded corner units, as follows:
 - 1. Height: 4".
 - 2. Thickness: 0.080" gage.
 - 3. Style: Standard top-set cove, (VB-1). Standard top - straight bottom (VB-2) inside cabinet.
 - 4. Manufacturer: Johnsonite or accepted equal, submit sample for final acceptance by owner. Color- To be selected by Architect.
 - 5. Metal Edge Strips: Of width shown and of required thickness to protect exposed edge of resilient flooring. Provide units of maximum available length, to minimize number of joints.
 - 6. Material: Vinyl plastic, unless otherwise shown.
 - 7. Adhesives/Cements: As recommended by flooring manufacturer to suit material and substrate conditions.
 - 8. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
 - 9. Crack Filler: As recommended by the floor covering manufacturer.
 - 10. Wax: FS P-W-155
 - 11. Polish: FS P-F-430
 - 12. Acclimation to space of 24 hours in environment intend for installation.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine the areas and conditions under which resilient flooring and

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accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work.

- B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PREPARATION

- A. Prior to laying of floor, broom clean or vacuum surfaces to be covered and inspect sub-floor. Start of floor installation indicates acceptance of sub-floor conditions and full responsibility for completed work.
- B. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.
- C. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured and ready to receive flooring.
- D. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.3 INSTALLATION

- A. General: Install flooring after finishing operations, including painting has been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by flooring manufacturer.
- B. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosings and edgings. Scribe around obstructions to produce neat joints, laid tight, even and straight. Extend flooring into toe spaces, door reveals and into closets and similar openings.
- C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on sub-floor. Use chalk or other non-permanent marking device.
- D. Install flooring on covers for telephone and electrical ducts, and other such items as occur within finished floor areas.
- E. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. tightly cement edges to perimeter of floor around covers and to covers.
- F. Tightly cement flooring to sub-base without open cracks, voids, raising and puckering at joints, telegraphing or adhesive spreader marks or other surface imperfections.
- G. Tile Floors: Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
- H. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped or deformed tile are not acceptable.

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- I. Lay tile with grain in tile running in the same direction.
- J. Accessories: Apply resilient base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.
- K. On masonry surfaces, or other similar irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- L. Apply but-type metal edge strips where shown on drawings, and prior to resilient flooring. Secure units to substrate with countersunk stainless steel anchors, complying with manufacturer's recommendations.

3.4 CLEANING AND PROTECTION

- A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by floor manufacturer. Protect installed flooring from damage by covering.
- B. Finishing: After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories.
- C. Apply wax and buff, with type of wax, number and coats and buffing procedures in compliance with floor manufacturer's instructions.

END SECTION 09 65 14

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SECTION 09 65 36.13- STATIC-DISSIPATIVE RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Static Dissipative Vinyl composition floor tile.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
- C. Provide a letter of certification from the manufacturer that material provided do not contain asbestos.
- D. Samples: Full-size units of each color and pattern of floor tile required. Resilient Flooring: Submit (6) sets of samples of each type, color and finish of resilient flooring and accessory required. Provide full-size tile units and 18" square samples of sheet flooring and 6" long sample of accessory. Include full range of flooring color and pattern variation. Sample submittals will be reviewed for color texture and pattern only. compliance with all other requirements is the exclusive responsibility of the contractor.
- E. Maintenance data: Resilient Flooring: Submit (2) copies of manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring and accessories.
- F. Replacement Material - Resilient Floors: After completion of work, deliver replacement materials to the project site, as follows: Tile flooring, not less than one box for each fifty (50) boxes, or fraction thereof, for each type, size and color installed. Furnish replacement materials from the same manufactured lot as the materials installed.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

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1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor tile.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 STATIC DISSIPATIVE VINYL COMPOSITION FLOOR TILE -SVCT-1

- A. Basis of Design:
 - 1. Armstrong World Industries, Inc.; Specialty VCT Static Dissipative Tile
- B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- C. Thickness: 0.125 inch
- D. Size: 12 by 12 inches
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Provide Armstrong S-202 Static Dissipative Tile Adhesive with 2 in. (5.08 cm) wide x 24 in. (60.96 cm) long copper ground-connection strips under the tile and Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer..
- C. Floor Polish: Provide Armstrong S-392 Static Dissipative Tile Polish for application as initial and on-going maintenance finish.

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2.3 ACCESSORIES

- A. A. Resilient Base: (VB) Burke 4" cove base, rubberhyte-type TP, with matching end stops and performed or molded corner units, as follows:
 - B. 1. Height: 4"
 - C. 2. Style 1 round top, cove bottom.
 - D. 3. Manufacturer: Burke.
 - E. 4. Material: Rubber, unless otherwise shown.
 - F. 5. Adhesives/Cements: As recommended by flooring manufacturer to suit material and substrate conditions.
 - G. 6. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
 - H. 7. Crack Filler: As recommended by the floor covering manufacturer.
 - I. 8. Acclimation to space of twenty-four (24) hours in environment intended for installation.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by floor covering manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)] in 24 hours.

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- b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Install copper grounding strips into adhesive in strict accordance with manufacturer's written instructions.

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- I. Roll tile with a 100-pound (45.36 kilogram) roller. Refer to specific rolling instructions of the tile manufacturer.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 36.13-

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SECTION 09 68 00 - CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Tufted carpet.

1.3 SUBMITTALS

- A. Product Data: For the following, including installation recommendations for each type of substrate:

1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

- B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Existing flooring materials to be removed.
3. Existing flooring materials to remain.
4. Carpet type, color, and dye lot.
5. Locations where dye lot changes occur.
6. Seam locations, types, and methods.
7. Type of subfloor.
8. Type of installation.
9. Pattern type, repeat size, location, direction, and starting point.
10. Pile direction.
11. Type, color, and location of insets and borders.
12. Type, color, and location of edge, transition, and other accessory strips.
13. Transition details to other flooring materials.

- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- square Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.
3. Carpet Cushion: 6-inch- square Sample.
4. Carpet Seam: 6-inch Sample.
5. Mitered Carpet Border Seam: 12-inch- square Sample. Show carpet pattern alignment.

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- D. Product Schedule: For carpet Use same designations indicated on Drawings.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
- G. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.
- H. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review delivery, storage, and handling procedures.
 - 2. Review ambient conditions and ventilation procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104 Section "Storage and Handling."

1.6 PROJECT CONDITIONS

- A. Comply with CRI 104, Section "Site Conditions; Temperature and Humidity" and Section "Ventilation."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

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- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

- A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET

- A. Construction: Textured Loop
- B. Dye Method: Solution dyed.
- C. Fiber Content: 100 percent nylon polypropylene.
- D. Construction: Woven.
- E. Pile Weight: 34 ounces per square yard.
- F. Density: 7, 628
- G. Pile Thickness: 0.160 inches.
- H. Primary Backing: Manufacturer's standard material.
- I. Secondary Backing: Manufacturer's standard material.
- J. Antimicrobial Treatment: Manufacturer's standard material.

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- K. Performance Characteristics: As follows:
1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
 2. Tuft Bind: Not less than 10 lbf per ASTM D 1335.
 3. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
 4. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
 5. VOC Limits: Provide carpet that complies with the following limits for VOC content when tested according to ASTM D 5116:
 - a. Total VOCs: 0.5 mg/sq. m x h.
 - b. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
 - c. Formaldehyde: 0.05 mg/sq. m x h.
 - d. Styrene: 0.4 mg/sq. m x h.
- L. Color and Pattern:
1. Color Type and Pattern to be selected by Owner/Architect.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
 - a. Total VOCs: 10.00 mg/sq. m x h.
 - b. Formaldehyde: 0.05 mg/sq. m x h.
 - c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.
- C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.
- D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

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- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
 - 1. Direct-Glue-Down Installation: Comply with CRI 104, Section "Direct Glue-Down Installation."
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

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- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders to comply with CRI 104, Section "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section "Protection of Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 09 68 00

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SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
 - 1. Exposed interior items and surfaces.
 - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available or will direct to match existing color.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
 - 2. GWB partitions
 - 3. GWB ceilings
 - 4. Hollow Metal Door Frames
 - 5. Hollow Metal Doors
 - 6. Exterior Wall
 - 7. Trim
 - 8. Other misc. surfaces affected by the work.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

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1.3 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
 - 1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 - 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.

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- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 degrees F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 degrees F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

- A. Manufacturer – Basis of Design: Benjamin Moore or approved equal.
- B. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- D. Colors: To be selected by the Architect, as noted on the drawings or to match existing.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

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3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINT SCHEDULE

- A. Gypsum Drywall:
 - a. Paint System, Application and Finish: Vinyl acrylic; two coats over primer.
- B. Concrete and Masonry: Walls
 - 1. Paint System, Application and Finish: Acrylic; two coats over filler.
- C. Ferrous Metal: Steel doors and frames, stairs, and miscellaneous exposed steel.
 - 1. Paint System, Application and Finish: Alkyd/Latex; two finish coats over prime coat; semi-gloss finish. Pre-primed requires top finish only; prime coat damaged surfaces.
 - a. Primer: B50Z Kem Kromik Primer
 - b. Finish Coat: B54Z Industrial Alkyd Gloss Enamel

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3.7 EXTERIOR PAINT SCHEDULE

1. Exterior masonry, concrete and stucco surfaces.
 - a. Silicone coating.
 - b. Dow corning all guard silicone
 - c. Elastomatic coating, 10 minute dry
 - d. Two coats – dow corning all guard primer and dow corning all guard finish coat, 10 minute dry.

END OF SECTION 09 91 00

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SECTION 10 28 13 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work included under this Section includes all labor, materials, equipment and services necessary to complete the toilet accessories as herein specified.

1.2 QUALITY ASSURANCE

- A. Provide products of the same manufacturer for all accessory units except as specified otherwise. Stamped names and labels will not be permitted except as specified otherwise. Locked dispensing units shall be keyed alike for all accessories.

1.3 SUBMITTAL

- A. Provide accessories Schedule.
- B. Manufacturer's Product literature.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Provide items shown on drawings and scheduled in the specifications. Provide all misc. accessories inserts, plates, connectors for a complete installation of toilet accessories; coordinate with plan for specific wall types and substrates the accessories will be attached to and provide misc. items required for that type of wall complete.

2.2 MANUFACTURER

- A. Toilet Accessories & Mirrors
 - 1. Bradley
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. American
 - 4. Metpar Corp. 516-333-2600

2.3 PARTITIONS

- 1. Doors 22 GA Stainless Steel type 304. Panels 22 GA Stainless Steel type 304. Pilasters 20 GA Stainless Steel type 304.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. The accessory manufacturer's mounting details shall be coordinated with other trades as their work progresses.
- B. Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory.
- C. Use concealed fastenings wherever possible.
- D. Provide anchors, bolts and other necessary fasteners, and attach accessories securely to

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walls and partitions in locations as shown or directed. Use manufacturers fasteners required for the type of wall shown on the drawings.

- E. Provide theft-resistant fasteners for all accessory mountings.
- F. Secure toilet room accessories to adjacent walls and partitions complying with the manufacturer's instructions for each item and each type of substrate construction.
- G. Mounting height shall meet minimum and maximum, State official ADA requirements.
- H. Installed location and height of accessories shall be approximately as indicated on drawings.

END SECTION 10 28 13

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SECTION 10 40 00 – ROOM SIGNS

PART 1 – GENERAL

RELATED DOCUMENTS

- A. Conditions of the Contract, and Modified General Conditions Division 1 as indexed, apply to this Section.

1.1 SCOPE

- A. Supply and install by each door an 8"x8" Braille and raised message room identification sign. Sign "Type 5".
- B. Location all proposed doors of South side of building renovation.
- C. Remove existing room number/signs from all existing walls, door and door frames, and all other existing signs complete.

1.2 SUBMITTALS

- A. Per general conditions, submit three (3) samples of color selection and installation hardware for approval by Architect.
- B. Submit a sign schedule listing all signage.
- C. Submit a sample and the literature for the selection of raised fonts and Braille.
- D. Submit shop drawings depicting the information on the sign and size of element components letter, Braille, and graphics for each room.
- E. Manufacturers standard colors for selection by Architect
- F. Sample sheet of available manufacturers font for selection by Architect
- G. Provide ADA International Symbol Sign for each restroom and shower room. Provide Gender International Symbol for each restroom and shower room.

1.3 GUARANTEE

- A. Per General Conditions.

1.4 REFERENCES

- A. Standards of the following as referenced: American National Standards Institute (ANSI).

1.5 DEFINITIONS

- A. Terms:

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1. Braille: Grade 2 Braille including 189 part-word or whole word contractions in addition to Grade 1 Braille 63 characters. Tactile is required whenever braille is required.
2. Symbols: Symbol itself is required to be tactile, but equivalent verbal description is required both in tactile letters and braille.
3. Tactile: 1/32" raised capital letters without serifs at least 5/8" height and not more than 2" height based on upper case "X". Braille is required whenever tactile is required.

1.6 ADA PERFORMANCE REQUIREMENTS

A. Tactile graphics signs mounting requirements:

1. Single doors: Mount 60" to sign centerline above finish floor and on wall adjacent to latch side of door.
2. Openings: Mount 60" to sign centerline above finish floor adjacent opening.
3. No wall space adjacent latch side of door, opening, or double doors: Mount 60" to sign centerline above finish floor on nearest adjacent wall.

PART 2 – PRODUCTS

2.1 ROOM NAME/NUMBER

- A. Manufacturer: "APCO", Atlanta, Georgia, 404-688-9000, Fax: 404-577-3847
- B. Or approved equal.
- C. Product: IM System, RI-88-A, color to match existing or selected by Architect to match existing, radius insert, photo-etched plastic, 1/32" raised graphics, font to be selected by Architect to match existing.
 1. Or approved equal
- D. Miscellaneous Items: Provide mounting hardware and fasteners for all mounting conditions.

2.2 DOOR EXIT SIGN

- A. At all doors with panic devices, provide IM System, RI-88-A, Color to be selected by Architect,, 1/32" raised graphics for exit, and in Braille written "EXIT".

PART 3 – EXECUTION

3.1 MEASUREMENTS

- A. Verify all dimensions shown on Drawings by taking field measurements; proper fit and attachment.

3.2 COORDINATION

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- A. Coordinate with all other trade whose Work relates to signage for placing of all required blocking, sub-framing, backing, furring, etc., to insure proper locations.

3.3 DELIVERY AND STORAGE

- A. Deliver and store materials in dry, protected areas. Keep free of dirt or other damage. Replace any damaged signs at no cost to Owner.

3.4 INSTALLATION

- A. Install all signs as per manufacturer's published instructions and approved installation layouts.
- B. Install all signs per Chapter 11, ADA requirements of the Florida Building Code.
- C. At each room of the South side renovation

3.5 CLEAN-UP

- A. Per General Conditions.

PART 4 – SCHEDULE

- A. General Contractor to provide schedule for review and approval by Owner.

END OF SECTION 10 40 00

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SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work included under this Section includes labor, materials, equipment and services necessary to complete the fire extinguishers as herein specified.

1.2 SUBMITTALS

- A. See Section 01 33 00 "Submittals Procedures"
- B. Submit 6 copies of product literature and mounting information.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide surface mounted multi-purpose dry chemical fire extinguishers as shown on drawing and as directed and approved by Local Fire Marshal.
- B. Quantity: 6 fire extinguishers
- C. The Fire Marshall shall make final determination for type and location of fire extinguishers as per NFPA. If the Fire Marshall does not set minimum standard for quantity, type, size or locations, provide extinguisher as listed above.
- D. Provide all mounting hardware surface mounted except as noted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install brackets, cabinet, reflective decals. as per manufacturer's recommendations. Provide solid blocking in stud wall for mounting. Provide appropriate fasteners for each wall condition and load.

END SECTION 10 44 16

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SECTION 12 21 00 - WINDOW BLINDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide and install Window Blinds as follows: At every exterior window of the office building, South side renovation.

1.2 REFERENCES

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

FEDERAL SPECIFICATIONS (FS)

FS AA-V-00200 (Rev. B) Venetian Blinds

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Manufacturer's Catalog Data: Blinds
- C. Manufacturer's Standard Color Charts: Blinds, color to be selected by Owner.
- D. Drawings: Blind details. Submit sufficient detail to verify installation method and compliance with requirements. Submit a numbering plan for identification of each blind with the proper installation location.
- E. Samples: Submit one complete unit of each type specified labeled for identification. Deliver approved samples to the site; if in good condition and otherwise suitable, the samples may be installed in the work. Identification and approval marks shall remain undisturbed until final acceptance. Colors shall be as specified in paragraph entitled "Colors for Slats, Tape, Cords, and Exposed Metal."

1.4 DELIVERY AND STORAGE

- A. Deliver the blinds to the site in the manufacturer's original containers with the manufacturer's name and container contents clearly labeled. Store in a safe, dry, clean, and well-ventilated area. Do not open containers until needed for installation unless verification inspection is required.

PART 2 - PRODUCTS

2.1 BLINDS

- A. Blind Units: FS AA-V-00200, Type II, one-inch slats, except as modified herein.
- B. Size: Lengths and widths as required for installation between the jambs.
- C. Slats: Aluminum for Type II venetian blinds.
- D. Cords; Braided nylon, ends heat-fused, and terminated with a plastic tassel.
- E. Tilting Device: Locate on the right side.

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- F. Lifting Cord Locks: Locate on the side opposite the tilting device enabling the blind to stop at any height.
- G. Color for Slats, Tape, Cords, and Exposed Metal: One color to be selected by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install blinds after the work of other trades, including painting, is substantially done. Install blinds level and in accordance with manufacturer's recommended installation instructions as approved. Use suitable type and size fasteners for the application. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, shall be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 0.75-inch (19.05mm) or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners and accessories necessary for a complete, finished installation.

END SECTION 12 21 00

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SECTION 22 00 01
PLUMBING 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 RELATED WORK SPECIFIED ELSEWHERE

- A. Outside utilities 5'-0" beyond the building wall.
- B. Final connections to heating, ventilating and air conditioning equipment.
- C. Cutting and patching.
- D. All concrete foundations or bases.
- E. Mounting of all starters, except those specified to be factory-mounted and wired as part of the equipment. All wiring necessary to supply power to electric motors and remote operating valves, including connections from the disconnect switches and starters to the motors.
- F. Providing the wiring of all plumbing alarm devices excluding house pump controls from the alarm devices to an alarm panel.
- G. Motor disconnect switches and circuit breakers, except in combination starters and where otherwise noted.
- H. All finished painting of exposed piping and appurtenances.
- I. Domestic water meters, detector fire meter and gas meter.
- J. Concrete pits for sump pumping units.
- K. Installation of access doors in finished construction furnished as the work of this Section.
- L. Flashing of roof drains and pipes penetrating the roof.
- M. Flashing of floor drains in membrane waterproofed floors.
- N. Excavation and backfilling.
- O. Extension of fire protection from valved outlets.
- P. Bracing and supports for hot water heaters.
- Q. Toilet accessories.

1.3 WORK INCLUDED

- A. Plumbing Fixtures and Trim.
- B. Sanitary Waste and Vent Systems.

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- C. Potable Water Supply System.

1.4 DESCRIPTION OF SYSTEMS

- A. Provide all plumbing fixtures and trim as indicated on the drawings. All fixtures shall be connected to the plumbing systems as indicated and required for proper operation. Piping materials, accessories, and equipment shall be as specified elsewhere in Division 22.
- B. Sanitary Waste and Vent Systems:
 - 1. Provide a complete sanitary, waste and vent system for all fixtures and equipment in the building.
 - 2. All waste from the building shall discharge by gravity 5 ft. outside of building.
 - 3. Certain areas, require drainage pumps which will discharge to the gravity waste system as shown on the drawings.
- C. Water Supply System:
 - 1. Provide a complete water supply system for all fixtures and equipment within the renovation scope of work in the building.
 - 2. The Contractor for the work of this Section shall furnish and install where shown on the drawings a domestic water meter as specified herein.
 - 3. The domestic water system shall connect to the existing system as shown on the plans.
 - 4. Local connections to fixtures and equipment shall be not less than full size of the fittings on the fixtures and equipment, and runouts and risers serving same shall be as shown and not less than one pipe size larger than the fittings on the fixtures and equipment.
 - 5. Provide stop-and-waste valves (or gate valves with auxiliary hose bibb drains) at every branch off water mains where accessible and provide approved gate or compression stops at every connection to fixtures and equipment.
 - 6. Provide water hammer arrestors in accordance with the Plumbing and Drainage Institute Standard PDI-WH201. Provide access door at each location. All water hammer arrestors shall comply with ANSI A112.26.1-1969 (R1975). Coordinate access door locations with the architect.
 - 7. Thermometers and pressure gauges shall be provided, on the inlet and outlet of each water heater and the HWR pipe at the discharge of the circulator pump. Thermometers shall be as specified herein.

PART 2 - PRODUCTS

2.1 SHOCK ARRESTERS

- A. Shock arrestors shall be barrel-fabricated of type "K" hard drawn copper, piston operated, manufactured by Zurn, Wilkins or Precision Plumbing Products.

PART 3 - EXECUTION

3.1 PIPING WORK - INSTALLATION

- A. The drawings shall be followed where they are definite and provided such procedure causes no objectionable conditions or does not conflict with other trades, laws, regulations or recommendations of equipment manufacturers. The drawings are intended to indicate the sizes of piping connections, and if certain sizes are omitted or

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unclear, obtain additional information before proceeding.

3.2 STERILIZATION OF PIPING AND EQUIPMENT

- A. After all domestic cold water, hot water supply and return piping has been flushed free of foreign matter, and within 30 days prior to turning the building over to the Owner, this piping shall be sterilized in accordance with Section 22 11 17 – Disinfection of Domestic Water Lines.

END OF SECTION 22 00 01

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SECTION 22 00 02
PLUMBING DEMOLITION

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 WORK INCLUDED

- A. The work of this section shall include furnishing all labor, materials and equipment for the demolition and removal of all existing fixtures, piping and equipment as indicated in the Contract Documents.

1.3 JOB CONDITIONS

- A. Provide protection of all fixtures, equipment and appurtenances to remain from damage during demolition.

PART 2 - PRODUCTS

- 2.1 Select tools and equipment appropriate to the scale and size of demolition.

PART 3 - EXECUTION

3.1 General:

- A. Remove piping, fixtures, ductwork, appurtenances and equipment where indicated on the drawings or where removal is required for completion of new work under this contract.
- B. Take all necessary precautions to protect existing structure, its contents and areas of the site not within demolition limits. Take any measures necessary to protect personnel from hazards.
- C. Where existing materials or assemblies are to be removed, modified, relocated or incorporated in the work take care to prevent damage. Provide temporary protection where new or existing openings exist in roof or walls as required to secure building and to keep weathertight.
- D. Where finishes are indicated to be patched and repaired, do demolition work required with care, to prevent damage to surrounding areas and to facilitate the patching and repairing work.
- E. During the progress of the work, efforts shall be made to keep dust to a minimum.
- F. Remove all trash and debris from the project as the work progresses and dispose of as directed by the Contracting Officer.

END OF SECTION 22 00 02

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.1 ARTICLES INCLUDED

- A. Definitions.
- B. Permits, Fees and Notices.
- C. Applicable Publications.
- D. Code Compliance.
- E. Scope of Work.
- F. Record Drawings.
- G. Intent of Drawings and Specifications.
- H. Quality Assurance
- I. Submittals.
- J. Product Requirements, Equals and Substitutions.
- K. Manufacturers Instructions.
- L. Transportation and Handling.
- M. Storage and Protection.
- N. Cutting, Patching and Demolition.
- O. Cleaning Up/Removal of Debris.
- P. Operating and Maintenance Manuals.
- Q. Training of Owners Operators.
- R. Guarantee of Work.
- S. System Testing.

1.2 ARTICLES

- A. Definitions:
 - 1. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as

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- "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.
2. The term "Provide", means furnish and install as part of the work covered in Division 22.
 3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
 4. The term "Install only" means to install under the work of Division 22 equipment furnished by other Divisions, or by the Owner.
 5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.
 6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the Plumbing system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.
 7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
 8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well organized high quality installation system (piping, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (piping, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.
 9. For additional definitions refer to Division 01 requirements.
- B. Permits, Fees and Notices: Comply with the Division 01 requirements.
- C. Applicable Publications:
1. Publications listed in each Section form a part of that Section to the extent referenced.
 2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
 3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.
- D. Code Compliance:
1. Life Safety Code - NFPA 101
 2. Florida Plumbing Code, 2010
 3. Florida Building Code, 2010
 4. Florida Accessibility Code, 2010
 5. NFPA.
- E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all PLUMBING as indicated in the Contract Documents.
- F. Record Drawings: Comply with the Division 01 requirements.
- G. Intent of Drawings and Specifications:
1. The intent of the drawings and specifications is to establish minimum acceptable

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- quality standards for materials, equipment and workmanship, and to provide operable plumbing systems complete in every respect.
 2. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern.
 3. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.
 4. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
 5. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the Comply with the Division 01 requirements.
- H. Quality Assurance:
1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
 2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
 3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
 4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
 5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
 6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
 7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.
 8. Comply with the Division 01 requirements.
- I. Submittals: Comply with the Division 01 requirements.
- J. Product Requirements, Equals and Substitutions: Comply with the Division 01 requirements.
- K. Manufacturer's Instructions:
1. Installation of work shall comply with manufacturer's printed instructions.
 2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.
- L. Transportation and Handling: Comply with the Division 01 requirements.

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M. Storage and Protection:

1. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.
3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
4. Provide protection as necessary to prevent damage after installation.
5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractors expense.

N. Cutting and Patching: Comply with the Division 01 requirements.

O. Cleaning Up/Removal of Debris:

1. Comply with the Division 01 requirements.
2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

P. Operating and Maintenance Manuals: Comply with the Division 01 requirements

Q. Training of Owners Operators:

1. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
2. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shut-down and any emergency procedures.
3. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.
4. Comply with the Division 01 requirements.

R. Guarantee of Work:

1. Comply with the Division 01 requirements.
2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
3. Insert warranties in appropriate locations in operating and maintenance manuals.
4. Materials and equipment having seasonal operation limitations, shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 22 specifications specify a longer period.

S. System Testing:

1. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
2. Provide all necessary labor, materials and equipment to assist contractors of

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other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 22 and the work of other divisions exists.

3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 22 05 00

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SECTION 22 05 10
BASIC MATERIALS AND METHODS FOR PLUMBING SYSTEM

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 WORK INCLUDED

- A. Piping and equipment identification.
- B. Electrical requirements.
- C. Painting.
- D. Concrete work.
- E. Fabricated steel supports.
- F. Excavation, trenching and backfilling.
- G. Placing of equipment.

1.3 RELATED WORK

- A. DIVISION 7 - THERMAL AND MOISTURE PROTECTION (Waterproofing and Flashing) and (FIRE AND SMOKE STOPPING).
- B. DIVISION 3 - CONCRETE.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced.
 - 1. American Institute of Steel Construction (AISC) Publications
 - 2. American National Standards Institute (ANSI) Standards
 - 3. American Society for Testing and Materials (ASTM) Publications
 - 4. American Welding Society (AWS) Publications
 - 5. Underwriters Laboratories, Inc. (UL) Standards

1.5 SUBMITTALS

- A. Where submittals are required, comply with Division 01 requirements.
- B. Shop Drawings: Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.
- C. Product Data: Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.
 - 1. Piping and equipment identification.

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PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Piping and Equipment Identification:
1. Communications Technology Corp.
 2. Craftmark Identification Systems, Inc.
 3. EMED Co., Inc.
 4. Florida Marking Products, Inc.
 5. Marking Services, Inc.
 6. Seton Name Plate Corp.
 7. W.H. Brady Co., Signmark Division

2.2 FABRICATION

- A. Piping and Equipment Identification:
1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6" diameter. For external diameters above 8". Marker shall be secured using cable ties for indoor use and stainless steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be overlaminated with Tedlar™ on polyester ultraviolet to avoid damage and fading. Markers shall identify the pipe contents and direction of flow through 360 degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 – Scheme for the Identification of Piping Systems.
 2. Valve tags: Contractors Option:
 - a. Indoor:
 - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link.
 - 2) 1/16 inch thick plastic, 1-1/2" round, with ¼ inch high black pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link.
 - b. Outdoor Service:
 - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link.
 - 2) 19 gauge Type 304 stainless steel, 1-1/2" round, with ¼ inch high pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6

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Type 304 stainless steel bead chain with locking link.

3. Valve chart frame: Self-closing, satin-finished, extruded aluminum with glass window, 8-1/2 inch by 11 inch chart size.
 4. Equipment nameplates:
 - a. Indoor: Shall be 1/16 inch thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
 - b. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically-resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
- B. Electrical Requirements: Refer to Division 26 for requirements
- C. Painting: Product specified in Division 9 - FINISHES.
- D. Concrete Work: Refer to Division 3 – CONCRETE.
- E. Fabricated Steel Supports:
1. Steel angles, channels, and plate shall be in accordance with ASTM A36.
 2. Steel members, including fasteners, exposed to weather shall be galvanized.
- F. Excavation, Trenching, and Backfilling: Product description not applicable.
- G. Placing of Equipment: Product description not applicable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation of materials and equipment shall be in accordance with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

- A. Piping and Equipment Identification:
1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
 2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
 3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in

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4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings. The marker shall be 1/16 inch thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
 5. Provide a minimum of 4 valve charts. Chart information shall indicate job name, Contractor name, date of installation, valve number, valve location, valve type, valve purpose, and system in which installed. Mount framed chart in equipment room, and insert copy of chart in each operating and maintenance manual under separate tabbed section labeled "Valve Chart". Where project drawings include a piping flow schematic, request AutoCad file from Engineer and label all of the valves according to the valve chart and frame in an 18" x 24" frame in main mechanical or pump room.
 6. Permanently affix nameplate to each item of equipment using stainless steel pop rivets. Where irregular surface impede direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts or suitable adhesive from nameplate manufacturer.
- B. Electrical Requirements: All work as provided under Division 26.
- C. Painting:
1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
 2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
 3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
 4. For quality control refer to DIVISION 9 - FINISHES.
 5. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
 6. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
 7. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
 8. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.
- D. Concrete Work:
1. Concrete pads and curbs for supports of equipment shall be a minimum of 4" high with chamfered edges and sized for approved equipment. Furnish drawings to Division 3 Contractor.
 2. Surfaces of concrete shall be troweled smooth. When forms are removed, fill voids with cement and rub smooth with rubbing stone.
 3. Do not pour concrete when ambient temperature is less than 40°F, and falling.
- E. Fabricated Steel Supports:
1. Because of the small scale of the drawings, details of equipment support are not always shown. It shall be the responsibility of the contractor to provide supports as required for safe and adequate support.
 2. Fabricated steel supports and ladders may be shop or field-fabricated, and shall be in accord with details on drawings.

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3. When details are not indicated, the contractor shall submit proposed support detail for review. The contractor shall bear all cost in producing this detail in the bid. This includes but is not limited to structural engineering support.
4. Steel members shall be saw cut, with corners ground smooth, and shall be assembled with welded or bolted connections at Contractor's option. Connections shall be in accord with specified AISC Publications.

F. Excavation, Trenching, and Backfilling:

1. Definitions:
 - a. Satisfactory material includes all materials except those classified "unsatisfactory", "unyielding" or "unstable".
 - b. Unsatisfactory material includes those materials containing roots, organic matter, trash, debris, frozen materials, stones larger than 3 inches in any dimension, and materials classified by ASTM D 2487 as OL, OH, and PT.
 - c. Unyielding material consists of rock and gravelly soils with stones greater than 3 inches in any dimension, or as defined by the pipe or tank manufacturer, whichever is smaller.
 - d. Unstable material consists of material too wet to properly support the pipe or tank.
 - e. Select granular material consists of well- graded sand, gravel, crushed gravel, crushed stone, or crushed gravel, crushed stone, or crushed slag composed of hard, tough, and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve, and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe or tank manufacturer, whichever is smaller.

G. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
3. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.
4. Exercise caution during equipment placing operations to insure that structure is not overloaded.
5. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required, or use crane to place equipment directly on permanent and finished support.
6. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in 2010 Figure 1609B of the Florida Building Code, Latest Edition.

END OF SECTION 22 05 10

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SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

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 WORK INCLUDED

- A. Angle valves.
- B. Backwater Valves
- C. Ball valves.
- D. Check valves.
- E. Gate valves.
- F. Globe valves.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.
 - 1. American National Standards Institute (ANSI).
 - 2. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

- A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).
- B. Product data shall be included in the operation for maintenance instruction manuals along with installation, operation and maintenance instructions.
- C. Refer to Division 01 for Submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Angle Valves:
 - 1. Nibco, Inc.
 - 2. Milwaukee Valve
 - 3. Stockham Valves & Fittings
- B. Backwater Valves
 - 1. Josam #67400
 - 2. MIFAB

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3. Watts
4. Zurn

C. Ball Valves:

1. Apollo
2. Crane Company
3. Milwaukee Valve.
4. Nibco, Inc.
5. Stockham
6. Victaulic Co. of America.

D. Check Valves:

1. API International, Inc.
2. Milwaukee Valve
3. Mueller Steam Specialty, Co. (Muessco)
4. Nibco, Inc.
5. Stockham
6. Victaulic Co. of America.

E. Gate Valves:

1. Milwaukee Valve
2. Nibco, Inc.
3. Stockham Valves & Fittings

F. Globe Valves:

1. Crane Company.
2. Milwaukee Valve
3. Nibco, Inc.
4. Stockham Valves & Fittings

2.2 FABRICATION

A. Angle Valves:

1. Potable Water Service:

- a. Size 1/4" thru 3". Bronze body, threaded or sweat connection, screwed bonnet, integral seat, renewable teflon or bronze disc, bronze stem, cast aluminum or malleable iron hand wheel, rising stem, inside screw, 125 lb. SWP-200 WOG (non-shock).
- b. Valves installed in insulated piping to have extended handles to clear insulation.

B. Backwater Valves: Series coated cast iron backwater valve, offset type, bronze fixed swing-check assembly, bolted gasketed cover, and no-hub connections.

C. Ball Valves:

1. Potable water service:

- a. Size 1/4" thru 2". Brass body, threaded or sweat connection, stainless steel stem, stainless steel or aluminum bronze conventional ported ball,

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teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.

- b. Size ½" thru 2". Two piece, standard port type with brass body, Viega ProPress connection, brass ball and stem, Teflon seat, carbon steel handle, 300 CWP.
- c. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated.

D. Check Valves:

1. Potable Water Service:

a. Horizontal swing check valve:

- (1) Size 1/4" thru 3". Bronze body thread or sweat connection, "Y" pattern, bronze seat, renewable teflon or bronze swing disc, Class 125.
- (2) Size 4" and up. Bronze body, sweat connection, bolted cover, bronze seat, bronze disc holder. Renewable bronze disc, Class 125.

b. Vertical lift check valve.

- (1) Size 3/8" thru 2". Bronze body, threaded or sweat connection, renewable teflon disc and seat, copper or stainless steel, spring loaded, stainless steel guide pin Class 125.
- (2) Size 2-1/2" thru 10". Iron wafer type body, taped lug connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125.
- (3) Size 12" and up. Bronze globe body, flanged connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125.
- (4) Size 2-1/2" thru 14" (grooved end): PPS coated ductile iron body, grooved end connection, aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft, EPDM seal, PPS coated or welded-in nickel seat, with spring-assisted disc. Valve may be installed horizontally or vertically for temperature ratings up to 230°.

E. Gate valves:

1. Potable water service:

- a. Size 1/4" thru 3". Bronze body, threaded or sweat connection, screwed bonnet, bronze wedge, bronze stem, malleable iron or aluminum hand wheel non rising stem, 125 lb. SWP-200 lb. WOG (non-shock). Based on Nibco T-113 or S-113.
- b. Valves installed in insulated piping to have extended handles to clear insulation.

F. Globe Valves:

1. Potable water service:

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- a. Size 1/4" thru 3". Bronze body threaded or sweat connection, screwed bonnet, integral seat, renewable teflon or bronze disc, bronze stem, malleable iron or cast aluminum hand wheel, rising stem, inside screw, 125 lb SWP-200 lb. WOG (non-shock).
- b. Size 4" and up. Iron body, flanged connection, bolted bonnet, renewable bronze disc and seat, brass stem, malleable iron or cast aluminum hand wheel, outside screw and yoke, Class 125.
- c. Valves installed in insulated piping to have extended handles to clear insulation.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off of each major branch from a header and at the base of each pipe riser in order to facilitate service.
- B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.
- C. Provide locking device on handle of the expansion tank isolation valve to prevent accidental closing.

3.2 INSTALLATION

A. Angle Valves:

1. Install valve in the upright or horizontal position.
2. Back disc off from seat prior to heating for sweat connected valves.
3. Provide a minimum of the manufacturers recommended clearance for stem travel and disc replacement.
4. Install valve with pressure under the disc.

B. Ball Valves:

1. Install valves with adequate access to lever actuator.
2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.
3. Provide infinite position handle with memory stop on the outlet of all heat exchangers for balancing purposes.

C. Check Valves:

1. Horizontal swing check valves: Install valve with swing disc in the pendent position, cover in upright position.
2. Vertical lift check valve:
 - a. Install valve in vertical position, upward flow.
 - b. Flanged valves will be installed between 125# or 150 ANSI flanges or other flanged valves.
 - c. A spool piece a minimum of 6" face to face will be used to separate a vertical lift check valve and a butterfly valve.
 - d. Inspect the face of the flange and valve for casting/matching burrs. If burrs exist remove by draw filing prior to gasket placement.
 - e. Grooved end check valves shall be installed with standard grooved

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couplings.

D. Gate Valves:

1. Back wedge off from seat prior to heating for sweat connected valves.
2. Provide a minimum of the manufacturers recommended clearance for stem travel, bonnet removal and repacking.
3. Install valve between faces of 125# or 150 standard ANSI flanges.
4. Inspect the face of the flange and valve for casing/ machining burrs. If burrs exist remove by draw filing prior to gasket placement.

E. Globe Valves:

1. Back disc off from seat prior to heating for sweat connected valves.
2. Provide a minimum of the manufacturers recommended clearance for stem travel bonnet removal and disc replacement.
3. Install valve with pressure under the disc.

END OF SECTION 22 05 23

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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 WORK INCLUDED

- A. Inserts, Shells and Upper Attachments.
- B. Pipe Hangers, Rods, Supports and Accessories.
- C. Pipe Sleeves.
- D. Pipe Seals.
- E. Fabricated Steel Support.

1.3 QUALITY ASSURANCE

- A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.
- B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.
 - 1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
 - 2. SP-69 Pipe Hangers and Supports: Selection and Application.
 - 3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.
- C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.
- D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.
- E. Welding of steel members shall be in accordance with AWS D1.1.
- F. Steel supports for pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

1.4 APPLICABLE PUBLICATIONS

- A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.
 - 1. American Institute of Steel Construction (AISC)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)

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4. American Welding Society (AWS)
5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
6. National Fire Protection Association (NFPA)
7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

1.5 SUBMITTALS

- A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Inserts, Shells and Upper Attachments:
 1. Anvil International, Inc.
 2. Carpenter Paterson, Inc.
 3. Cooper B-Line®, Inc.
 4. Elcen Metal Products
 5. Hilti
 6. Michigan Hanger Company
 7. PHD Manufacturing, Inc.
 8. Unistrut®
- B. Pipe Hangers, Rods, Supports and Accessories:
 1. Anvil International, Inc.
 2. Carpenter Paterson, Inc.
 3. Cooper B-Line®, Inc.
 4. Elcen Metal Products
 5. Hilti
 6. Michigan Hanger Company
 7. PHD Manufacturing, Inc.
 8. Unistrut®
- C. Pipe Sleeves:
 1. Metraflex – Metraseal
 2. Thunderline Corporation - Link Seal
 3. Owner approved substitution
- D. Pipe Seals:
 1. Metraflex – Metraseal
 2. Thunderline Corporation - Link Seal
 3. Owner approved substitution
- E. Fabricated Steel Support: As Detailed on Drawings.

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2.2 FABRICATION

A. Inserts, Shells and Upper Attachments:

1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs.
2. Shells: Steel shell and expander plug, snap off end fastener.
3. Upper Attachments:
 - a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size.
 - b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size.
 - c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size.
 - d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size.
 - e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size.

B. Pipe Hangers, Rods, Supports and Accessories:

1. Pipe Hangers:

- a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size.
- b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel, sized to accommodate required insulation. Rating is contingent on rod and bolt size.
- c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size.

2. Rods:

- a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

<u>Copper Tube, Plastic Fiberglass Reinforced Pipe Size</u>	<u>Steel, Cast Iron or Glass Pipe Size</u>	<u>Rod Size</u>	<u>Max Equip. Load</u>
1/4" to 2"	1/4" to 2"	3/8"	730 lbs.
2-1/2" to 5"	2-1/2" to 3"	1/2"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs
8" to 12"	6"	3/4"	3230 lbs.

- b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" is maintained.

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3. Supports:

- a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange.
- b. Pipe Saddle Cold Piping; MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr.°F at 75°F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
- c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish.
- d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size.
- e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size.

4. Accessories:

- a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation.
- b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation.
- c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size.
- d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size.
- e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size.

C. Pipe Sleeves:

1. Wall: Schedule 40 carbon steel pipe sized to accommodate pipe, insulation and firestopping. Refer to Division 7 for firestopping materials. If sleeves are field cut coat cut edges with cold galvanizing spray, ZRC or equivalent.
2. Floor or Exterior Walls below Grade: Schedule 40 steel pipe with anchor and water stop hot dip galvanized after fabrication. Sized to accommodate pipe and waterproofing or firestopping. Refer to Division 7 for firestopping materials. Sleeve length will be sized to allow a minimum of 1/2" extension below floor or exterior side of a wall below grade and 1-1/2" extension above floor and 1/2" extension on interior side of an exterior wall below grade.
3. Roof: All penetrations of roof to be in accordance with requirements of Division 7 - Thermal and Moisture Protection.
4. Based on Thunderline Corp. Link Seal Wall Sleeve.

D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40°F to +250°F. Based on Thunderline Corp. Link Seal LS Series.

E. Fabricated Steel Supports:

1. Field or shop fabricated. See details on drawings.
2. If not detailed on drawings the contractor is to provide suitable supports as

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required.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Where applicable install in accordance with the manufacturers written installation instructions.
- B. Where supports are in contact with copper pipe provide copper plated support, or wrap pipe with sheet lead.
- C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.
- D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed and painted black within one week of installation. At substantial completion all supports shall be free of rust and in a "like new condition".
- E. Hangers and supports, including attachments & pipe supports, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a "like new condition".
- F. Fabricated steel supports exposed to weather (including pipe supports) or located in utility tunnels and accessible utility trenches or subject to spillage shall be hot dipped galvanized after fabrication, primed and painted black within one week of installation. Cut, welded, drilled, or otherwise damaged surfaces of galvanized coating shall be repaired. At substantial completion all supports shall be free of rust and in a "like new condition".

3.2 INSTALLATION

- A. Inserts, Shells and Upper Attachments:
 - 1. Inserts:
 - a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
 - b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
 - c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.
 - 2. Shells: Size shell length to assure a minimum of 1" solid concrete remaining from shell end to concrete face.
 - 3. Upper Attachment:
 - a. Select proper attachment for building construction.
 - b. For plain steel devices, prime with black paint prior to installation.
 - c. Adjust attachment location for proper alignment and no more than 4 deg. offset from a perpendicular alignment.
 - d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.

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B. Pipe Hanger, Rods, Supports and Accessories:

1. Select proper hanger for piping systems.
2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
6. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
7. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
8. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT
SPACING TABLE

- a. Steel Pipe (Schedule 40 & 80):

Up to 1":	7 ft. on center
1-1/4" and greater:	10 ft. on center
- b. Copper Pipe (Types L, K and M):

Up to 1-1/4" size:	5 ft. on center
1-1/2" to 2-1/2":	6 ft. on center
3" and larger:	10 ft. on center
- c. Ductile Iron and Cast Iron: Two hangers per section length.
- d. Polyvinyl Chloride (PVC):

Up to 1-1/2":	3 ft. on center
2" and larger:	4 ft. on center
10. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
11. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
12. Provide protective shields on all cold and dual temperature piping required to be insulated.
13. Provide protective saddles sized to match insulation thickness on all hot piping

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required to be insulated. Fill void between saddle and pipe with insulation as specified.

14. Provide turnbuckles on all hangers which require leveling or aligning.
15. Provide steel clevis where detailed and/or required.
16. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

C. Pipe Sleeves:

1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.
5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the pipe and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Provide firestopping, waterproofing and/or insulation as required. Refer to Division 7.
11. Sleeves are not required in existing structures where openings through existing concrete floors, walls, or roof are core drilled.

D. Pipe Seals:

1. Provide pipe seals for all pipe sleeves used in:
 - a. External walls.
 - b. Floor slabs on grade.
 - c. Upper floors where spillage may occur.

- E. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.

END OF SECTION 22 05 29

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches , 1/2 inch for viewing distances up to 72 inches , and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

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7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032-inch or Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

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3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
 - 7. Identification of potable and non-potable water.
 - a. In all buildings where two or more water distribution system, one potable water and the other non-potable water, are installed, each system shall be identified either by color marking or metal tags as required by ASME A13.1. Reclaimed water systems shall be identified using color coded Pantone Purple 522C and marked with the statement "NONPOTABLE WATER - NOT FOR HUMAN CONSUMPTION."
- B. Pipe Label Color: Refer to ASME(ANSI) Standard A13.1-2007.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 2 inches, round.
 - b. Hot Water: 2 inches, round.

END OF SECTION 22 05 53

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SECTION 22 05 76
FACILITY DRAINAGE PIPING CLEANOUTS

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 WORK INCLUDED

- A. Cleanouts.

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01 for submittal requirements.
- B. Each cleanout submittal must be marked to show what area it will be used.

1.4 JOB CONDITIONS

- A. Provide protection for all cleanouts against damage during construction. The plumbing contractor shall be responsible to replace any damaged cleanouts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The manufacturers referenced herein are those that the specifications and drawings are based on. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

2.2 MATERIALS

- A. Cleanouts:

1. Floor Type (FCO):

- a. Finished Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top, with inverted hub and neoprene gasket.

Zurn #ZN1400-BP
J. R. Smith Fig. 4033-L
Josam #56010-22
Watts #CO-200-R

- b. Linoleum or Asphalt Tile Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top. Top depression to be covered with surrounding floor pattern bonded with waterproof adhesive.

Zurn ZN1400-X
Josam # 56010-12

- c. Terrazzo Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top with center lifting device. Top depression to be

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filled with terrazzo and finished.

Zurn #ZN1400-Z-BP
J. R. Smith Fig. 4180, Gasket #4193
Josam #56040-13-1
Watts #CO-200-LL

- d. Unfinished Floors - All cast iron adjustable floor level cleanout assembly with round heavy duty top, inverted hub and neoprene gasket.

Zurn ZN-1400-HD
Josam # 56070
Owner approved substitution

- e. Carpeted Floors - Cast iron adjustable floor level cleanout assembly with round nickel bronze top. Top furnished with clamping frame for use on carpeted floors.

Zurn Z-1400-CF
Josam # 56010-22
Owner approved substitution

2. Above Floor (CO): (In Mechanical Rooms)

- a. Caulk Ferrule Cleanouts - Cast iron ferrule with countersunk bronze plug.

Zurn #Z-1440-BP
J. R. Smith Fig. 4420
Josam #58900
Watts #CO-380

3. Wall Type (WCO):

- a. Wall-Round Cover - Cast iron ferrule with lead seal plug, round stainless steel cover with center screw.

Zurn #Z-1441
J. R. Smith Fig. 4402
Josam #58600-CO
Watts #CO-380-RD

- b. Wall-Round Cover - Cast iron ferrule with lead seal plug; chrome plated bronze round frame and cover secured with slotted screws for "face-of-wall".

Zurn #Z-ZAB-1463
J. R. Smith Fig. 4432
Josam #58610
Watts #CO-300-R

- c. Wall-Square Cover - Cast iron ferrule with lead seal plug; chrome plated bronze square frame and cover secured with slotted screws for "face-of-wall".

Zurn Z-1443-G
Josam # 58720
Owner approved substitution

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Cleanouts:

1. Provide cleanouts in all locations shown on the drawings and in all other locations required by The Local Building Code, and as directed by the Local Inspector.
2. Where special conditions exist, such as the need for a shallow cleanout to meet invert elevations, make changes necessary at no change in contract price and submit drawings or description for approval if requested by the Architect.
3. Cleanouts shall be the same size as the pipes they serve up to 4 inch, and not less than 4 inch for piping of larger size.
4. Cleanouts shall be installed not more than 100 feet apart in horizontal drainage piping.
5. Cleanouts shall be installed in the horizontal piping at each change of direction of the building waste, soil and storm systems which is greater than 45 degrees.
6. A cleanout shall be installed at or near the base of each waste, soil or rainleader stack.
7. All work this section shall conform to local building/plumbing code.

END OF SECTION 22 05 76

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SECTION 22 05 77
FACILITY PLUMBING DRAINS AND ACCESSORIES

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 WORK INCLUDED

- A. Roof Drains.
- B. Floor Drains.
- C. Downspout Nozzle.
- D. Trap Guard

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01 requirements.
- B. Each drain submittal must be marked to show what area it will be used.

1.4 JOB CONDITIONS

- A. Provide protection for all drains against damage during construction. The plumbing contractor shall be responsible to replace any damaged drains and cleanouts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to plumbing fixture schedule description and acceptable manufacturers. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drains:
 - 1. Unless otherwise specified, drains to be complete with strainers, trim, flashing and appurtenances and constructed of cast iron with painted finish.
 - 2. Set all floor drains level and at proper elevations to surrounding floor area to provide smooth and uniform drainage area.
 - 3. Unless noted otherwise, provide a trap for each floor drain of a material to match the pipe line to which it discharges.
 - 4. Provide drains in all locations shown on the Architectural and Plumbing drawings. Drains to be of the types specified herein and sized as shown on the plumbing drawings. Refer to the Architectural drawings for additional installation details.
 - 5. Actual sizes and quantities of all drains shall be determined from the drawings.

END OF SECTION 22 05 77

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SECTION 22 07 00
PLUMBING INSULATION

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 WORK INCLUDED

- A. Piping Systems Insulation.
- B. Accessories.

1.3 QUALITY ASSURANCE

- A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.
- B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.
- C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

- A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.
- D. Refer to Division 01 for submittal requirements.

1.5 GENERAL REQUIREMENTS

- A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.
- B. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

- A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.

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- B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.
- C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass Insulation:
 - 1. Owens-Corning Fiberglas
 - 2. Knauf Fiberglass
 - 3. CertainTeed
 - 4. Johns Manville
- B. Closed Cell Elastomeric Insulation:
 - 1. Armacell LLC
 - 2. Johns Manville
 - 3. Rubatex
- C. Insulation Coatings, Mastics, Adhesives and Sealants:
 - 1. Foster
 - 2. Childers
 - 3. Armacell
 - 4. K-Flex

2.2 PIPE INSULATION REQUIREMENTS

	<u>Thickness</u>	<u>Type</u>
A. Condensate Drain (C): All Sizes	1/2"	Closed Cell Elast.
B. Dom. Cold Water (CW): Up to 4"	--	Not Required
5" through 14"	--	Not Required
C. Dom. Hot Water (HW) (HWR):		
<u>Conditioned Space</u>		
Runouts less than 1/2"	1/2"	Rigid Fiberglass
Up to 2"	1"	Rigid Fiberglass
2-1/2" through Larger	1-1/2"	Rigid Fiberglass
<u>Unconditioned Space</u>		
Up to 2"	1"	Rigid Fiberglass
2-1/2" through 4	1-1/2"	Rigid Fiberglass
5" through Larger	2"	Rigid Fiberglass
D. Roof Drain Body - All Sizes	1-1/2"	0.75# Density Blanket Fiberglass

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- | | | | |
|----|--|--------|----------------------------------|
| E. | Rain Leader - All Sizes
(Horizontal Only) | 1-1/2" | 0.75# Density Blanket Fiberglass |
| F. | Floor Drains Receiving
Condensate - All Sizes | 1/2" | Closed Cell Elast. |
| G. | Fire Resistive Pipe Wrap: | 2" | 3M™ FireBarrier 20A, |
1. Tapes:
 - a. High performance filament tape.
 - b. Aluminum foil tape: Minimum 3" wide to seal cut blanket edges.
 2. Banding Material
 - a. Carbon steel banding for for \leq 1-hour ratings; 1/2" to 3/4" wide x 0.015" thick minimum.
 - b. 304 Stainless Steel banding for 2-hour ratings; 1/2" to 3/4" wide x 0.015" thick minimum.

2.3 MATERIALS

A. Pipe Insulation (to 450F):

1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F, .29 at 200°F and .43 at 400°F mean temperature. Based on Knauf Pipe Insulation.
2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000.
3. Closed Cell Elastomeric (Large Pipe Sizes, 6" and Larger): Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of 2.7 at 75°F mean temperature. Based on Armacell LLC Armaflex II.

B. Accessories:

1. Corner angles shall be minimum 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch heavy kraft paper.
2. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
3. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated.
4. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
5. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex or Foster 30-64 elastomeric finish.
6. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
7. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to

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flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for coating temperatures to 200F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Foster 85-75, Childers CP-82, Armacell 520, or K-Flex 373 contact adhesive or approved equal

8. Vapor Barrier Coating: Air drying flexible water based coating used for applying a vapor barrier coating with reinforcing mesh at all below ambient piping/equipment insulated elbows, fittings, and valves. All vapor retarder film seams on below ambient piping/equipment shall also be vapor sealed with vapor barrier coating to prevent moisture ingress. Suitable for temperatures between -20°F and 180°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08 as tested by ASTM E96, Procedure A at 45 mils dry. Childers CP-34 Vapor Retardant Coating, Foster 30-65 Vapor Fas® Coating, Marathon Industries, Inc. 590 LO-PERM, Vimasco Corp. 749 Vapor-Blok, or approved equal. Reinforcing mesh: Childers Chil Glas #10, Foster Mast A Fab, or Pittsburgh Corning PC 79.
9. Acrylic Finish:
 - a. Elastomeric Insulations: Air drying flexible water based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex or Foster 30-64 elastomeric finish.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install all insulation in strict accordance with the manufacturers written installation instructions.
- B. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.
- C. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.
- D. Insulation shall not be applied on any piping or duct system requiring testing until testing is completed and approved by Owner's Representative.
- E. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust or grease.
- F. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Owner's Representative shall be the final judge of acceptance of workmanship.
- G. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".
- H. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either

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factory or field insulated.

- I. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.
- J. Insulation shall be protected from moisture and weather during storage and installation.
- K. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Owner's Representative is satisfied that there is no longer any inferior insulation installed on this project.
- L. Insulation, fabric and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.
- M. The insulation subcontractor is responsible for proper material storage at the work site.
- N. Work performed prior to receipt of approved documents or submittals, later proving to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.
- O. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns and walls have been provided.
- P. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.
- Q. Where an insulated pipe passes through a sleeve or opening in a non-rated partition, the full specified thickness of the insulation shall pass through the sleeve or opening. Where an insulated pipe passes through a rated partition, the insulation shall be stopped at the partition. The void between the pipe and the sleeve shall be sealed with an approved fire-stopping material, and the insulation trimmed and sealed to the partition sufficient to cover the sleeve.
- R. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.
- S. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.
- T. The insulation subcontractor shall be responsible for his own safety program at the work site, and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.
- U. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

3.2 INSTALLATION

- A. Pipe Insulation:
 - 1. General:

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- a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness. If applicable, chilled water piping, 3" and over shall have a section of foamglas insulation installed between the pipe and shield. 3 and 4" to be 12" long, 5" and 6" to be 18" long and 8" and over, 24" long. If the possibility exists that the hanger may conduct the temperature of the conveyed medium and thus cause condensation or personal injury due to high temperature, the hanger shall also be insulated. Joints between foamglas and pipe insulation shall be properly sealed.
 - b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.
 - c. If applicable, the insulation at threaded unions in steam and hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives. Foster 30-36 Sealfas or Childers CP-50AMV1 Chil Seal lagging adhesive.
 - d. If applicable, insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.
 - e. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.
 - f. Cover fittings, flanges, unions, valves, anchors, and accessories with premolded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Apply vapor barrier coating and reinforcing mesh in two coats to a minimum dry thickness of 32 mils on all below ambient fittings, elbows, valves. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of premolded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.
 - g. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
 - h. Seal all raw edges of insulation with lagging adhesive.
 - i. For piping supported by hangers outdoors, apply a rainshield to prevent water entry.
2. Rigid Fiberglass:
- a. Provide PVC fitting covers for all fittings.
 - b. Align all jacket seams.
 - c. Assure all vapor barriers are properly sealed with vapor barrier coating.
 - d. Provide PVC jacket over all exposed insulation in the equipment room.
 - e. All corner angles below 6'-10" shall have padded insulation and be marked with yellow stripes.
3. Closed Cell Elastomeric:
- a. All joints shall be sealed with contact adhesives.
 - b. Where the thickness is to be obtained by use of two layers of insulation,

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- c. install with staggered joints.
Finish:
- 1) Concealed Indoors: No additional finish.
 - 2) Exposed Indoors: Provide PVC jacket over all insulation.
 - 3) Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.
 - 4) Outdoors: Provide aluminum pipe jacket.

END OF SECTION 22 07 00

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SECTION 22 11 16
DOMESTIC WATER PIPING

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 WORK INCLUDED

- A. Domestic Water (CW/HW) Piping.

1.3 DEFINITIONS

- A. The pipe sizes given in this document shall be construed nominal.

1.4 QUALITY ASSURANCE

- A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.
- B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:
 - 1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
 - 2. All other metallic piping - ASME/ANSI B31.1
- C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
- D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 SUBMITTALS

- A. All submittals shall be made in accordance with Division 01 Requirements.
- B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Domestic (Potable) Water (CW/HW Piping System Design Pressure: 150 psig).
 - 1. Piping, 8" and smaller - Above grade, copper tube, Type "L", hard temper, ASTM B88. Wrought cooper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.

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2. Piping, 4" and smaller – Below grade, copper tube, Type "K", hard temper, ASTM B88. Wrought copper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.
 - a. One-half inch (1/2") trap primer wastewater feed line to floor drains, same as domestic water, Type "L", except soft-drawn copper.
 - b. Temperature and pressure relief lines and drain pan lines same as domestic water, Type "L" hard-drawn copper or CPVC if not in a return air plenum.
 - c. Piping above slab/grade pipe, size 2-1/2" to 24" may be Type "L" ASTM B-88 copper tubing system using Victaulic System 607H mechanical pipe coupling of a bolted type with a central cavity design pressure-responsive EPDM-HP (green and red strip marking) gasket along with grooved end copper fittings, as manufactured by Victaulic Company of America, and installed per manufacturer's instructions. Fittings and couplings shall be UL classified in accordance with ANSI / NSF-61 for potable water service, and shall meet the low lead requirements of NSF-372.
3. Pipe Fittings, 8" and smaller - Above ground installation may be:
 - a. Wrought Copper, ANSI B16.22.
 - b. ProPress Fitting: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22.
4. Solder for factory fabricated fittings: Lead-free per FPC.
5. Brazing for Mechanically formed tee fittings: Brazing may be:
 - a. 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
 - b. 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
 - c. 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal
6. Fittings and couplings shall be UL classified in accordance with ANSI / NSF-61 for potable water service, and shall meet the low lead requirements of NSF-372.

2.2 MECHANICAL JOINT SYSTEMS (Press-fit (ProPress) mechanical fittings are allowed in domestic water piping, grooved fittings are not acceptable.)

A. General:

1. All couplings, fittings, and gaskets shall be the products of a single manufacturer.
2. Valve ends shall be compatible with the couplings used on the connecting piping.
3. All exposed piping shall be cleaned, removing all rust, primed and painted black. At substantial completion all exposed piping shall be free of rust and in a "like new condition".
4. All grooved joint fittings, couplings and valves shall be provided by a single manufacturer.
5. The grooving tools shall be of the same manufacturer as the grooved components.
6. Fittings:

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- a. Steel Piping: Fittings shall be manufactured of ductile iron per ASTM A536; wrought steel per ASTM A234; or factory-fabricated from carbon steel pipe conforming to ASTM A53.
 - b. Copper-Tubing: ASME B16.22 wrought copper or ASME B16.18 cast bronze, manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.) Victaulic Copper-Connection.
7. The grooved coupling manufacturer's factory-trained representative shall provide on-site training for the contractor's field personnel in the use of the grooving tools and installation of grooved joint products. The representative shall periodically visit the job site to review best-practices are being followed and provide a report to the Owner and engineer of their visit. (A distributor's representative is NOT considered qualified to conduct the train or job site inspections).
- B. Pipe Wall Thickness (Schedule Number):
1. Where rolled groove joints are used, the pipe wall thickness may, in some cases, be decreased below that specified for the particular fluid system. In all cases, the minimum pipe wall thickness shall be in accordance with ANSI/ASME B31.9, Chapter II, using 150% of the system operating pressure as the design pressure.
 2. Pipe having cut (machined) grooves shall have a nominal wall thickness of not less than the wall thickness specified for Schedule 40 pipe of the particular pipe size.
 3. Non-metallic pipe shall not be joined with grooved-end pipe mechanical joints.

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3.1 INSTALLATION

- A. General:
1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
 2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
 3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
 4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
 5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
 6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
 7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that

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- the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
 9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
 10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
 11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
 12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
 13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
 14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
 15. Avoid bushings. Reducing fittings shall be used wherever practical.
 16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
 17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
 18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.

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19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions, waterways or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Plumbing Systems Additional Requirements:

1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
3. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
 - a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
 - 1) The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
 - 2) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
 - 3) The number of joints in the service pipe shall be kept to a minimum.
 - 4) The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and superimposed loads.
 - 5) Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.
 - 6) Domestic water lines shall be disinfected.

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4. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
5. Provide clean-outs at the base of all sanitary waste and vent stacks.
6. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
7. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
8. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an "insect proof" closure.
9. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.
10. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.

3.2 BRAZING AND SOLDERING

- A. Operator and Procedure Qualifications: All brazing operators and all brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
- B. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".
- C. Soldering: Joints in copper tubing shall be made with solder- type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self- cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

- A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
 1. Plumbing related systems shall be tested with water at not less than a 10 foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.

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2. Domestic Water Distribution Systems shall be tested with water at the system working pressure, but not less than 100 psig. Joints will be visually examined for leaks.
 3. Domestic Water Distribution Systems utilizing Viega Pro-Press fittings with SC Feature Contour Design shall be initially tested at a minimum of ½ psig but not more than 85 psig. Joints shall be visually examined for leaks.
 4. Domestic Water Service System shall be tested with water at 150 psig. Joints will be visually examined for leaks.
 5. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
- B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
- C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.
- D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
- E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.
- F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
- G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
- H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
- I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
- J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

3.4 CLEANING OF PIPING SYSTEMS

- A. Plumbing piping systems shall be thoroughly cleaned as described in Section 22 11 17 - Disinfection of Domestic Water Lines. The chlorination and disinfections process shall be witnessed by a representative of the owner and provide a written Certification, as such.

END OF SECTION 22 11 16

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SECTION 22 11 17
DISINFECTION OF DOMESTIC WATER LINES

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 WORK INCLUDED

- A. Provide personnel, equipment and supplies, disinfect domestic hot and cold water systems, and flush out systems at completion of treatment.

1.3 DEFINITIONS

- A. Disinfectant Residual means the quantity of disinfectant in treated water.
- B. pH Factor means the measure of alkalinity and acidity in water.
- C. ppm means parts per million.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced.
 - 1. American Waterworks Association (AWWA) Standards.
 - 2. Standard Methods for the Examination of Water & Waste Water (14th edition).

1.5 QUALITY ASSURANCE

- A. Water Treatment Contractor: At least 5 years experience performing work specified herein.
- B. Bacteriological Laboratory: State certification.

1.6 SUBMITTALS

- A. General: Submit product literature for approval in accordance with Division 01 requirements.
- B. Water Treatment Contractor's evidence of experience: Submit three (3) copies.
- C. Bacteriological Laboratory's evidence of certification: Submit three (3) copies.
- D. Test Reports: Submit four (4) copies as follows:
 - 1. Disinfection Report, include:
 - a. Date issued.
 - b. Project name and location.
 - c. Treatment Contractor's name, address, and phone number.
 - d. Type and form of Disinfectant used.
 - e. Time and date of Disinfectant injection start.
 - f. Time and date of Disinfectant injection completion.
 - g. Test locations.

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- h. Initial and 24 hour Disinfectant Residuals in ppm for each outlet tested.
- i. Time and date of flushing start.
- j. Time and date of flushing completion.
- k. Disinfectant Residual after flushing in ppm for each outlet tested.

2. Bacteriological Report. Include:

- a. Date issued.
- b. Project name and location.
- c. Laboratory's name, certification number, address, and phone number.
- d. Time and date of water sample collection.
- e. Name of person collecting samples.
- f. Test locations.
- g. Time and date of laboratory test start.
- h. Coliform bacteria test results for each outlet tested.
- i. Certification that water conforms or fails to conform to bacterial standards or fails to conform to bacterial standards of Federal Safe Drinking Water Act.
- j. Bacteriologist's signature.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect against damage and contamination.
- B. Maintain caution labels on hazardous materials.
- C. Maintain storage room dry and with temperatures as uniform as possible between 60°F and 80°F.
- D. Do not store Caustic Soda directly on floor colder than 55°F.

1.8 PROTECTION

- A. Provide necessary signs, barricades, and notices to prevent any person from accidentally consuming water or disturbing system being treated.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall conform to the respective publications and other requirements specified herein.
- B. Disinfectant: Free chlorine; liquid, powder, tablet, or gas.
- C. Alkali: Caustic Soda or Soda Ash.
- D. Acid: Hydrochloric (Muriatic) type.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Prior to starting work verify that domestic water system is completed and cleaned.
- B. Notify Contractor about defects requiring correction.

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- C. Do not start work until conditions are satisfactory.

3.2 PREPARATION OF WATER FOR TREATMENT

- A. Verify pH factor of water to be treated.
- B. If pH factor is less than 7.2, introduce sufficient Alkali during Disinfectant injection.
- C. If pH factor is greater than 7.6, introduce sufficient Acid during Disinfectant injection.

3.3 SYSTEM TREATMENT

- A. Injection Disinfectant throughout system to obtain 50 to 80 ppm residual.
- B. Starting at outlet closest to water source, bleed water from each outlet until water produces odor of Disinfectant. Repeat process at each outlet throughout system. If odorless Disinfectant is used testing is required to determine if Disinfectant is fully dispersed throughout system.
- C. Test for Disinfectant Residual at each of the following locations:
 - 1. Ends of piping runs.
 - 2. Remote outlets.
 - 3. At least 15% of outlets on each floor where directed by Architect, but in no case less than 2 outlets.
- D. Maintain Disinfectant in system for 24 hours.
- E. If Disinfectant Residual is less than 25 ppm, repeat system treatment.

3.4 FLUSHING

- A. Remove Disinfectant from system; permit no more than residual rate of incoming water or 1.0 ppm, whichever is greater.

3.5 BACTERIOLOGICAL TEST

- A. Instruct Bacteriological Laboratory to take water samples no sooner than 24 hours after flushing system.
- B. Take water samples at each of the following locations:
 - 1. Where water enters system.
 - 2. Ends of piping runs.
 - 3. Remote outlets.
 - 4. At least 10% of outlets on each floor other than those used for testing Disinfectant Residual, where directed by Architect, but in no case less than two (2) outlets.
- C. Analyze water samples in accordance with AWWA Standard Methods for the Examination of Water & Waste Water, 14th edition.
- D. If bacteriological test proves water quality to be unacceptable, repeat system treatment until water quality is acceptable.

END OF SECTION 22 11 17

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SECTION 22 13 16
SANITARY DRAIN, WASTE AND VENT PIPING

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 WORK INCLUDED

- A. Sanitary Drain, Waste and Vent (DWV).

1.3 DEFINITIONS

- A. Pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

- A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.
- B. Each item provided under this section shall meet the requirements for that item as installed and used.
- C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
- D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.
- C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
 - 1. American National Standards Institute (ANSI) Standards
 - 2. American Petroleum Institute (API) Specification
 - 3. American Society of Mechanical Engineers (ASME) Publications
 - 4. American Society for Testing and Materials (ASTM) Publications
 - 5. American Welding Society (AWS) Publication
 - 6. American Water Works Association (AWWA) Standards
 - 7. Cast Iron Soil Pipe Institute (CISPI) Standards
 - 8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
 - 9. National Fire Protection Association (NFPA) Standards
 - 10. National Sanitation Foundation (NSF) Testing Laboratory Standards.

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11. Plastic Pipe Institute (PPI) Manual.
12. Underwriters Laboratories (UL)

1.6 SUBMITTALS

- A. All submittals shall be made in accordance with Division 01 requirements.
- B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, fittings, valves, hangers and supports. Include the designation of the publication applicable for each type of material and method.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Sanitary Drain, Waste and Vent (DWV) Piping:
 1. Underground sanitary piping:
 - a. Service weight hub and spigot pipe and fittings, Fed. Spec. WW-P-401F, ASTM-A74-98, CISPI-301.
 - b. Charlotte Seal Gaskets, ASTM C-564-97, CISPI-HSN.
 - c. Warco-Quik-Tite Gaskets, ASTM C-564-94, CISPI-HSN.
 - d. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
 - 1) ASTM D-1784 – Rigid PVC Vinyl Components.
 - 2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
 - 3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
 - 4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
 - 5) NSF Standard 14 – Plastic Piping Components and Related Materials.
 - g. Pipe Size 15" – PVC pipe and fittings, ASTM D-3034 or ASTM F-679, SDR 35 gasket.
 - h. PP Schedule 40 polypropylene, ASTM D635 and ASTM F1412, drainage pattern, mechanical joint stainless steel components, ASTM B117. Polypropylene shall be used where indicated on the drawings and as specified herein.
 2. Above-ground sanitary and vent piping:
 - a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
 - b. Service weight hub and spigot pipe and fittings, Fed. Spec. WW-P-401F, ASTM-A74-98, CISPI-301.
 - c. No-hub couplings, CISPI Standard 310.
 - d. Charlotte Seal Gaskets, ASTM C-564, CISPI-HSN.
 - e. Warco-Quik-Tite Gaskets, ASTM C-564-97, CISPI-HSN.
 - f. 2" and smaller Type DWV hard-drawn copper tubing, ASTM B-306 with copper drainage pattern and (lead-free) solder 95-5 Tin-antimony.
 - g. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
 - 1) ASTM D-1784 – Rigid PVC Vinyl Components.
 - 2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.

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- 3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
 - 4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
 - 5) NSF Standard 14 – Plastic Piping Components and Related Materials.
3. Piping ½” to 1”: Same as domestic water, Type “L” hard-drawn, or Schedule 40 PVC pipe and solvent joint fittings.
 4. PVC Foam core DWV pipe, ASTM F891, is not and shall not be approved under any circumstances nor installed on this project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring

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10. enough to allow for expansion without straining. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
13. Avoid bushings. Reducing fittings shall be used wherever practical.
14. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
15. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
16. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
17. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
18. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
19. Connections between plastic and metallic pipe shall be made with transition fittings manufactured for the specific purpose.
20. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Plumbing Systems Additional Requirements:

1. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
2. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
3. Joints between cast-iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
4. Joints between cast-iron and vitrified clay piping shall be made using either hot-poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast-iron spigot and the vitrified clay hub.

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5. Joints between steel and cast-iron pipe shall be either caulked or threaded, or made with approved adapter fittings.
 6. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8" per ft. unless noted otherwise.
 7. The underground water service pipe and the building sewer shall be not less than 10 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
 - a. The water service pipe and the building sewer may be installed in the same trench, provided written approval is given by the plumbing official and the following conditions are met:
 - 1) The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
 - 2) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
 - 3) The number of joints in the service pipe shall be kept to a minimum.
 - 4) The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and superimposed loads.
 - 5) Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.
 8. If applicable, provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
 9. Provide clean-outs at the base of all sanitary waste and vent stacks.
 10. If applicable, if a PVC piping system is employed; the final rough-in piping shall transition from PVC to Type "L" copper tubing at penetration of wall construction to the fixture. The copper piping rough-in shall employ the usage of the "Hold Rite" support system to prevent movement of branch tubing. No exceptions.
 11. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
 12. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
 13. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an "insect proof" closure.
- C. Plastic Pipe Systems Additional Requirements:
1. Joints between plastic pipe and other materials shall be subject to the following requirements:
 - a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.

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- b. Joints between the hub of cast-iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
 - c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.
- 2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold water service shall bear the NSF seal for potable water.
 - 3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
 - 4. Plastic vent piping shall not pass through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.
 - 5. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

3.2 BRAZING AND SOLDERING

- A. Operator and Procedure Qualifications: All brazing operators and all brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
- B. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".
- C. Soldering: Joints in copper tubing shall be made with solder- type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self- cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

- A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
 - 1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
 - 2. Plumbing related systems shall be tested with water at not less than a 10 foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
 - 3. The building sewer shall be tested by insertion of a test plug at the point of

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- connection with the public sewer, and filled with water under a head of not less than 10 feet, with no drop in water level for a period of not less than 15 minutes.
4. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
 - B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
 - C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.
 - D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
 - E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.
 - F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
 - G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
 - H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
 - I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
 - J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION 22 13 16

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SECTION 22 14 13
FACILITY STORM DRAINAGE PIPING

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 WORK INCLUDED

- A. Storm Water (ST) Piping.

1.3 DEFINITIONS

- A. The pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

- A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.
- B. Each item provided under this section shall meet the requirements for that item as installed and used.
- C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
- D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 SUBMITTALS

- A. All submittals shall be made in accordance with Division 01 requirements.
- B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.
- C. Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.
- D. Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Storm Water (ST) Piping
 - 1. Above-ground piping:

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- a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
 - b. Service weight hub and spigot pipe and fittings, Fed. Spec. WW-P-401F, ASTM-A74-98, CISPI-301.
 - c. No-hub couplings, CISPI Standard 310.
 - d. Charlotte Seal Gaskets, ASTM C-564, CISPI-HSN.
 - e. Warco-Quik-Tite Gaskets, ASTM C-564-97, CISPI-HSN.
 - f. 2" and smaller Type DWV hard-drawn copper tubing, ASTM B-306 with copper drainage pattern and (lead-free) solder 95-5 Tin-antimony.
 - g. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
 - 1) ASTM D-1784 – Rigid PVC Vinyl Components.
 - 2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
 - 3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
 - 4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
 - 5) NSF Standard 14 – Plastic Piping Components and Related Materials.
2. PVC Foam core DWV pipe, ASTM F891, is not and shall not be approved under any circumstances nor installed on this project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of

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- the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
 10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
 11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
 12. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
 13. Avoid bushings. Reducing fittings shall be used wherever practical.
 14. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
 15. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
 16. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
 17. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
 18. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
 19. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
 20. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

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C. Plumbing Systems Additional Requirements:

1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
5. Joints between cast-iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
6. Joints between cast-iron and vitrified clay piping shall be made using either hot-poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast-iron spigot and the vitrified clay hub.
7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
8. Joints between steel and cast-iron pipe shall be either caulked or threaded, or made with approved adapter fittings.
9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8" per ft. unless noted otherwise.

D. Plastic Pipe Systems Additional Requirements:

1. Joints between plastic pipe and other materials shall be subject to the following requirements:
 - a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
 - b. Joints between the hub of cast-iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
 - c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.
2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold water service shall bear the NSF seal for potable water.
3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
4. Plastic vent piping shall not pass through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.

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5. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

3.2 TESTING OF PIPING SYSTEMS:

- A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
 1. Plumbing related systems shall be tested with water at not less than a 10 foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 5 psig, with no loss in pressure for a period of not less than 15 minutes.
 2. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer, and filled with water under a head of not less than 10 feet, with no drop in water level for a period of not less than 15 minutes.
 3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
- B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
- C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.
- D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
- E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.
- F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
- G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
- H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
- I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
- J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION 22 14 13

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SECTION 23 00 02
HVAC DEMOLITION

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 WORK INCLUDED

- A. Heating, Ventilation and Air Conditioning: Remove all existing heating, ventilating and air conditioning equipment including as shown on the Contract Documents.

PART 2 – PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall obtain the permission of the Owners Representative and coordinate with other trades prior to commencement of demolition of the existing installations.
- B. The Contractor shall provide for safe conduct of the work, protection of property, and coordination with other work in progress. The spread of dust and flying particles shall be minimized.
- C. Existing construction to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to match existing work.
- D. When indicated, the contractor shall remove specific equipment in a careful manner so as to maintain the equipment in proper operating order. This equipment will be turned over to the owner and transported to a storage area as directed by the owner and further described herein.
- E. Material demolished under this section shall become the property of the Contractor and shall be promptly removed and disposed of off the site.
- F. Debris and rubbish shall not accumulate on the site, and shall be disposed of periodically by the Contractor.
- G. All necessary precautions shall be taken by the Contractor to prevent spillage during removal activities. Pavement and areas adjacent to the demolition areas shall be kept clean and free from mud, dirt and debris at all times.
- H. Existing utilities and mechanical systems including related equipment shall be disconnected by the Contractor to the extent shown on the contract drawings or specified and as required to perform the work in accordance with Division 23 of the specifications.
- I. The Contractor shall exercise care during the progress of the work under this section so as not to damage or displace the work of the other trades performed under other sections. He shall coordinate work under this section with work under other sections, as necessary for the proper execution of the entire work.
- J. When the contract documents indicate the removal of existing equipment to be

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temporarily stored and to be re-used, the contractor shall provide adequate protection for the stored equipment including the proper capping of several pipe connections, protection of power and control wiring and devices, and draining of coils to prevent freezing damage.

- K. Equipment which contains refrigerants shall be pumped down prior to demolition. The refrigerant shall be properly contained and disposed of in accordance with the accepted local procedures.
- L. Pre-demolition Conference: Conduct conference at Project site with the Owner to inspect and discuss condition of construction to be selectively demolished, review areas where existing construction is to remain and requires protection, review list of items to be salvaged and delivered to the Owner.

END OF SECTION 23 00 02

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SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.1 ARTICLES INCLUDED

- A. Definitions.
- B. Permits, Fees and Notices.
- C. Applicable Publications.
- D. Code Compliance.
- E. Scope of Work.
- F. Record Drawings.
- G. Intent of Drawings and Specifications.
- H. Quality Assurance
- I. Submittals.
- J. Product Requirements, Equals and Substitutions.
- K. Manufacturers Instructions.
- L. Transportation and Handling.
- M. Storage and Protection.
- N. Cutting, Patching and Demolition.
- O. Cleaning Up/Removal of Debris.
- P. Starting of Mechanical Systems.
- Q. Operating and Maintenance Manuals.
- R. Training of Owners Operators.
- S. Guarantee of Work.
- T. System Testing.

1.2 ARTICLES

- A. Definitions:

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1. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.
 2. The term "Provide", means furnish and install as part of the work covered in Division 23.
 3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
 4. The term "Install only" means to install under the work of Division 23 equipment furnished by other Divisions, or by the Owner.
 5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.
 6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the plumbing system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.
 7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
 8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well organized high quality installation system (duct, pipe, control wire or tube, conduit, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (duct, pipe, control wire or tube, conduit, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.
 9. For additional definitions refer to the Division 01 requirements.
- B. Permits, Fees and Notices: Comply with the Division 01 requirements.
- C. Applicable Publications:
1. Publications listed in each Section form a part of that Section to the extent referenced.
 2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
 3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.
- D. Code Compliance:
1. Life Safety Code - NFPA 101
 2. Florida Building Code, 2010
 3. Florida Mechanical Code, 2010
 4. Florida Accessibility Code, 2010
 5. NFPA.
- E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all HVAC as indicated in the Contract Documents.
- F. Record Drawings: Comply with the Division 01 requirements.

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G. Intent of Drawings and Specifications:

1. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.
2. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern.
3. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.
4. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
5. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the Comply with the Division 01 requirements.

H. Quality Assurance:

1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.
8. Comply with the Division 01 requirements.

I. Submittals: Comply with the Division 01 requirements

J. Product Requirements, Equals and Substitutions: Comply with the Division 01 requirements.

K. Manufacturer's Instructions:

1. Installation of work shall comply with manufacturer's printed instructions.
2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not

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3. proceed with work without clear instructions.
Comply with the Division 01 requirements.
- L. Transportation and Handling: Comply with the Division 01 requirements.
- M. Storage and Protection:
1. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
 2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.
 3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
 4. Provide protection as necessary to prevent damage after installation.
 5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractors expense.
- N. Cutting and Patching: Comply with the Division 01 requirements.
- O. Cleaning Up/Removal of Debris:
1. Comply with the Division 01 requirements.
 2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.
- P. Starting of Mechanical Systems:
1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
 2. Provide labor to assist the Owner's Representative in acceptance review.
 3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
 4. Provide information and assistance and cooperate with test, adjust and balance services.
 5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
 6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.
- Q. Operating and Maintenance Manuals: Comply with the Division 01 requirements.
- R. Training of Owners Operators:
1. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
 2. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shut-down and any emergency procedures.
 3. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative

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- 4. maintenance.
4. Comply with the Division 01 requirements.

S. Guarantee of Work:

- 1. Comply with the Division 01 requirements.
- 2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
- 3. Insert warranties in appropriate locations in operating and maintenance manuals.
- 4. Materials and equipment having seasonal operation limitations shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 23 specifications specify a longer period.

T. System Testing:

- 1. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
- 2. Provide all necessary labor, materials and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 23 and the work of other divisions exists.
- 3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.
- 4. Comply with the Division 01 requirements.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 23 05 00

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SECTION 23 05 10
BASIC MATERIALS AND METHODS OF HVAC 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 WORK INCLUDED

- A. Access doors.
- B. Waterproofing and flashing. (Refer to Division 7)
- C. Fire and smoke stopping. (Refer to Division 7)
- D. Electrical requirements.
- E. Painting.
- F. Concrete work.
- G. Excavation, trenching and backfilling.
- H. Placing of equipment.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced.
 - 1. American Institute of Steel Construction (AISC) Publications
 - 2. American National Standards Institute (ANSI) Standards
 - 3. American Society for Testing and Materials (ASTM) Publications
 - 4. American Welding Society (AWS) Publications
 - 5. Underwriters Laboratories, Inc. (UL) Standards

1.4 SUBMITTALS

- A. General: Where submittals are required, comply with Division 01 requirements.
- B. Shop Drawings: Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.
- C. Product Data: Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.
 - 1. Access doors.
 - 2. Waterproofing and flashing material.
 - 3. Fire and smoke stopping material.

PART 2 - PRODUCTS

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2.1 ACCEPTABLE MANUFACTURERS

- A. Access Doors:
 - 1. Acudor
 - 2. Elmodor Manufacturing, Co.
 - 3. Karp Metal Associates, Inc.
 - 4. Larsen's Manufacturing Co.
 - 5. Milcor
- B. Waterproofing and Flashing: (Refer to Division 7 for requirements).
 - 1. Stoneman Engineering and Manufacturing Co.
 - 2. S.B.C. Industries.
 - 3. Other suppliers acceptable.
- C. Fire and Smoke Stopping Material: (Refer to Division 7 for requirements).

2.2 FABRICATION

- A. Access doors:
 - 1. Access doors: UL labeled where installed in fire rated walls, partitions, and ceilings. Door rating shall be not less than wall, partition, or ceiling rating.
 - 2. Frames: 16 gauge steel, flush trim, with corners welded and ground smooth, masonry anchor strap for masonry walls, bolt holes for mounting in framed openings.
 - 3. Non-fire rated doors: 13 gauge steel, concealed continuous piano hinge with dust flap, flush screwdriver operated lock with stainless steel cam and studs.
 - 4. Fire rated doors: 20 gauge steel welded pan type, concealed continuous piano hinge with stainless steel pins, key-operated latch bolt, interior latch release, automatic door closer, automatic door latch when door closes. The door panel shall contain 2- inch thick insulation in sandwich type construction.
 - 5. Finish of doors and frames: Prime coat of rust inhibitive baked enamel, except as specified otherwise.
 - 6. Finish of doors and frames in wet areas, and in areas with surfaces subject to wet cleaning: No. 4 satin stainless steel.
 - 7. Label access doors per NFPA 80-19.2.3.2. and NFPA 105-6.3.2.2.
- B. Waterproofing and Flashing: All work is provided under Division 7.
- C. Fire and Smoke Stopping: All work is provided under Division 7.
- D. Electrical Requirements: Product description not applicable to this Section.
- E. Painting: Product specified in Division 9 - FINISHES.
- F. Concrete Work:
 - 1. Concrete is provided under DIVISION 3 - CONCRETE.
 - 2. This contractor to provide detailed dimension drawings, including anchor bolt locations where required for all bases and pads required for equipment furnished under this Division.
 - 3. Concrete for equipment bases and pads shall be 3000 p.s.i. design mix prepared in accord with ASTM C94. Cement shall be in accord with ASTM C150. Aggregate shall be fine sand in accord with ASTM C33. Water shall be clean, fresh, drinkable.

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- G. Excavation, Trenching, and Backfilling: Product description not applicable
- H. Placing of Equipment: Product description not applicable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation of materials and equipment shall be in accord with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

A. Access Doors:

1. Furnish access doors for installation under Division 9 - FINISHES.
2. Deliver access doors to the appropriate trade well in advance of the time they are needed so as to avoid unnecessary delay of the work.
3. Access doors shall be sized as indicated on drawings. If no size is given, provide access door of size suitable for servicing equipment or valve. Unless otherwise noted, the minimum size for a access door shall be 12" x 12".
4. Access doors shall be provided where indicated and if not indicated, where required.
5. Access doors shall be installed so as to allow full door swing.
6. Where full swing and access is not possible, removable doors shall be provided.
7. Access doors not required in lay-in-tile ceilings.

- B. Waterproofing and Flashing: All penetrations of roof to be in accordance with requirements of Division 7.

- C. Fire and Smoke Stopping: Fire and smoke stopping shall be provided in Division 7.

- D. Electrical Requirements: Refer to Division 26 for electrical requirements.

E. Painting:

1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
4. For quality control refer to DIVISION 9 - FINISHES.
5. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
6. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
7. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
8. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

F. Concrete Work:

1. Concrete pads and curbs for supports of equipment shall be a minimum of 4" high with chamfered edges and sized for approved equipment. Furnish drawings to Division 3 Contractor.

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2. Surfaces of concrete shall be troweled smooth. When forms are removed, fill voids with cement and rub smooth with rubbing stone.
3. Do not pour concrete when ambient temperature is less than 40°F, and falling.

G. Excavation, Trenching, and Backfilling:

1. Definitions:
 - a. Satisfactory material includes all materials except those classified "unsatisfactory", "unyielding" or "unstable".
 - b. Unsatisfactory material includes those materials containing roots, organic matter, trash, debris, frozen materials, stones larger than 3 inches in any dimension, and materials classified by ASTM D 2487 as OL, OH, and PT.
 - c. Unyielding material consists of rock and gravely soils with stones greater than 3 inches in any dimension, or as defined by the pipe or tank manufacturer, whichever is smaller.
 - d. Unstable material consists of material too wet to properly support the pipe or tank.
 - e. Select granular material consists of well- graded sand, gravel, crushed gravel, crushed stone, or crushed gravel, crushed stone, or crushed slag composed of hard, tough, and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve, and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe or tank manufacturer, whichever is smaller.

H. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
2. All air handling units shall have code required and manufacturer required clearances around all equipment.
3. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
4. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.
5. Exercise caution during equipment placing operations to insure that structure is not overloaded.
6. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required, or use crane to place equipment directly on permanent and finished support.
7. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in 2010 Figure 1609B of the Florida Building Code, Latest Edition.
7. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliance, equipment, fan or component and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter sphere and shall comply with the loading requirements for guards specified in the Florida Building Code.

END OF SECTION 23 05 10

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SECTION 23 05 13
MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 WORK INCLUDED

- A. Starters for all motors furnished under this Division, except where starters are provided in a motor control center by Electrical Specifications or where motors require adjustable frequency drives.
- B. Motors for equipment furnished under this Section.

1.3 SUBMITTALS

- A. Motors:
 - 1. Submission for acceptance is required. All three phase motors are based on NEMA Premium™ efficiency motors as described below by the minimum allowable efficiency. As a result, all motor starting codes are based on Code letter F or greater as defined by NEC Article 430. In the event that a manufacturer provides a motor with a code letter less than F, the overcurrent protection of the motor shall be coordinated with the Electrical Contractor to comply with NEC Article 430.
 - 2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

1.4 APPLICABLE PUBLICATIONS

- A. NEMA Publication ICS.
- B. NEMA Publications MG-1, MG-2, MG-13.

1.5 QUALITY ASSURANCE

- B. Motor efficiencies in accordance with IEE Standard 112 Method B as defined by NEMA MG1-1.23 a. and b.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Motors:
 - 1. A.O. Smith/Century E-Plus
 - 2. Baldor Electric Company, Premium Efficiency.
 - 3. Emerson Electric Company, U.S. Electrical Motors Div., Premium Efficiency Type 'DE' & 'RE'.
 - 4. The Louis Allis Company, High Efficiency.
 - 5. General Electric Company, Premium Efficiency Energy Saver®
 - 6. Reliance Electric Manufacturing Company, XE™ Premium Efficiency Motors.

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2.2 FABRICATION – MOTORS

A. 3/4 HP and Larger Horsepower Motors:

1. NEMA Premium™ efficiency type having the following minimum efficiencies:

Minimum Nominal Full-Load Motor Efficiency (%)						
	Open Motors			Totally Enclosed		
Number of Poles	2-Pole	4-Pole	6-Pole	2-Pole	4-Pole	6-Pole
Speed (RPM)	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
HP						
0.75	---	85.5	---	---	85.5	---
1	82.5	85.5	82.5	77.0	85.5	82.5
1.5	84	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93	91.7	91.0	92.4	91.7
20	91	93	92.4	91.0	93.0	91.7
25	91.7	93.6	93	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93	94.7	94.1	93.0	94.5	94.1
60	93.6	95	94.5	93.6	95.0	94.5
75	93.6	95	94.5	93.6	95.4	94.5
100	93.6	95.4	95	94.1	95.4	95.0
125	94.1	95.4	95	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95	95.8	95.4	95.4	96.2	95.8
250	95	95.8	95.4	95.4	96.2	95.8
300	95	95.8	95.4	95.4	96.2	95.8

2. Drip proof, except motors located outdoors to be TEFC or as otherwise specified.
3. Continuous duty, 40°C ambient.
4. Regreasable ball bearing design.
5. Speed/Torque curves shall be NEMA Design B so that overload protection provided by standard motor starters will be adequate to prevent over-heating during stall or slightly prolonged motor acceleration.
6. Class B insulation, except motors for variable speed drive application to be specially built for Adjustable Frequency Drive (AFD) duty and include Class F insulation and be suitable for operation down to 10% on fan and pump applications.
7. Assembly to meet application.
8. 1.15 service factor.
9. Suitable for starter type as scheduled on drawings.

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10. Slide bases as required.
11. 60 Hz. terminal box large enough to accommodate the required conduit and wiring.
12. 200, 208, 230 or 460 volt, 3 phase as scheduled.
13. Provide shaft grounding rings on all motors driven by a VFD. Typically to an AEGIS – SGR model.

B. Fractional Horsepower Motors:

1. Permanent split capacitor.
2. 115 volt, 1 phase, 60 Hz.
3. Thermally protected.
4. Other features of motors supplied as an integral part of a factory assembly shall be acceptable as the manufacturers' standard based on acceptance of the assembly as a whole.

PART 3 - EXECUTION

3.1 GENERAL

- A. Furnish all necessary wiring diagrams to Division 26 for installation and power wiring.

3.2 MOTORS – INSTALLATION

A. Motors:

1. Install in accordance with requirements of the duty.
2. Lugs to be provided under this Division.
3. All motors shall have overload protection as required by NEC. Any motor without integral protection shall have a starter that provides overload protection furnished by Division 23.

END OF SECTION 23 05 13

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SECTION 23 05 18
CONTROL WIRING

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. Refer to Division 26 for electrical wiring requirements.

1.2 WORK INCLUDED

- A. Building Control System Wiring.

1.3 DEFINITIONS

- A. Control Wiring: All wiring, high or low voltage other than power wiring, required for the proper operation of the mechanical systems.
- B. Power Wiring: All line voltage wiring to the mechanical equipment. Line voltage which also serves as a control circuit, such as a line voltage thermostat, or involves interlocking with a damper, shall be considered control wiring.

1.4 QUALITY ASSURANCE

- A. All work will be in accordance with the requirements of the National Electrical Code.

1.5 SUBMITTALS

- A. Submittals are not required.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All material used in the completion of the wiring under this section will comply with the requirements of Division 26 Electrical and Section 23 09 00 – Building Automation System.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cooperate completely with the contractor for Division 26.
- B. Provide all conduit, wire and accessories necessary to complete the control wiring as specified under WORK INCLUDED.
- C. Because of variations in requirements from manufacturer to manufacturer, all details may not be included in the Contract Documents. This sub-contractor must obtain approved coordinated wiring diagrams before proceeding with the control wiring.
- D. All control wiring shall be properly installed in an approved raceway system or when allowed, run exposed in concealed spaces. All control wiring run in exposed areas shall

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be in an approved raceway unless otherwise noted.

- E. Control wire run exposed shall be neatly bundled and routed parallel and/or perpendicular to building structure or equipment casing. Routing of wire shall be so that it does not interfere, chafe or obstruct service or maintenance of the equipment served.
- F. Exposed control wire shall be properly secured and/or supported within equipment enclosures. Cable shall be secured on no greater than 18" centers.
- G. All openings made for the passing of control wire shall be properly bushed to prevent chafing. The hole size shall be suitable for the quantity of wires or tubing passing through while allowing for ease of pulling and future expansion. Oversized holes beyond these requirements are not allowed.
- H. Holes made within air handling equipment which may allow the transfer or bypassing of air shall be properly sealed after wire is pulled. Expanding foam sealant and proper backing material will be acceptable. Seal shall be suitable for maximum unit operating pressures.
- I. Attachments of control devices, raceway and cable supports shall be made with proper attachments. Self-drilling screws which result in exposed end will not be acceptable. Bolts and nuts shall be used with bolt head exposed to view. All fasteners located where exposed to weather or moisture shall be stainless steel or cadmium plated.
- J. Any opening, holes or cuts in equipment enclosures or building structure not used shall be neatly sealed. On equipment, the seal or patch shall be of similar material sealed and painted to match.
- K. The control contractor shall clean all unused or scrap material from the equipment enclosure.
- L. All control wire shall be identified by proper cable identification methods. Verify how cables shall be labeled with the Owner's Representative prior to the start of work. All termination shall be labeled and labels clearly visible.
- M. All control devices, cabinets, equipment and raceways shall be labeled. Verify how the hardware shall be labeled with the Owner's Representative prior to the start of work.
- N. Splices in control wire are not allowed unless the length of run is too great to allow for a continuous run. When splices become necessary, they shall be solder connected with heat shrink tubing. When raceway is used, all splices shall be in junction boxes.
- O. Control devices (i.e., flow switches), connected to cold equipment where the possibility of condensation may occur shall be vaporproof type. The connecting conduit shall be properly sealed with spray type foam after the wires are pulled through. If this is not possible, a weatherproof junction box shall be close mounted to the device to allow for proper moisture sealing. Conduit connections shall be sealed with a silicon type caulk/sealant.
- P. All control devices or wiring located exposed to weather or moisture shall be in an approved raceway system. This system shall be properly supported and sealed to prohibit moisture convection or transfer. Provide flexible conduit similar to seal tight for connection to all equipment. EMT and set screw fittings are not acceptable. All exterior raceway shall be IMC (Intermediate Metallic Conduit) or better with threaded fittings.
- Q. Where a disconnect switch is mounted between an adjustable frequency drive and the

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motor, the disconnect must have a late make, early break auxiliary contact. This contact shall be wired into the AFD control circuit so that the control circuit is disconnected before the power circuit it broken.

END OF SECTION 23 05 18

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SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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 WORK INCLUDED

- A. Pipe Hangers, Rods, Supports and Accessories.
- B. Duct Hangers and Supports.
- C. Duct Sleeves.

1.3 QUALITY ASSURANCE

- A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.
- B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.
 - 1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
 - 2. SP-69 Pipe Hangers and Supports: Selection and Application.
 - 3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.
- C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.
- D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.
- E. Welding of steel members shall be in accordance with AWS D1.1.
- F. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as applicable.

1.4 APPLICABLE PUBLICATIONS

- A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.
 - 1. American Institute of Steel Construction (AISC)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. American Welding Society (AWS)
 - 5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
 - 6. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

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1.5 SUBMITTALS

- A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Pipe Hangers, Rods, Supports and Accessories:
 - 1. Anvil International, Inc.
 - 2. Carpenter Paterson, Inc.
 - 3. Cooper B-Line®, Inc.
 - 4. Elcen Metal Products
 - 5. Hilti
 - 6. Michigan Hanger Company
 - 7. PHD Manufacturing, Inc.
 - 8. Unistrut®
- C. Duct Hangers and Supports: Fabricated per Specifications
- D. Duct Sleeves: Fabricated per Specifications

2.2 FABRICATION

- A. Pipe Hangers, Rods, Supports and Accessories:
 - 1. Pipe Hangers:
 - a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300 or approved substitution.
 - b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe or approved substitution.
 - c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181 or approved substitution.
 - 2. Rods:
 - a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic Fiberglass Reinforced	Steel, Cast Iron or Glass		Max Equip. Load
<u>Pipe Size</u>	<u>Pipe Size</u>	<u>Rod Size</u>	<u>Load</u>
1/4" to 2"	1/4" to 2"	3/8"	730 lbs.

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2-1/2" to 5"	2-1/2" to 3"	1/2"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs
8" to 12"	6"	3/4"	3230 lbs.
14"	8" to 12"	7/8"	4480 lbs.
16"	14" to 16"	1"	5900 lbs.
18" to 20"	18" to 20"	1-1/4"	9500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

- b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" in maintained. Based on Anvil Fig. 146 or approved substitution.

3. Supports:

- a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange or approved substitution.
- b. Pipe Saddle Cold Piping; MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr.°F at 75°F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
- c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274 or approved substitution.
- d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 19 5 or approved substitution.
- e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261 or approved substitution.

4. Accessories:

- a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation. Based on Anvil Fig. 167 or approved substitution.
- b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation. Based on Anvil Fig. 160 thru 165 or approved substitution.
- c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 230 or approved substitution.
- d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 299 or approved substitution.
- e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 290 or 290L or approved substitution.

- B. Duct Hangers and Supports: Fabrication and application of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and

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Flexible, Latest Edition, as applicable.

- C. Duct Sleeves: Sleeves shall be provided for ducts penetrating concrete and masonry walls, stud framed fire rated walls, and poured- in-place concrete floors and roofs. Sleeves shall be sized to accommodate duct, insulation and firestopping. Refer to Division 7 for firestopping requirements.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Where applicable install in accordance with the manufacturers written installation instructions.
- B. Where supports are in contact with copper pipe provide copper plated support, or wrap pipe with sheet lead.
- C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.
- D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed and painted black within one week of installation. At substantial completion all supports shall be free of rust and in a "like new condition".
- E. Hangers and supports, including attachments & pipe supports, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a "like new condition".

3.2 INSTALLATION

- A. Pipe Hanger, Rods, Supports and Accessories:
 - 1. Select proper hanger for piping systems.
 - 2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
 - 3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
 - 4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
 - 5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
 - 6. For vibration isolation hanger intermediate attachment requirements for isolated equipment refer to Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.
 - 7. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
 - 8. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
 - 9. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within

the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT
SPACING TABLE

a. Steel Pipe (Schedule 40 & 80):

Up to 1":	7 ft. on center
1-1/4" and larger:	10 ft. on center

b. Copper Pipe (Types L, K and M):

Up to 1" size:	5 ft. on center
1-1/4" and larger:	7 ft. on center

c. Ductile Iron and Cast Iron: Two hangers per section length.

d. Polyvinyl Chloride (PVC):

Up to 1-1/2":	3 ft. on center
2" and larger:	4 ft. on center

10. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
11. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
12. Provide protective shields on all cold and dual temperature piping required to be insulated.
13. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated. Fill void between saddle and pipe with insulation as specified.
14. Provide turnbuckles on all hangers which require leveling or aligning.
15. Provide steel clevis where detailed and/or required.
16. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

B. Duct Hanger and Supports: Installation of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.

C. Duct Sleeves:

1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
3. Provide temporary internal bracing where required preventing distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.
5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing

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- fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the duct and inside of sleeve, or between jacket over insulation and sleeve.
 9. Provide membrane clamping devices on sleeves for waterproof floors.
 10. Duct sleeves shall be secured to opening and have a flange turned back to wall to cover any irregularities in the opening provided for the sleeve.

END OF SECTION 23 05 29

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SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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 WORK INCLUDED

- A. Piping and equipment identification.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated
 - 1. Piping and equipment identification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Piping and Equipment Identification:
 - 1. Communications Technology Corp.
 - 2. Craftmark Identification Systems, Inc.
 - 3. EMED Co., Inc.
 - 4. Florida Marking Products, Inc.
 - 5. Marking Services, Inc.
 - 6. Seton Name Plate Corp.
 - 7. W.H. Brady Co., Signmark Division

2.2 FABRICATION

- A. Piping and Equipment Identification:
 - 1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6" diameter. For external diameters above 8". Marker shall be secured using cable ties for indoor use and stainless steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be overlaminated with Tedlar™ on polyester to prevent ultraviolet to avoid damage and fading. Markers shall identify the pipe contents and direction of flow through 360 degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 – Scheme for the Identification of Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use or approved substitution.
 - 2. The marker shall be 1/16 inch thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be ¾ inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.

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3. Valve tags: Contractors Option:
 - a. Indoor:
 - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc., or approved substitution.
 - 2) 1/16 inch thick plastic, 1-1/2" round, with 1/4 inch high black pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc., or approved substitution.
 - b. Outdoor Service:
 - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc., or approved substitution.
 - 2) 19 gauge Type 304 stainless steel, 1-1/2" round, with 1/4 inch high pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link. Based on Marking Services, Inc., or approved substitution.
4. Equipment nameplates:
 - a. Indoor: Shall be 1/16 inch thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
 - b. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically-resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
 - c. Based on Marking Services Inc. Model MS-215 Max-Tex or approved substitution.

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PART 3 - EXECUTION

3.1 GENERAL

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 INSTALLATION

A. Piping and Equipment Identification:

1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings.
5. Provide air flow diagrams installed in waterproof, laminated frames on the wall in each Mechanical Room. Air flow diagrams shall show locations of dampers, sensors, and exhaust fans associated with the air handling unit.
6. Permanently affix nameplate to each item of equipment using stainless steel pop rivets. Where irregular surface impede direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts or suitable adhesive from nameplate manufacturer.
7. Refrigeration System - Additional Requirements:
 - a. Marking and Signage:
 - (1) Provide a permanent sign containing the following information:
 - (a) Name and address of installer.
 - (b) Kind of refrigerant.
 - (c) Lbs. of refrigerant.
 - (d) Field test pressure applied.
 - (2) Provide a permanent sign: Main electrical supply, i.e., main compr. disc.
 - (3) Provide metal tags with 0.5" letters:
 - (a) Shut-off valves to each vessel, i.e., L.P. receiver shut-off.
 - (b) Relief valve.
 - (4) Piping shall be marked as either:
 - (a) Refrigerant - High Pressure - Liquid or Hot Gas.
 - (b) Refrigerant - Low Pressure - Suction, Pumped Liquid Supply or Pumped Liquid Return.

END OF SECTION 23 05 53

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SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC 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 WORK INCLUDED

- A. Checking installation for conformity to design.
- B. Checking each piece of equipment for proper installation and operation.
- C. Balancing air and water distribution systems to provide design fluid quantities.
- D. Measuring and recording of fluid quantities.
- E. Electrical measurement.
- F. Verification of performance of all equipment and sequence of operation of automatic controls.
- G. Checking sound levels and vibration isolators for proper function and measurement and correction where a problem or question of acceptability exists.
- H. Recording and reporting results on sub-contractors standard report forms and on commissioning data sheets where these have been provided.

1.3 REFERENCES

- A. Air Diffusion Council (ADC) 1062R3 Equipment Test Code
- B. Associated Air Balance Council (AABC)
National Standards for Field Measurements and Instrumentation, Total Balance System Balance, Air Distribution - Hydronic Systems, Volume 1.

1.4 SUBMITTALS

- A. Submit complete description of procedures, instrument calibration and qualifications of personnel actually doing testing and balancing on this project prior to beginning of any balancing.
- B. Submit schedules of test data readings in organized, schematic, tabulated format. Include schematic drawing showing location of all readings.
- C. Submit as-built drawings showing locations of all readings.

1.5 QUALITY ASSURANCE

- A. Adjusting, balancing and testing procedures and compilation of test data shall be performed by a Certified Test and Balance Engineer or by personnel trained and supervised by a Certified Test and Balance Engineer.

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- B. Test and balance personnel shall be qualified to perform testing and balancing in accordance with AABC or NEBB procedures.

1.6 TOLERANCES

- A. Balance final airflow to within plus or minus 5 percent of specified quantities. Caution is urged on systems where diversity has been taken and the total flow exceeds the equipment capacity. In this case, the system must be sectioned as necessary to get proper terminal flow.

1.7 GENERAL COMMENTS

- A. Air Balance: Readings from a pitot tube traverse will be given highest priority as to accuracy. Terminal flow shall be as taken from the terminal DDC flow readings. Outlet flow as established by flow hood will be used to pro-rate air flow. Pressure readings as well as voltage and ampere readings will be used for check purposes only. Temperature readings will be used as a check against performance.
- B. All readings shall be cross-checked for accuracy. These cross-checks shall be tabulated within the report.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.1 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. Review drawings and specifications with regard to adjusting and balancing.
- B. Additional balancing devices which, in the opinion of the TAB sub-contractor, would aid in the adjusting and balancing of the systems shall be brought to the attention of the contractor prior to bid time so that the contractor may make allowances to cover the provision of these additional devices in the original bid.
- C. Minor modifications in system design which, in the opinion of the Contractor, would aid in the adjusting and balancing of the systems may be provided subject to approval of the Owner's Representative at no additional cost to the Owner. Design modifications shall not lessen the operating efficiency of the systems.

3.2 AIR BALANCE

- A. Check system visually and audibly for leakage and proceed with balancing as outlined by AABC or NEBB.
- B. Balance for full flow shall be based on dirty friction loss across the filters. Artificially blank-off sections on a uniform pattern as required to simulate this condition.
- C. Constant Volume Systems:
 - 1. Adjust each fan to deliver the specified quantity of air at the specified temperatures to all areas of the building served by the air system. Where the installed drive cannot be adjusted to obtain the required flow, advise the contractor so that the necessary drive change can be made. Adjust speed, in direct proportion to actual vs. required cfm. Exercise caution because amps vary with the cube of speed.
 - 2. Determine air volume in ducts by use of pitot tube, and inclined manometer.

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- Plug all holes in duct.
3. Determine air quantity through air grilles or diffusers by use of flow hood with direct readout meter calibrated in CFM. If use of flow hood is not possible, use velometer nozzle as recommended by air device manufacturer. Calculate air quantity based on air device area factors provided by the air device manufacturer.
 4. Compare duct traverse to accumulated air flow at diffusers. If the two do not reconcile, examine system for leaks and, report to contractor so that he can repair and repeat.

3.3 AIR HANDLING UNIT PERFORMANCE TESTING

- A. Recognizing that it will be unlikely that the performance testing will be done on a design day, cooling and heating coil performance shall be recorded as follows.
 1. With fan delivering design air flow, read and record entering and leaving drybulb and wetbulb temperatures.
 2. Through the contractor, request performance data from the equipment supplier based on the measured air flow and entering air temperatures. Submit this data with test data for review.

3.4 CONTROLS ADJUSTMENT

- A. Check the automatic temperature controls to ascertain that the specified sequence of operation is occurring. Record thermostat set point and room conditions in each space. This includes checking each terminal box to ensure that supply air goes to minimum position before heat comes on.
- B. Compare temperature of space (taken with test instrument) to temperature read by thermostat or temperature sensor. Tabulate results.
- C. In cooperation with the controls contractor, set adjustments of automatically operated dampers to operate as specified, indicated, and / or noted.
- D. Check all controls for proper calibrations, and list all controls requiring adjustment by control installers.

3.5 CONTRACTOR'S RESPONSIBILITIES

- A. Final testing and balancing of the HVAC systems shall be performed as specified in this section. It is the responsibility of the Contractor to be completely familiar with all the provisions and responsibilities of the Balancer, and to provide such certification, cooperation, and support required.
- B. The Contractor shall repair all deficiencies noted by the Balancer in a timely manner. The Balancer will notify the contractor in writing, on a daily basis, of any deficiencies discovered and Contractor will notify the Balancer immediately, in writing, upon completion of the repairs. The cost for extra re-testing by the Balancer due to unrepaired items that were certified as repaired will be the responsibility of the Contractor. The final testing and balancing report will contain no punch list items. All deficiencies will have been corrected prior to submission of the final report. Preliminary reports are not to be submitted to the Owner.
- C. The Contractor shall:

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1. Allow adequate time in the construction schedule to perform the Testing and Balancing work.
 2. Notify the Balancer upon commencement of work related to the HVAC system.
 3. Provide required shop drawings and equipment data.
 4. Provide test openings as required for testing and balancing HVAC systems.
 5. Provide updated job schedule and timely notice prior to scheduled events.
 6. Provide test openings and temporary end caps or otherwise seal off ends of ductwork to permit leakage testing prior to installation of diffusers, grilles, and similar devices.
 7. Make preliminary tests to establish adequacy, quality, safety, completed status, and satisfactory operation of HVAC systems and components. The systems shall be free of electrical grounds and short circuits.
 8. Perform duct leakage tests, in the presence of the Balancer, on all supply, return, outside air make-up, and exhaust air systems.
 9. Within the intent of the contract documents, provide, at the request of the Balancer, all equipment, material, supplies, workmen, and supervisions necessary to provide a satisfactory, operating system.
 10. During the test and balance period, operate all HVAC equipment as necessary to permit systems to be tested and balanced as fully operating, functional systems.
 11. Work harmoniously with the Balancer, providing all courtesies normally extended to professional consultants.
 12. Perform all work necessary to make ceiling plenums air-tight and functional.
 13. Remove and replace ceilings as necessary to permit test and balance operations.
 14. Remove and replace equipment, lights, or other items which obstruct testing and balancing operations. Where equipment, lights, or other items will interfere with future adjustments of the HVAC system, such equipment, lights, or other items shall be relocated by the Contractor, as directed by the Architect.
 15. Provide completed start-up forms on each piece of equipment.
 16. Replace belts and drives as required for proper balancing. Drives shall be adjusted and aligned by the Contractor to prevent abnormal belt wear and vibration.
 17. Adjust fan speed as required not to exceed RFLA of motor.
 18. Open all manually adjustable dampers and test dampers for smooth, vibration-free operation.
 19. Verify that all controls are installed and operating in accordance with the sequence of operation.
 20. Before requesting final testing and balancing, submit signed statement that HVAC systems are installed, adjusted, fully lubricated, operating satisfactorily, and are ready for use.
- D. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.
1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of

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design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.

2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.

3.6 TEST DATA SCHEDULES

- A. Submit typewritten schedules of test data readings.
- B. Schedules shall record the specified reading, the first reading taken and the final balanced reading for the following items.
- C. Where Commissioning Forms are provided, equipment data shall be recorded on these forms for comparison with submitted design data.
- D. Witness and record the testing of the ductwork for leakage to insure proper sealing. The Balancer shall randomly select sections of the completed duct system for testing. The sections selected shall not exceed more than 20% of the measured linear footage of supply, return, and exhaust or plenum duct length. All selected ductwork shall be leak tested in accordance with SMACNA. Maximum allowable leakage at any tested section shall not exceed 2% of the total air. If any of the selected duct sections exceed the specific leakage allowance, those sections shall be repaired by the Contractor and retested by the Balancer. If initial testing exceeds specification allowance, testing of all remaining duct ductwork shall be required at the Contractor's expense. All additional costs for duct leak repair and retesting shall be the responsibility of the Contractor.
- E. Advise Contractor in writing of all ductwork that shall be repaired to reduce air leakage. Retest to confirm minimum allowable leakage. The cost of retest of failed systems will be the responsibility of the Contractor.
- F. In the case of off season performance testing of air handling equipment and refrigeration equipment, include manufacturer's projected performance for comparison.
 1. Motors:
 - a. Designation.
 - b. Nameplate HP, voltage and full load amperes.
 - c. RPM.
 - d. Motor amperes and voltage under operating conditions.
 - e. For belt drive applications, motor amperes and voltage under no load condition.
 2. Fans:
 - a. Designation.
 - b. Nameplate data.
 - c. RPM.
 - d. Static pressure, inlet and discharge.
 - e. CFM from pitot tube traverse of discharge duct.
 - f. Final pitot tube traverse sheets showing all readings.
 3. Main and Sub-main Ducts:
 - a. Designation and location.

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- b. CFM from pitot tube traverse.
 - c. Final pitot tube traverse sheets showing all readings.
4. Air Outlets and Inlets:
- a. Room designation.
 - b. Type of outlet.
 - c. Design CFM.
 - d. Measured CFM.
 - e. Method of measurement.
 - f. All final measurement readings.
5. Direct Expansion Cooling Coil:
- a. Designation.
 - b. Nameplate data.
 - c. Entering air DB (F).
 - d. Entering air WB (F).
 - e. Leaving air DB (F).
 - f. Leaving air WB (F).
 - g. Evaporative pressure (PSIG).
 - h. Air flow (CFM).
 - i. Load calculation (tons).

3.7 OPERATING TESTS

- A. Operate systems to demonstrate that systems have been properly adjusted and balanced, and to demonstrate that the systems' performance conforms with the intent of the specifications and drawings.
- B. The balancing contractor shall make available to the Owner's operating personnel a Certified Test and Balance Engineer for a minimum of 8 hours, one working day, not necessarily consecutive, with all necessary equipment to demonstrate that all systems operate as intended and that the balancing reports are accurate.
- C. This demonstration will occur after the balancing contractor has submitted his reports to confirm that all systems or portions of the systems that coincide with the building's occupancy schedule, are adjusted and balanced.
- D. Conduct tests with natural building heating and/or cooling loads for a minimum 4 hours duration.

END OF SECTION 23 05 93

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SECTION 23 07 00
HVAC INSULATION

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 WORK INCLUDED

- A. Duct Systems Insulation.
- B. Piping Systems Insulation.
- C. Accessories.

1.3 QUALITY ASSURANCE

- A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.
- B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.
- C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

- A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.

1.5 GENERAL REQUIREMENTS

- A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.
- B. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

- A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.

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- B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.
- C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass Insulation:
 - 1. Owens-Corning Fiberglas
 - 2. Knauf Fiberglass
 - 3. CertainTeed
 - 4. Johns Manville
- B. Closed Cell Elastomeric Insulation:
 - 1. Armacell LLC
 - 2. Johns Manville
 - 3. K-Flex
- C. Jackets:
 - 1. Southern Asbestos Company
 - 2. John Mansville
 - 3. Owens-Corning Fiberglas
- D. Insulation Coatings, Mastics, Adhesives, and Sealants
 - 1. Foster
 - 2. Childers
 - 3. Pittsburgh Corning
 - 4. Armacell

2.2 DUCT INSULATION AND FIREPROOFING REQUIREMENTS

- A. Refer to the drawings for insulation requirements.

2.3 MATERIALS

- A. Duct Insulation:
 - 1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket (ASJ) vapor barrier, maximum vapor permeance of .02 perm/in and puncture resistance of 50 units, minimum density 3.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F mean temperature. Based on Knauf Insulation Board or approved substitution.
 - 2. Blanket Fiberglass: Flexible fibrous glass, flame retardant factory laminated foil-skrim-kraft (FSK) vapor barrier, 2" stapling flange, maximum vapor permeance of .02 perm/in., minimum density of 1.5 lb/cf, maximum conductivity per 1"

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thickness of .28 at 75°F mean temperature. Based on Knauf Duct Wrap or approved substitution.

B. Pipe Insulation (to 450F):

1. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC, AP Armaflex or Self-seal Armaflex 2000.

C. Insulation Accessories:

1. Aluminum Pipe Jacket and Fitting Covers: Jacket shall be 0.016" thick (26 gauge) embossed aluminum, sized to provide a 2" (min.) lap joint both longitudinally and circumferentially, with 3/4" min. wide x 0.015" min. (30 gauge) thick draw bands. Fitting covers shall be aluminum, 0.025" (22 gauge), min., thickness.

D. Accessories:

1. Aluminum Pipe Jacket and Fitting Covers: Jacket .016" thick (28 ga.) embossed aluminum sized to provide a minimum 2" lap joint both longitudinal and circumferentially, minimum 3/4 inch x .015 inch thick (30 ga) draw bands. Covers .024 inch thick.
2. PVC pipe jacket and fitting covers used with insulation for pipe, elbows, tees, couplings, 25/50 flame/smoke ratings, suitable for temperatures to 500°F.
3. Glass Cloth Pipe, Duct and Equipment Jacket: Glass lagging cloth, 8 oz/sy treated weight. Secure with elastomeric insulating adhesive on elastomeric insulation, for fiberglass insulation use Childers CP-50AMV1 or Foster 30-36 lagging adhesive.
4. Corner angles shall be minimum 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch heavy kraft paper.
5. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
6. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accordance with ASTM A 167 or Monel® coated.
7. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
8. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel approved substitution to WB Armaflex, Foster 30-64 elastomeric finish or approved substitution.
9. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
10. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Foster 85-75, Childers CP-82 or Armaflex 520 adhesive or approved substitution.
11. Vapor Barrier Coating: Air drying flexible water based coating used for applying a vapor barrier coating with reinforcing mesh at all below ambient piping/equipment insulated elbows, fittings, and valves. All vapor retarder film (ASJ) seams on below ambient piping/equipment shall also be vapor sealed with vapor barrier coating. Suitable for temperatures to -20F and 180°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08 as tested by ASTM E96, Procedure A at 45 mils dry. Childers CP-34 Vapor Retardant coating, Foster 30-65 Vapor Fas® Coating, Marathon Industries, Inc. 590 LO-PERM, Vimasco Corp. 749 Vapor-Blok, or approved substitution.

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12. Insulation Joint Sealant: Fire- and water-resistant, flexible, sealant. Used in all cellular glass joints on below ambient piping/equipment. Childers CP-76 Chil Byl, CP-70 Chil Joint, Foster 95-50 Flextra, Foster 30-45 Foamseal, Pittsburgh Corning 444 or approved substitution.
13. Acrylic Finish and Vapor Barrier Coatings:
 - a. Elastomeric Insulations: acrylic coating, air drying flexible water based finish used for finishing flexible elastomeric insulation. Suitable for coating temperatures to 200°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex, Foster 30-64 elastomeric finish or approved substitution.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install all insulation in strict accordance with the manufacturers written installation instructions.
- B. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.
- C. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.
- D. Insulation shall not be applied on any piping or duct system requiring testing until testing is completed and approved by Owner's Representative.
- E. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust or grease.
- F. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Owner's Representative shall be the final judge of acceptance of workmanship.
- G. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".
- H. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.
- I. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.
- J. Insulation shall be protected from moisture and weather during storage and installation.
- K. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any

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and/or all insulation until the Owner's Representative is satisfied that there is no longer any inferior insulation installed on this project.

- L. Insulation, fabric and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.
- M. The insulation subcontractor is responsible for proper material storage at the work site.
- N. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.
- O. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns and walls have been provided.
- P. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.
- Q. Where an insulated pipe or ductwork passes through a sleeve or opening in a non-rated partition, the full specified thickness of the insulation shall pass through the sleeve or opening. Where an insulated pipe or ductwork passes through a rated partition, the insulation shall be stopped at the partition. The void between the pipe and the sleeve shall be sealed with an approved fire-stopping material, and the insulation trimmed and sealed to the partition sufficient to cover the sleeve.
- R. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.
- S. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.
- T. The insulation subcontractor shall be responsible for his own safety program at the work site, and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.
- U. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

3.2 INSTALLATION

A. Duct Insulation:

1. General:

- a. Insulate or internally line all flexible duct connectors equal to or greater than adjacent insulation thickness.
- b. The tops of all diffusers shall be insulated same as connecting ductwork to prevent condensation.
- c. Duct insulation at fire dampers shall be extended over supporting angle iron and sealed to wall.

2. Rigid Fiberglass Insulation:

- a. Use boards in largest possible size to minimize seams. Do not use

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- "scraps".
- b. Shall be installed in all non-public exposed areas up to 10'-0" above finished floor.
 - c. Provide corner angles where insulation is subject to harm.
 - d. All fasteners shall be non-corroding.
 - e. The insulation shall be applied by use of cup head weld pins. Such fasteners shall be spaced in accordance with NCIA recommendations, where NCIA standards do not address exact dimensions, cup head weld pins shall be spaced on 12" centers. Pin caps shall be covered with a round vapor seal patch that matches the jacket on the ASJ board. On cold ducts, these shall be coated so as to not cause condensation.
 - f. Ducts having sharp bends shall have the insulation scored as required to conform to the curved surfaces to provide a neat and acceptable appearance when finished.
 - g. Insulation edges and joints shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh.
 - h. Generally, rigid fiberglass material will only be used in finished or exposed areas, and it is intended that the finish present a neat and uniform appearance as to color and workmanship.
 - i. In finished areas, molded glass fiber insulation shall be used to insulate round ducts where commercially available sizes can be used.
 - j. Fittings on round ducts in finished areas shall be covered with premolded fiberglass fitting insulators equal to Insul-Coustic where sizes are available. For sizes where premolded fittings are not available use miter-cut segments of molded pipe insulation, wired in place, with all joints sealed with adhesive and smoothed out with a coat of insulating cement.
 - k. On cold ducts, the fittings shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh. Hot ducts shall be finished in a similar manner, except the mastic need be of the weather barrier breather mastic type. Foster 46-50 Weatherite, Childers CP-10 Vi Cryl or Pittsburgh Corning 404.
3. Blanket Fiberglass Insulation:
- a. Insulation shall be tightly wrapped on the ductwork with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. Joints shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh. Additionally secure insulation to bottom of rectangular ducts over 24 inches wide with weld pins at no more than 18 inches on center.
 - b. Insulation shall be butted with facing overlapping all joints shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier coating.

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B. Pipe Insulation:

1. General:

- a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness.
- b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.
- c. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.
- d. Cover fittings, flanges, unions, valves, anchors, and accessories with premolded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Apply vapor barrier coating and reinforcing mesh in two coats to a minimum dry thickness of 32 mils on all below ambient piping. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of premolded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.
- e. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
- f. Seal all raw edges of insulation with vapor barrier coating or lagging adhesive.
- g. For piping supported by hangers outdoors, apply a rainshield to prevent water entry.

3. Closed Cell Elastomeric:

- a. All joints shall be sealed with adhesives.
- b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.
- c. Finish:
 - 1) Concealed Indoors: No additional finish.
 - 2) Exposed Indoors: Provide PVC jacket over all insulation.
 - 3) Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.
 - 4) Outdoors: Provide aluminum pipe jacket.

C. Weatherproof Duct Jacket:

1. Locate joints and seams to shed water.
2. All joints shall be sealed.
3. Securing shall be by non-corrosive wire banding. Maximum banding spacing 9" on center.
4. Finishing shall be with a minimum of 1/4" coat of insulating weatherproofing.

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5. Provide on all ducts exposed to the weather.

D. Aluminum Pipe Jacket:

1. Provide aluminum jacket over all exposed pipe insulation located outdoors.
2. Align all seams.
3. Securing shall be with 3/4" wide draw bands. Maximum band spacing 18" on center.
4. All openings and voids shall be sealed air and water tight with metal jacketing sealant Foster 95-44 Elastolar, Childers CP-76 Chil Byl or approved substitution.

E. PVC Jacket:

1. Provide PVC sheet jacket over all exposed, indoor piping or insulation.
2. Provide PVC pipe jacket over all exposed, indoor elastomeric pipe insulation.
3. Provide PVC fitting covers over all fittings fabricated from insulation sections or sheet material.
4. PVC pipe jacket shall be applied with special attention given to achieving positive seal at all longitudinal and circumferential joints using a welding solvent on the longitudinal joint as recommended by the manufacturer. Slip joints to have 4" minimum lap and no welding solvent.

F. Self Adhesive Indoor/Outdoor Jacket (Non Asphaltic):

1. Vapor barrier and waterproofing jacketing for installation over insulation located aboveground outdoors or indoors.
2. Specialized jacket with five layers of laminated aluminum and polyester film with low temperature, acrylic, pressure sensitive adhesive; outer aluminum surface coated with UV resistant coating for protection from environmental contaminants.
3. Permeance: 0.00 perm as tested by ASTM F 1249.
4. Flame Spread <25, Smoke Developed <50 tested by ASTM E-84. Aluminum finish. Embossed.
5. Foster Vapor Fas 62-05, Ideal Tape 777, Ventureclad 1577CW.

G. Flexible Acrylic Latex:

1. Apply two coats to glass cloth jacket, concealed closed cell elastomeric insulation.
2. Refer to Division 9 for color to be used. If no instructions are given, provide a white finish.

3.3 MISCELLANEOUS ITEMS

- A. General: Provide insulation of any portion of a system or piece of equipment not previously discussed where ambient operating conditions will allow condensation to occur or whose surface temperature exceeds 115°F. Insulation materials and method shall be as directed by the Designer.
- B. Final Inspection: At final inspection, the finished surfaces of all exposed insulation shall be clean and without stains or blemishes. Repair and clean the insulation surfaces and, if necessary, to obtain a new appearance, shall coat discolored surfaces with off-white latex water-base semi-gloss paint or lagging adhesive, without a change in the contract price.

END OF SECTION 23 07 00

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SECTION 23 09 00
BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 General

- A. All work of this Division shall be coordinated and provided by the single Building Automation System (BAS) Contractor.
- B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.
- C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.
- D. If the BAS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.
- E. Refer to attached requirements from the Orange County Information Systems and Services (ISS) division for all Orange County hardware, software, and network requirements.

1.2 BAS Description

- A. The Building Automation System (BAS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BAS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
- B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BAS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- C. The work of the single BAS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.
- D. The BAS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BAS.
- E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.
- F. Manage and coordinate the BAS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- G. The BAS as provided shall incorporate, at minimum, the following integrated features, functions and services:
 - 1. Operator information, alarm management and control functions.

2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BAS functions.
5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.

H. Acceptable Manufacturers (NO SUBSTITUTIONS)

1. Reliable Controls
2. Honeywell
3. Johnson Controls
4. Automated Logic Controls
5. The Trane Company

1.3 Quality Assurance

A. General

1. The Building Automation System Contractor shall be the primary manufacturer-owned branch office or primary installer of said manufacturer that is regularly engaged in the engineering, programming, installation and service of total integrated Building Automation Systems.
2. The BAS Contractor shall be a recognized national installer and service provider of BAS.
3. The BAS Contractor shall have a branch facility within a 3-hour response time of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
4. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BAS business for at least the last six (6) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The Building Automation System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Automation Systems, and shall be the manufacturer's latest standard of design at the time of bid.
6. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system both existing and new.
7. The Building Automation System contractor shall provide the Owner with 24 months of future software system upgrades as part of their package. The upgrade period shall begin once the final completion has been signed off by the engineer of record for each project.

B. Workplace Safety And Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BAS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.

3. The Contractor and its employees and subtrades shall comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BAS Project Management. The designated Project Manger shall be empowered to make technical, scheduling and related decisions on behalf of the BAS Contractor. At a minimum, the Project Manager shall:
 - a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
 - b. Manage the financial aspects of the BAS Contract.
 - c. Coordinate as necessary with other trades.
 - d. Be responsible for the work and actions of the BAS workforce on site.

1.4 Work By Others

- A. The demarcation of work and responsibilities between the BAS Contractor and other related trades shall be as outlined in the BAS RESPONSIBILITY MATRIX

BAS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	Low Volt. WIRING/TUBE	LINE POWER
BAS low voltage and communication wiring	BAS	BAS	BAS	N/A
BAS conduits and raceway	BAS	BAS	BAS	BAS
Automatic dampers	BAS	23	N/A	N/A
BAS Current Switches.	BAS	BAS	BAS	N/A
BAS Control Relays	BAS	BAS	BAS	N/A
All BAS Nodes, equipment, housings,	BAS	BAS	BAS	BAS

enclosures and panels.				
Smoke Detectors	26	26	26	26
Fire/Smoke Dampers	23	23	26	26
Fire Dampers	23	23	N/A	N/A
Fire Alarm shutdown relay interlock wiring	26	26	26	26
Fire Alarm smoke control relay interlock wiring	26	26	BAS	26
Fan Coil Unit controls	BAS	BAS	BAS	26
Unit Heater controls	BAS	BAS	BAS	26
Packaged RTU space mounted controls	23*	BAS	BAS	26
Packaged RTU factory-mounted controls	23*	23	BAS	26
Packaged RTU field-mounted controls	BAS	BAS	BAS	26
Starters, HOA switches	26	26	N/A	26
Control damper actuators	BAS	BAS	BAS	26

1.5 Submittals

A. Shop Drawings, Product Data, and Samples

1. The BAS contractor shall submit its qualifications to the Orange County's Representative after bidding has been completed but prior to the submittal of shop drawings. These qualifications shall be submitted within 15 days of contract award.
2. Once the BAS contractor receives approval from the Owner for their qualifications, the BAS contractor shall submit a list of all shop drawings with submittals dates within 45 days of contract award.
3. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
4. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BAS work.
5. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BAS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
6. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
7. The BAS Contractor shall correct any errors or omissions noted in the first review.
8. At a minimum, submit the following:
 - a. BAS network architecture diagrams including all nodes and interconnections.
 - b. Systems schematics, sequences and flow diagrams.
 - c. Points schedule for each point in the BAS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
 - d. Samples of Graphic Display screen types and associated menus.
 - e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
 - f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper

attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.

- ~~g.~~ Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
- ~~h.~~ Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
- i. Details of all BAS interfaces and connections to the work of other trades.
- j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 Record Documentation

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BAS provided:
 - a. Table of contents.
 - b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings on the latest version of AUTOCADD shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
 - c. Manufacturers product data sheets or catalog pages for all products including software.
 - d. System Operator's manuals.
 - e. Archive copy of all site-specific databases and sequences.
 - f. BAS network diagrams.
 - g. Interfaces to all third-party products and work by other trades.
2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 Warranty

A. Standard Material and Labor Warranty:

1. Provide a two-year labor and material warranty on the BAS.
2. If within twenty-four (24) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the cost of the BAS Contractor.
3. Maintain an adequate supply of materials within 50 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BAS Contractor's normal business hours.

2. PART 2 - PRODUCTS

2.1 Network Area Controllers (NAC)

- A. The Network Area Controller (NAC) shall provide a thin-client, Graphical User Interface (GUI) to the Building Automation System (BAS).
 - 1. Local Access. The NAC shall be installed upon the owner's Local Area Network (LAN) and shall support local operator access using standard web browsers including at a minimum Microsoft Internet Explorer 8.
 - 2. Remote Access. A high-speed connection from the NAC to the Wide Area Network (WAN) shall be provided and maintained by the owner to facilitate remote operator access to the BAS using the standard web browsers including at a minimum Microsoft Internet Explorer 8.
- B. The NAC(s) shall meet or exceed the requirements of a BACnet[®] Operator Workstation (B-OWS) and a BACnet[®] Building Controller (B-BC).
- C. The NAC(s) shall not require any hardware, software or firmware licensing agreements.
- D. The NAC(s) shall support the following hardware characteristics as a minimum:
 - 1. One (1) ISO-8802.3 Ethernet Port – 10/100 Mbps
 - 2. One EIA-232 Port – 115.2 Kbps maximum
 - 3. Two EIA-485 Ports – 76.8 Kbps maximum
 - 4. Local onboard and/or expandable hardware inputs/outputs (I/O)
 - a. Expandable to a minimum of 96 Inputs and 64 Outputs
 - 5. 8 MB operating RAM
 - 6. 1 MB non-volatile RAM
 - 7. 128 MB Flash EEPROM
- E. The NAC(s) shall support the following communication protocols at a minimum:
 - 1. ASHRAE 135-2008 BACnet[®]
 - a. Point-to-Point (PTP)
 - b. Master Slave/Token Passing (MS/TP)
 - c. Ethernet
 - d. BACnet[®] IP (B/IP)
 - 2. Modbus
 - a. RTU (master or slave)
 - b. TCP (master or slave)
 - 3. Simple Mail Transfer Protocol (SMTP)
 - 4. Simple Network Management Protocol (SNMP)

5. Hyper Text Transfer Protocol (HTTP)
 6. Short Message Service (SMS) – for GSM / GPRS modems
- F. The NAC database and all necessary Graphical User Interface (GUI) resources including animations are to be stored on the NAC. Web-enabled applications that require system graphics to be stored on the client machines will not be acceptable.
- G. The NAC shall support unlimited access by five (5) simultaneous clients
- H. Multiple NAC devices shall be capable of being installed on the same BACnet[®] internetwork without any separate server applications, separate network management or additional licensing.
1. Browser clients shall have the ability to access any NAC on the internetwork directly
- I. The NAC shall provide native BACnet[®] communications directly with all BACnet[®] devices on the BACnet[®] internetwork. Applications that require translation of data, gateways, or mapping of any kind shall not be acceptable.
1. The NAC shall provide BACnet[®] client and server functionality on all data links without any additional modules or licensing
- J. Real-time values displayed on the web browser shall update automatically without requiring a manual “refresh” of the web page.
- K. HTML programming shall not be required to create or display system graphics or data on a web page.
- L. A new point displayed on a B-OWS graphic screen shall appear automatically on the identical graphic screen served by the NAC with no further programming or file transfer required.
- M. The NAC shall be capable of automatically uploading any changes to existing GUI images or animations.
- N. The NAC shall support operator interface via the web browser the following at a minimum:
1. Password Protection
 - a. Multiple-level password access protection shall be provided.
 - b. Passwords may be exactly the same for all software applications provided to communicate with the internetwork including the web-based browser interface. Passwords and access credentials shall be able to be imported from the B-OWS to the NAC.
 - c. A minimum of three (3) levels of access shall be supported with a configurable matrix of operator actions allowed for each access level, broken down into at least 20 possible operator actions
 - d. A minimum of 128 passwords shall be supported at each NAC

- e. Operators will be able to perform only those commands available for their respective passwords.
- f. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving an NAC browser interface in an unsupervised logged-in state.
- g. The NAC shall be configurable to provide read-only access without requiring log-on
- h. Unencrypted passwords shall not be transmitted between the NAC and the client browser

2. Alarming and Event Notification

- a. NAC shall be capable of generating configurable automatic and dynamic alarm notification that is presented on-top of any current browsing screens in the form of a pop-up message
- b. NAC shall be capable of e-mail and telephonic test message notification of system alarms configurable to include notification class, recipient, inclusive and exclusive times and days as well as transition states (to alarm, to fault, return to normal). Systems that use e-mail and/or text message as the exclusive means of annunciating alarms are not acceptable.
- c. System shall provide log of notification messages.
- d. Alarm messages shall be in user-definable text and shall be entered either at the B-OWS terminal or via remote communication
- e. An alarm summary shall be available to show all alarms including but not limited to whether or not they have been acknowledged
- f. System shall provide ability to prioritize and differentiate communications for at least 255 different levels of alarms
- g. Alarm messages shall be fully customizable in size, content, behavior and sound.

3. Weekly, Annual and Special Event Exception Scheduling

- a. Provide ability to view and modify the schedule for the calendar week and up to 255 special events in a graphical format. Each calendar day and special event shall provide at least six time/value entries per day.
- b. Provide the ability for the operator to select scheduling for binary, analog, or multi-state object values.
- c. Provide the ability for the operator to designate days, date ranges, or repeating date patterns as exception schedules.
- d. Provide the capability for the operator to define special or holiday schedules and to link the BACnet schedule to a BACnet calendar, thereby over-riding weekly schedule programming on holidays defined in

the BACnet calendar.

- e. There shall be a provision with proper password access to manually override each schedule.
- f. Provide the capability to designate any exception schedule to be "Executed Once" then automatically cleared.
- g. Provide the ability to name each exception schedule with a user defined term to describe each special event.

4. Trend Log Graphing

- a. All data points (both hardware and software) system-wide shall be assignable to a historical trending program by gathering configurable historical samples of object data stored in the local controller (B-BC, B-AAC, B-ASC).
- b. All trend log information shall be displayable in text or graphic format. All information shall be able to be printed in black & white or color and exported directly to a Microsoft Excel Spreadsheet.

5. Runtime Log Information

- a. B-OWS Software shall be capable of displaying Runtime and On/Off Cycle data of all Binary data points (both hardware and software) system-wide. Runtime logs shall provide the following at a minimum:
 - 1) Total Accumulated Runtime
 - 2) Accumulated Starts Today
 - 3) Total Accumulated Starts
 - 4) Timestamp each Start/Stop and duration of each on/off cycle
 - 5) Monitor equipment status and generate maintenance messages based upon user designated run time

6. Ability to Manually Override any Database point

- a. All hardware and software points may be temporarily overridden for a user adjustable configured time period

7. Custom navigation file tree

8. Color Graphical User Interface (GUI)

- a. All color graphic displays shall be dynamic with current point data automatically updated from the BACnet internetwork to the browser without operator intervention. Manual operator intervention shall use the same methodology as on the B-OWS application.
- b. Depending upon configured access level; the operator shall be able to manually adjust digital, analog or calculated values in the system, adjust

values of control loops, override points or release points to automatic mode.

- O. The NAC shall provide the capability to create individual user (as determined by the log-on user identification) home pages. Provide the ability to limit a specific user to a defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
- P. The NAC shall include an Audit Trail feature that automatically records the time, date, and user, and action associated with all user changes made via Web Browser clients.
- Q. The NAC shall store complete help files describing system configuration, and use of the browser interface, the help files shall be served on-line as part of the browser interface.
 - 1. The web browser interface shall include tool tips to describe the functionality of the interface.

2.2 Advanced Applications Controllers (AAC)

A. General

- 1. Provide a micro-processor based, networkable, custom programmed, BACnet[®] Advanced Application Controller for each [heat pump, packaged rooftop unit, etc](#), wall-mounted where shown on floor-plans. Each AAC shall include an LCD user interface and all input/output points required to monitor and control each unit as a stand-alone system, according to the specified sequence of operation. In addition AAC's shall allow monitoring and remote control via a supervisory network (BACnet) with a WEB-Based Browser-accessible front end.
- 2. Provide a 5 year standard manufacturer's warranty for the AAC

B. Network Protocol and Operator Connections

- 1. The AAC's shall allow direct connection to a host network using BACnet[®] MS/TP (EIA-485) protocol. The network communication speed shall be operator selectable up to 76.8 kbps.
- 2. Each AAC shall be BTL tested, and listed to meet the B-AAC Standard Device Profile including BIBBs for this level of device. A Protocol Implementation Conformance statement for the AAC proposed shall be submitted along with shop drawings. Network points to be viewable on each AAC are listed in the sequence of operation, however provide a minimum of 32 Read/Write objects per AAC.
- 3. Each AAC shall include an externally mounted port allowing operators to connect a laptop computer directly to the AAC for network configuration, custom programming, and trouble-shooting.

C. Hardware Components

- 1. Provide the following hardware input points at minimum in each AAC:
 - a. Room temperature sensor, local or remote 10K thermistor with an accuracy of +/- 0.1 Deg C
 - b. User set-point adjustment control with programmable set-point limits

- c. On-board room humidity sensor, with replaceable CMOSense element, overall accuracy of +/- 1.8 % over 10 – 90 % range
 - d. On-board room passive infra-red occupancy sensor, with a maximum detection distance of 5m (16.4 ft), and 64 detection zones
 - e. In addition to the above, provide 4 user-definable universal inputs capable of accepting 0 -5 VDC, 4 – 20 mA, 10K thermistor, or dry contacts. Refer to the sequence of operation for specific input point requirements.
2. Provide hardware analog and digital output points as required by the sequence of operation, however include the following point types at minimum to allow for future expansion:
 - a. Six universal outputs, user-definable as analog or digital
 - b. Two additional digital output points
 - c. Digital output points shall be dry contacts capable of switching 0.5 Amps at 24 VAC.
 3. Provide a large LCD screen for display and adjustment of AAC points and mapped network points. Security codes MUST be provided to prevent unauthorized access from the local LCD screen. Minimum LCD size shall be 128 x 64 pixels. The screen shall be back-lit, however the light may be configured to shut off after a programmable inactive time.
 4. Provide push-buttons on the panel face to facilitate navigation, point adjustment, data entry, and switching of operational modes (password protected).
 5. AAC memory shall include a minimum 64 Kb RAM for logs and temporary data, and 512 kb flash EEPROM for non-volatile storage of firmware configuration and custom database. Provide a 24 hour clock and 365 day calendar on-board. Clock accuracy shall be +/- 1 second over 24 hours, and system time shall be retained during power outages exceeding 7 years.
 6. Provide a software configurable buzzer which shall be set-up to trigger on the occurrence of selected alarms, and shall be audible and acknowledgeable either to all users, or only to those users with sufficient password authority.
 7. AAC's shall be capable of monitoring and controlling at least 4 networked, remote temperature sensors, each with adjustable set-point and outputs for zone controls. These networked sensors shall not consume input/output points in the AAC.

D. Custom Configuration

1. Each AAC shall allow custom setup of the primary user interface screen; definition of all points to be monitored, controlled and displayed; alarms; schedules; trends; password access; and programmed sequence of operation as required to optimize the AAC for the specific requirements of this project, and also to allow future modification by the owner. AAC's using canned programs for pre-determined HVAC applications are not acceptable.
2. Each AAC shall allow the following custom set-up at minimum:
 - a. Primary User Interface screen set-up, including display of time, system mode, fan mode, primary temperature display, and display of up to 3 additional operator-defined AAC or network points.
 - b. ALL physical Inputs AND Outputs of the controller MUST be able to be overridden at the LCD screen for technician checkout of the system locally.

- c. Seven additional user defined point groups, each including up to six AAC or network points per group, to be displayed and adjusted by system users with sufficient password authority. Each group, and each individual point shall be defined to allow/disallow editing and manual override by users, and the password level required. Point definition shall also determine if units are to be displayed, and whether point names are displayed as text, or alternatively using an icon chosen from an on-board list of industry standard symbols.
- d. custom programs of 2000 bytes each, using a BASIC control language, with source code stored on board.
- e. The AAC may be defined with full access by all users without password protection, or with three levels of password protected access. Each level of access shall be enabled by entering a 4 digit password via the front panel keys. AAC's that require removal of the faceplate to unlock the keyboard are not acceptable.
- f. Alarm states shall be defined using AAC custom programming, with the definition including the password level required to acknowledge, reset, and clear alarms. When an AAC alarm condition exists, an alarm icon shall be displayed on all screens.
- g. 48 user-definable program-driven variables, with selectable ranges and standard or custom units.
- h. user-definable PID controls loops
- i. user-definable trend logs, each with 150 samples of 6 points each, and programmable sampling times
- j. 8 user-definable runtime logs to accumulate the run-times of selected digital points, and record the time and date of the last 100 changes of state
- k. 2 user-definable system groups, 50 points per group, allowing related points to be grouped together on one display for use in network graphics
- l. 1 user-definable weekly schedule, including 4 on/off pairs for each weekday, and two additional daily schedules triggered by the annual schedule or by custom programming
- m. Override of the unoccupied schedule for a programmed period of time shall be triggered via a front panel button
- n. 1 annual schedule, allowing pre-programming of holidays 365 days in advance

2.3 Input Devices

A. General Requirements

- 1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.
- 2. Outside Air Sensors
 - a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
 - b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
 - c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
- 3. Duct Mount Sensors
 - a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.

- b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
 - c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
 - 4. Averaging Sensors
 - a. For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
 - b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
 - c. Capillary supports at the sides of the duct shall be provided to support the sensing string.
 - 5. Acceptable Manufacturers: Setra or approved equal.
- B. Humidity Sensors
 - 1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
 - 2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
 - 3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
 - 4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealite fittings and stainless steel bushings.
 - 5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
 - 6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
 - 7. Acceptable Manufacturers: Veris Industries, and Mamac.
- C. Differential Pressure Transmitters
 - 1. General Air and Water Pressure Transmitter Requirements:
 - a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
 - c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
 - d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
 - 2. Building Differential Air Pressure Applications (-1" to +1" w.c.)
 - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.

- b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - ◇ -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
 - ◇ 4-20 mA output.
 - ◇ Maintain accuracy up to 20 to 1 ratio turndown.
 - ◇ Reference Accuracy: +0.2% of full span.
 - c. Acceptable Manufacturers: Setra or approved equal.
 - 3. Low Differential Air Pressure Applications (0" to 5" w.c.)
 - a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - ◇ (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges. (Select range appropriate for system application.)
 - ◇ 4-20 mA output.
 - ◇ Maintain accuracy up to 20 to 1 ratio turndown.
 - ◇ Reference Accuracy: +0.2% of full span.
 - c. Acceptable Manufacturers: Setra or approved equal.
 - 4. Medium Differential Air Pressure Applications (5" to 21" w.c.)
 - a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
 - ◇ Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
 - ◇ Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.
 - ◇ Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
 - c. Acceptable manufacturers: Setra or approved equal.
- D. Flow Monitoring
- 1. Air Flow Monitoring
 - a. Duct Air Flow Measuring Stations
 - ◇ Each device shall be designed and built to comply with, and provide results in accordance with, accepted practice as defined for system testing in the ASHRAE Handbook of fundamentals, as well as in the Industrial Ventilation Handbook.
 - ◇ Airflow measuring stations shall be fabricated of 14-gauge galvanized steel welded casing with 90 Deg. connecting flanges in configuration and size equal to that of the duct into which it is mounted. Each station shall be complete with an air directionalizer and parallel cell profile suppressor (3/4" maximum cell) across the entering air stream and mechanically fastened to the casing in such a way to withstand velocities up to 6000 feet

per minute. This air directionalizer and parallel cell honeycomb suppressor shall provide 98% free area, equalize the velocity profile, and eliminate turbulent and rotational flow from the air stream prior to the measuring point.

- ◇ The total pressure measurement side (high side) will be designed and spaced to the Industrial Ventilation Manual 16th Edition, Page 9-5. The self-averaging manifolding will be manufactured of brass and copper components.
- ◇ The static pressure sensing probes (low side) shall be bullet-nosed shaped, per detailed radius, as illustrated in Industrial Ventilation Manual 16th Edition, Page 9-5.
- ◇ The main take-off point from both the total pressure and the static pressure manifolds must be symmetrical.
- ◇ Total and static pressure manifolds shall terminate with external ports for connection to control tubing. An identification label shall be placed on each unit casing, listing model number, size, area, and specified airflow capacity.
- ◇ Installation Considerations

(i) The maximum allowable pressure loss through the Flow and Static Pressure elements shall not exceed .065" w.c. at 1000 feet per minute, or .23" w.c. at 2000 feet per minute. Each unit shall measure the airflow rate within an accuracy of plus 2% as determined by U.S. – GSA certification tests, and shall contain a minimum of one total pressure sensor per 36 square inches of unit measuring area.

(ii) The units shall have a self-generated sound rating of less than NC40, and the sound level within the duct shall not be amplified nor shall additional sound be generated.

(iii) Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.

(iv) Where control dampers are shown as part of the airflow measuring station, opposed blade precision controlled volume dampers integral to the station and complete with actuator, pilot positioner, and linkage shall be provided.

(v) Stations shall be installed in strict accordance with the manufacturer's published requirements, and in accordance with ASME Guidelines affecting non-standard approach conditions.

- ◇ Acceptable manufacturers: Air Monitor Corp., Tek-Air, Ebtron, and Dietrich Standard.

b. Static Pressure Traverse Probe

- ◇ Duct static traverse probes shall be provided where required to monitor duct static pressure. The probe shall contain multiple

static pressure sensors located along exterior surface of the cylindrical probe.

◇ Acceptable manufacturers: Cleveland Controls

c. Shielded Static Air Probe

◇ A shielded static pressure probe shall be provided at each end of the building. The probe shall have multiple sensing ports, an impulse suppression chamber, and airflow shielding. A suitable probe for indoor and outdoor locations shall be provided.

E. Power Monitoring Devices

1. Current Measurement (Amps)

a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.

b. Current Transformer – A split core current transformer shall be provided to monitor motor amps.

◇ Operating frequency – 50 - 400 Hz.

◇ Insulation – 0.6 Kv class 10Kv BIL.

◇ UL recognized.

◇ Five amp secondary.

◇ Select current ration as appropriate for application.

◇ Acceptable manufacturers: Veris Industries

c. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:

◇ 6X input over amp rating for AC inrushes of up to 120 amps.

◇ Manufactured to UL 1244.

◇ Accuracy: +.5%, Ripple +1%.

◇ Minimum load resistance 30kOhm.

◇ Input 0-20 Amps.

◇ Output 4-20 mA.

◇ Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).

◇ Acceptable manufacturers: Veris Industries or approved equal.

F. Status and Safety Switches

1. General Requirements

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BAS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

- c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
- d. Acceptable manufacturers: Veris Industries or approved equal.

3. Air Filter Status Switches

- a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
- b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
- c. Provide appropriate scale range and differential adjustment for intended service.
- d. Acceptable manufacturers: Cleveland Controls or approved equal.

4. Air Flow Switches

- a. Differential pressure flow switches shall be snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
- b. Acceptable manufacturers: Cleveland Controls or approved equal.

5. Air Pressure Safety Switches

- a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
- b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
- c. Acceptable manufacturers: Cleveland Controls or approved equal.

6. Low Temperature Limit Switches

- a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
- b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
- c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.

2.4 Output Devices

A. Actuators

1. General Requirements

- a. Damper and valve actuators shall be electronic as specified in the System Description section.

2. Electronic Damper Actuators

- a. Electronic damper actuators shall be direct shaft mount.
- b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise

specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.

- c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
- d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
- e. Acceptable manufacturers: Belimo or approved equal.

B. Control Dampers

- 1. The BAS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BAS Contractor or as specifically indicated on the Drawings.
- 2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
- 3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
- 4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
- 5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Ruskin CD50 and Vent Products 5650.
- 6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Ruskin CD36 and Vent Products 5800.
- 7. Multiple section dampers may be jack-shafted to allow mounting of direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

- 1. Control Pilot Relays

- a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 - b. Mounting Bases shall be snap-mount.
 - c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 - d. Contacts shall be rated for 10 amps at 120VAC.
 - e. Relays shall have an integral indicator light and check button.
 - f. Acceptable manufacturers: Lectro or approved equal.
2. Lighting Control Relays
- a. Lighting control relays shall be latching with integral status contacts.
 - b. Contacts shall be rated for 20 amps at 277 VAC.
 - c. The coil shall be a split low-voltage coil that moves the line voltage contact armature to the ON or OFF latched position.
 - d. Lighting control relays shall be controlled by:
 - ◇ Pulsed Tri-state Output – Preferred method.
 - ◇ Pulsed Paired Binary Outputs.
 - ◇ A Binary Input to the Facility Management System shall monitor integral status contacts on the lighting control relay. Relay status contacts shall be of the “dry-contact” type.
 - e. The relay shall be designed so that power outages do not result in a change-of-state, and so that multiple same state commands will simply maintain the commanded state. Example: Multiple OFF command pulses shall simply keep the contacts in the OFF position.

D. Electronic Signal Isolation Transducers

- 1. A signal isolation transducer shall be provided whenever an analog output signal from the BAS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
- 2. The signal isolation transducer shall provide ground plane isolation between systems.
- 3. Signals shall provide optical isolation between systems.
- 4. Acceptable manufacturers: Advanced Control Technologies or approved equal.

E. External Manual Override Stations

- 1. External manual override stations shall provide the following:
 - a. An integral HAND/OFF/AUTO switch shall override the controlled device pilot relay.
 - b. A status input to the Facility Management System shall indicate whenever the switch is not in the automatic position.
 - c. A Status LED shall illuminate whenever the output is ON.
 - d. An Override LED shall illuminate whenever the HOA switch is in either the HAND or OFF position.
 - e. Contacts shall be rated for a minimum of 1 amp at 24 VAC.

2.5 Miscellaneous Devices

A. Power Supplies

- 1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
- 2. Input: 120 VAC +10%, 60Hz.
- 3. Output: 24 VDC.

4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

3. PART 3 – EXECUTION

3.1 BAS Specific Requirements

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection. .

B. Custom Reports:

1. Provide custom reports as required for this project:

C. Actuation / Control Type

1. Primary Equipment
 - a. Controls shall be provided by equipment manufacturer as specified herein.
 - b. All damper and valve actuation shall be electric.
2. Air Handling Equipment
 - a. All air handlers shall be controlled with a HVAC-DDC Controller
 - b. All damper and valve actuation shall be electric.
3. Terminal Equipment:
 - a. Terminal Units (VAV, UV, etc.) shall have electric damper and valve actuation.
 - b. All Terminal Units shall be controlled with HVAC-DDC Controller)

3.2 Installation Practices

A. BAS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation System, as herein specified, shall be provided by the BAS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

4. Class 2 Wiring
 - a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
 - b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
 5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
 6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.
- B. BAS Line Voltage Power Source
1. 120-volt AC circuits used for the Building Automation System shall be taken from panel boards and circuit breakers provided by Division 16.
 2. Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.
 3. DDC terminal unit controllers may use AC power from motor power circuits.
- C. BAS Raceway
1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
 2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
 3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
 4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
- D. Penetrations
1. Provide fire stopping for all penetrations used by dedicated BAS conduits and raceways.
 2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
 3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
 4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
- E. BAS Identification Standards
1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

- F. BAS Panel Installation
 - 1. The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
 - 2. The BAS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.
- G. Input Devices
 - 1. All Input devices shall be installed per the manufacturer recommendation
 - 2. Locate components of the BAS in accessible local control panels wherever possible.
- H. HVAC Input Devices – General
 - 1. All Input devices shall be installed per the manufacturer recommendation
 - 2. Locate components of the BAS in accessible local control panels wherever possible.
 - 3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
 - 4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
 - 5. Outside Air Sensors
 - a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
 - b. Sensors shall be installed with a rain proof, perforated cover.
 - 6. Medium to High Differential Water Pressure Applications (Over 21" w.c.):
 - a. Air bleed units, bypass valves and compression fittings shall be provided.
 - 7. Building Differential Air Pressure Applications (-1" to +1" w.c.):
 - a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
 - b. The interior tip shall be inconspicuous and located as shown on the drawings.
 - 8. Air Flow Measuring Stations:
 - a. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.
 - b. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.
 - 9. Duct Temperature Sensors:
 - a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
 - b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
 - c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
 - d. The sensor shall be mounted to suitable supports using factory approved element holders.
 - 10. Space Sensors:

- a. Shall be mounted per ADA requirements.
 - b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
- 11. Low Temperature Limit Switches:
 - a. Install on the discharge side of the first water or steam coil in the air stream.
 - b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
 - c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
- 12. Air Differential Pressure Status Switches:
 - a. Install with static pressure tips, tubing, fittings, and air filter.
- I. HVAC Output Devices
 - 1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
 - 2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke.
 - 3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
 - 4. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Automation System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.3 Training

- A. The BAS contractor shall provide the following training services:
 - 1. A minimum of one and a half days (12 hours total) of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.
 - 2. Operational training of the BAS shall include at a minimum: changing set points, overrides, starting and stopping equipment, log in to field controllers when the server or PC is down. The BAS contractor shall be required to develop a training outline for this procedure. The training outline, including the lesson plans and course materials, shall be reviewed and approved by the engineer of record through the submittal process.

3.4 Sequence of Operations

- A. Refer to the drawings for the Sequence of Operations.

ATTACHMENT I
DMZ SECURITY STANDARD

- 1.0 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.
- 2.0 Scope - The scope of this document applies to all platforms located within the OCGBCC DMZ.
- 3.0 Policies
 - 3.1 Activity - 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).
 - 3.2 Web Servers - All internal ISS-ESU policies apply to the OCGBCC DMZ and are augmented by the DMZ Security Standard. The following differences are noted:
 - 3.2.1 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.
 - 3.2.2 All platforms within the OCGBCC DMZ shall be patched immediately upon the release and testing by the ISS-ESU.
 - 3.3 Administrative Rights - ISS-ESU shall be the only group with administrative rights to servers in the DMZ.
 - 3.4 Production Servers - The OCGBCC DMZ shall host production servers only.
 - 3.5 Remote Access - Remote Access to the OCGBCC DMZ shall be allowed only using Microsoft Terminal Services or Microsoft Remote Desktop protocols.
 - 3.6 Traffic
 - 3.6.1 Internet Activity - HTTP/HTTPS/FTP/SMTP/IMAPS are the only protocols allowed from the Internet into the DMZ.
 - 3.6.2 Internal Activity - 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 (88, 135, 137, 138, 139, 389, 445, 464, 530, 543, 544, 636, 749, 3389), LDAP, RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.
 - 3.6.3 Routing
 - 3.6.3.1 All approved access from the DMZ to the internal network shall be routed through a proxy server residing in the DMZ.
 - 3.6.3.2 The Enterprise DMZ proxy server shall only use firewall conduits to access approved resources within the OCGBCC network.
 - 3.7 Data
 - 3.7.1 Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.
 - 3.7.2 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.

- 3.7.3 The OCGBCC DMZ shall not have access to data containing bank information.
- 3.7.4 The OCGBCC DMZ shall not have access to social security information.
- 3.7.5 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.

4.0 Guidelines

- 4.1 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.
- 4.2 The DMZ should access data repositories in the internal OCGBCC network using SQL database calls.

5.0 Enforcement - Any server found within the OCGBCC DMZ that does not meet the above criteria shall be immediately 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.

6.0 Definitions

<u>Term</u>	<u>Definition</u>
Bank Information	Checking account numbers, credit card numbers, or any unique number from a bank institution.
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.
HTTPS	HyperText Transfer Protocol over Secure Socket Layer (SSL) – By convention, URLs that require an SSL connection start with https: instead of just http:.
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.
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.
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.
LDAP	Lightweight Directory Access Protocol – A set of protocols for accessing information directories.

- 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.
- SQL Structured query language – SQL is a standardized query language for requesting information from a database.
- DMZ Demilitarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.
- 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.

ATTACHMENT II ENCRYPTION AND CERTIFICATION AUTHORITIES

- 1.0 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).
- 2.0 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.
- 3.0 Policies
- 3.1 Activity
- 3.1.1 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).
- 3.1.2 The ISS-ESU shall approve the storage and transfer of any data containing personal information and/or residing in the DMZ.
- 3.2 Encryption Algorithms
- 3.2.1 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:
- Triple-DES (3DES)
 - Rijndael (AES)
 - RSA
 - Blowfish
 - Twofish
 - CAST
- 3.2.2 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 3.2.1.
- 3.3 Data Hashing - The following standard data hashing algorithms shall be used to hash data. The key length for the algorithms shall be no less than 128bits.
- MD5
 - SHA-1
 - SHA-2
- 3.4 SSL Certificates - Web Server, SSH, IMAPS, SMTPS SSL certificates should have key lengths of no less than 128bits.
- 3.5 Sensitive Data - 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.
- 3.6 DMZ

- 3.6.1 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).
- 3.6.2 Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.
- 3.6.3 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.

3.7 Data Backups

- 3.7.1 Any backup of OCGBCC should be encrypted. Sensitive data as listed in 3.5 of this document shall be backed up using encryption algorithm standards found in 3.2.

3.8 Laptops and Removal Devices

- 3.8.1 All laptop hard drives should be encrypted.
- 3.8.2 Any sensitive data (see section 3.5 of this document) stored on laptops and removable devices shall be encrypted.
- 3.8.3 All individuals who work with sensitive data (see section 3.5 of this document) shall have their laptop hard drives encrypted.

4.0 Guidelines

- 4.1 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.
- 4.2 SSL certificates issued to servers and applications used by internal OCGBCC resources should be issued by OCGBCC's Certification Authority.

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

6.0 Definitions

<u>Term</u>	<u>Definition</u>
Encryption	Transforming understandable data into a form that is incomprehensible and that looks like random noise.
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.
DMZ	De-Militarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.

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

ATTACHMENT III
ANTIVIRUS STANDARDS

1.0 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.

2.0 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.

3.0 Policy

3.1 Virus Software – Servers

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

3.2 Virus Software – Workstations

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

3.3 Virus Software – Exchange Servers

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

3.4 Virus Software – Internet Mail

All incoming and outgoing internet email shall be scanned by Trend Micro InterScan Messaging Security Suite before being delivered.

3.5 Virus scanning - Antivirus software shall be running at all times on the computers on which it is installed. Real-time scanning of incoming and outgoing files shall be enabled at all times. Antivirus scans of servers shall be executed on a weekly basis in accordance with the schedules set in Trend Micro Server Protect. Antivirus scans of workstations shall be executed on a weekly basis in accordance with the schedules set in Trend Micro OfficeScan.

4.0 Guidelines

- When employees receive unwanted and unsolicited emails, they should be deleted and should avoid replying to the sender. These messages should not be forwarded.
- 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.
- Employees should never download files from unknown or suspicious sources.

5.0 Enforcement - 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.

6.0 Definitions

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.

ATTACHMENT IV
WEB SECURITY STANDARD

- 1.0 Purpose - The purpose of this document is to establish requirements that will better manage and secure all web server platforms within the Orange County Government Board of County Commissioners (OCGBCC).
- 2.0 Scope - The scope of this document applies to all web server platforms located within the OCGBCC.
- 3.0 Policies
 - 3.1 Activity - 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).
 - 3.2 Hardware
 - 3.2.1 All hardware platforms operating as a web server shall abide by all standards, policies and guidelines of the OCGBCC Enterprise Systems unit.
 - 3.2.2 All hardware platforms operating as a web server shall reside on server hardware. Any exception shall require a documented wavier by the Information Systems and Services Enterprise Security unit (ISS-ESU).
 - 3.3 Software
 - 3.3.1 Web Server Platforms
 - 3.3.1.1 Microsoft - Microsoft's Internet Information Server (IIS) is the approved, supported web server platform for OCGBCC.
 - 3.3.1.2 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.
 - 3.3.1.3 Other - Other web server platforms may qualify for use, but shall require an evaluation, approval and a documented wavier by the ISS-ESU.
 - 3.3.2 Databases
 - 3.3.2.1 Location - A database server shall not reside on the same hardware platform as a web server.
 - 3.4 Security
 - 3.4.1 General - All web servers shall comply with all other documented ISS-ESU standards to include, but not limited to: virus, patch and account management.
 - 3.4.2 Account Management
 - 3.4.2.1 Local Account Access - Only accounts with local administrator privileges shall be allowed to log on locally to a web server.
 - 3.4.2.2 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.

3.4.2.3 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.

3.4.3 Permissions

3.4.3.1 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.

3.4.3.2 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.

3.4.3.3 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

3.4.4 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).

3.4.5 FTP - Web servers that also run an FTP server shall not map FTP directories to directories accessible via a web browser.

3.4.6 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).

3.4.7 Other

- Shares are not allowed on any directory accessible via web browser.
- Microsoft Windows web servers and any web application shall not be installed on the same drive as the host operating system.
- 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).

4.0 Guidelines - It is recommended that all web applications use the enterprise FTP and SMTP servers for all FTP/SMTP traffic.

5.0 Enforcement - 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.

6.0 Definitions

<u>Term</u>	<u>Definition</u>
FTP	File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring Web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.
WebDav	Web-based Distributed Authoring and Versioning – Extensions to HTTP that allows users to collaboratively edit and manage files on remote Web servers.
Front Page Extensions	A series of scripts that can be employed using Microsoft FrontPage, a visual HTML editor.
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.

ATTACHMENT V STANDARDS SUMMARY

The following is a summary of key points in the Orange County Government Board of County Commissioners (OCGBCC) 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 OCGBCC environment. Complete details about these standards can be found in the Orange County Government Standards and Guidelines packet.

WEB SERVERS

Web and Database Placement

A database server shall not reside on the same hardware platform as a 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.

DMZ

Web Server Platforms

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.

Services and Protocols

Traffic using the following protocols from the OCGBCC 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.

Encrypted Data

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.

Data Access

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.

ANTIVIRUS

Virus scanning

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

MICROSOFT SECURITY PATCHES

Patch Installation

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

ATTACHMENT VI
DESKTOP COMPUTING STANDARDS

AUTHORIZED PRODUCTS

1: HARDWARE

Dell Desktop minitower and small form factor (SFF) PC

- ◆ Dell GX960
 - ◆ Energy Smart system enabled
 - ◆ Intel Core 2 Duo processor or better
 - ◆ Minimum 2 Gb of Memory
 - ◆ Maximum 4 Gb Memory
 - ◆ USB Keyboard and Mouse
 - ◆ 160 GB SATA Hard drive
 - ◆ DVD+/- RW
 - ◆ 4 Year Basic Limited Warranty and 4 year Onsite Service
 - ◆ Intel vPro enabled

Dell Laptop

- ◆ Dell Latitude e6510
 - ◆ Intel Core 2 Duo processor or better
 - ◆ Minimum 2 Gb of Memory
 - ◆ Maximum 4 Gb of memory
 - ◆ CD-RW/DVD
 - ◆ 80 GB Hard Drive
 - ◆ 4 Year Limited Warranty and 4 year Onsite Service
 - ◆ Intel vPro enabled
- ◆ Dell Latitude e4300
 - ◆ Intel Centrino Core 2 Duo processor
 - ◆ Minimum 2 Gb memory
 - ◆ Maximum 4 Gb memory
 - ◆ CD-RW/DVD
 - ◆ 80 Gb Hard Drive
 - ◆ 4 Year Limited Warranty
 - ◆ Intel vPro enabled
 - *All PCs with 4yr limited warranty*
- ◆ PDAs- Blackberry Devices Only

2: OPERATING SYSTEMS and PROTOCOLS

Desktop/Laptop

- ◆ Microsoft Windows 7 Professional with IE 8 (for new PCs)
- ◆ Microsoft Windows XP Service Pack 3 (for existing PCs)
- ◆ Internet Explorer 8.0- *IE8 is current County Standard included with Windows 7. IE7 is available for backwards compatibility.*
- ◆ *Application software may specifically require a certain Internet Explorer version. Contact ISS for assistance as needed. ServiceCenter@ocfl.net*
- ◆ Microsoft Office 2003 or greater (Standard or Professional Suite)

Portable Devices

- ◆ Blackberry OS

Network Connectivity

- ◆ Cisco Wireless Access Points, Cisco 802.11 LAN Card
- ◆ TCP/IP

- ◆ Sprint Wireless AirCard

3: CLIENT DATABASES

Desktop/Workstations Only, Single User Only

- ◆ Microsoft Access (user databases not supported)
- ◆ Oracle Client
- ◆ SQL Server Client

4: PERIPHERALS and ACCESSORIES

- ◆ HP LaserJet series
 - ◆ Black and White LaserJet
 - ◆ P1606dn < 4 users
 - ◆ P3015dn (supports secure printing – PIN)
 - ◆ P4015dn 8+ users (supports secure printing – PIN)
 - ◆ Color LaserJet
 - ◆ CP2025dn
 - ◆ CP4525dn 7+ users (supports secure printing – PIN)
 - ◆ 5550dn 15+ users (supports secure printing – PIN)
- ◆ *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.*

UNSUPPORTED PRODUCTS

1: HARDWARE

- ◆ Pre-Pentium class desktop systems
- ◆ Non-Dell PCs
- ◆ Non-Blackberry Smartphones

2: OPERATING SYSTEMS AND PROTOCOLS

- ◆ Microsoft Windows 2000
- ◆ Microsoft Windows NT 4.0
- ◆ Microsoft Windows 3.x, Windows 95 and 98
- ◆ MAC OS

3: CLIENT DATABASES

- ◆ Dbase
- ◆ RBASE
- ◆ Paradox
- ◆ FOXPRO

4: DESKTOP APPLICATIONS

Desktop/Workstation

- ◆ MS Office platforms prior to Office 2000
- ◆ ProComm
- ◆ Microsoft Internet Explorer, 4.x, 5.x
- ◆ McAfee Viruscan **Trend Micro is OCGOV standard*
- ◆ WordPerfect
- ◆ Quattro
- ◆ Hotmetal
- ◆ Freelance
- ◆ Harvard Graphics
- ◆ Lotus Suite
- ◆ Netscape, Opera, Firefox Browsers
- ◆ Rumba

- ◆ LAN Workplace
- ◆ Exceed
- ◆ Visio 3.x and older
- ◆ SHL Vision & Vision Express, WIN9x/WINNT/UNIX
- ◆ McAfee Remote Desktop32
- ◆ Reflection version 9 or lower
- ◆ PC Anywhere

5: PERIPHERALS AND ACCESSORIES

- ◆ HP LaserJet Series 4 and older printers
- ◆ Inkjet printers

PROHIBITED PRODUCTS

1: HARDWARE

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

2: OPERATING SYSTEM AND PROTOCOLS

- ◆ Windows 9x
- ◆ Windows Vista
- ◆ 64 bit operating systems
- Network Protocols
- ◆ NETBUI
- ◆ AppleTalk
- ◆ Token Ring
- ◆ Any network (voice or data) software or service not operated, administered or expressly approved by Orange County ISS.
- ◆ Any internet access service not operated, administered or expressly approved by Orange County ISS.

3: APPLICATIONS

- ◆ Any Alpha/Beta Software not operated, administered or expressly approved by Orange County ISS
- ◆ Anti-virus products other than Trend Micro
- ◆ Personal firewall products
- ◆ Network scanning tools
- ◆ Remote access software other than ISS authorized VPN
- ◆ User installed screen savers
- ◆ Games
- ◆ 3rd Party Desktops
- ◆ Disk Compression
- ◆ Non-Static BITMAP Backgrounds or screen savers
- ◆ iTunes (or other content sharing applications)
- ◆ P2P software

4: PERIPHERALS AND ACCESSORIES

- ◆ Portable music devices
- ◆ Personal (non-County) mass storage devices (hard drives, thumb drives, etc)
- ◆ Webcams

END OF SECTION 23 09 00

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SECTION 23 09 93
SEQUENCE OF OPERATION

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 WORK INCLUDED

- A. Provide all labor, material, documentation and services required for the implementation of the Sequences of Operation detailed herein.

1.3 RELATED WORK

- A. Section 23 09 00 - Building Automation System (BAS).

1.4 APPLICABLE PROVISION

- A. Were modulation of a valve or damper is referred to then it shall mean the direct digital control of the valve or damper based on a control algorithm resident in the BAS software at the remote field panel. Unless noted otherwise the control algorithm shall be PID control. Optimum loop response shall be ensured by the use of a built in automatic loop tuner.
- B. An Operator having the required level of password access shall be able to modify the Operator changeable or definable parameter(s) on-line from an I/O device such that the monitoring and control functions of the BAS shall not be affected during the period of the change. The mechanism by which the change is made shall be simple and shall be adequately described in the Operator's manuals. Where setpoints for control parameters such as setpoint or changeover temperatures, humidities, or times are referred to in this Section they shall be Operator changeable on-line.
- C. Where the sequences refer to the start/stop of a system this shall be initiated either by an Operator manually entered command or automatically by a software routine such as "Optimum Stop/Start", "Power Demand Control", "Programmed Stop/Start", etc. or via an interlock in the sequences of operation to other equipment or event(s).
- D. When the motor controller is equipped with a HOA the motors shall only be controlled by the BAS when the HOA switch is in the auto position.
- E. Firestats, freezestats, smoke and fire detectors and interlocked dampers shall be wired to shutdown motors when the HOA switch is in both the hand and auto positions. It shall not be possible for the BAS to override these or any other safety devices or any fire alarm system control functions, except in the case of an engineered smoke control system in which case freeze protection safeties shall be overridden.
- F. Refer to the Point Definition Sheets and System Schematics, which form part of these Contract Documents, to facilitate the interpretation of the sequences of operation as defined herein.
- G. Provide additional I/O points, whether or not such points are indicated in the Point Definition Sheets, if they are required in order to attain the requirements of the Contract Documents.

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- H. Where fans and dampers are to be interlocked, provide hardwire interlocks between the motor terminal strip and damper such that the damper shall be driven open when the motor is required to start. Motor start-up shall not occur until the damper end switch indicates the damper is in the full open position.
- I. Where fans and dampers are hardwire interlocked, the interlocks shall apply in both the "hand" and "auto" positions of the HOA switch at the motor controller.
- J. Where there are fans not identified within the sequence of operation, point definition sheets or schematic drawings that provide supply and/or exhaust air that are not controlled via a thermostat, they shall be hardwire interlocked to the controlling device. The supply fans shall be hardwire interlocked with their associated exhaust fan (if applicable) to operate simultaneously. The dampers shall be hardwire interlocked with the fans via end switches such that the fans cannot operate when the damper is not fully open. The damper status shall not be monitored by the BAS. If the supply or exhaust fan serves a riser with multiple dampers, the end switches of the riser dampers shall be wired in parallel as a group then wired in series with the fan's associated damper end switch to prevent the fan from operating unless both the fan's damper is open and at least one of the riser dampers are open.
- K. The point list is provided for convenience and is not intended to be all-inclusive. All points required to provide the Sequence of Operation shall be included as if listed.
- L. All wiring required to provide the Sequence of Operation shall be included.

1.5 ABBREVIATIONS

AFD	Adjustable Frequency Drive
AUX	Starter Auxiliary Contact
AI	Analog Input
AO	Analog Output
CFM	Air Flow in CFM from Air Monitor
CSR	Current Sensing Relay
D	Damper Operation
DI	Digital Input
DO	Digital Output
DP	Differential Pressure
ES	End Switch
Fa	Failure Alarm
FR	Freezestat
FS	Flow Switch
H	Humidity Sensor
Ha	High Static Pressure Alarm
IAQ	Indoor Air Quality
IGV	Inlet Guide Vanes
La	Low Static Pressure Alarm
Ma	Maintenance Alarm
Pd	Discharge Static Pressure
Pdd	Downduct Static Pressure
Pds	Discharge Static Pressure Safety
Ps	Suction Static Pressure
Pss	Suction Static Pressure Safety
R	Relay
Sa	Safety Alarm/Shut-down
SD	Smoke Detector
DP	Static Pressure Sensor
SR	Damper Smoke Rated

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SS	Start-Stop
T	Temperature Sensor
Ta	Temperature Alarm
V	Valve Operator
VP	Virtual Point
X	Hardwired Item

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

- A. Refer to the drawings for the Sequence of Operations.

END OF SECTION 23 09 93

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SECTION 23 23 00
REFRIGERANT PIPING AND SPECIALTIES

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 WORK INCLUDED

- A. Refrigerant (RS/RL/RHG) Piping.
- B. Valves and Specialties

1.3 DEFINITIONS

- A. The pipe sizes given in this document shall be construed as nominal pipe sizes.

1.4 QUALITY ASSURANCE

- A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.
- B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:
 - 1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
 - 2. Refrigeration Piping and Heat Transfer Components - ASME/ANSI B31.5
 - 3. Safety Code for Refrigeration Systems – ASHRAE 15
 - 4. Refrigerant Containing Components and Accessories – UL 207
- C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
- D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.
 - 1. American National Standards Institute (ANSI) Standards
 - 2. American Petroleum Institute (API) Specification
 - 3. American Society of Mechanical Engineers (ASME) Publications
 - 4. American Society for Testing and Materials (ASTM) Publications
 - 5. American Welding Society (AWS) Publication
 - 6. American Water Works Association (AWWA) Standards

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8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Underwriters Laboratories (UL)

1.6 SUBMITTALS

- A. All submittals shall be made in accordance with Division 01 requirements.
- B. Materials List: Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.
- C. Refrigeration Piping Requirements: Submit a letter from the refrigeration equipment manufacturer stating that the refrigeration piping system, as shown on the contract documents, is acceptable for the equipment the manufacturer proposes to furnish, or submit drawings prepared by an authorized representative of the refrigeration equipment manufacturer.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Refrigerant (RS/RL/RHG) Piping.
System Design Pressure: 300 psig.
 1. Piping carrying Refrigerants shall be ACR copper.
 2. ACR Copper Refrigerant Piping:
 - a. Piping, 3" and smaller: Type ACR hard-drawn copper tubing, ASTM B88, ANSI H23.1.
 - b. Fittings, 3" and smaller, all types, wrought copper: ASTM B16.22, ANSI B16.22. All 90° elbows shall be the long radius type.
 - c. Brazing: Contractors Option:
 - (1) 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
 - (2) 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
 - (3) 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflo® 5 or equal
 - d. Unions used shall be specifically designed for refrigeration piping.

2.2 VALVES AND SPECIALTIES

- A. Solenoid Valves:
 1. Liquid line shut off.
 2. Normally closed.

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3. Manual lift stem.
 4. Pilot operated.
 5. Synthetic seat for permanent tight shut-off.
 6. 120 volt solenoid coil (interchangeable).
 7. Top grade brass, bronze and/or semi-steel body materials.
 8. Acceptable Manufacturers: Sporlan, Alco, Hubbell, Phillips, Henry.
- B. Filter Drier:
1. Replaceable core type.
 2. Heavy steel, cadmium plated with external coat of paint.
 3. All internal parts cadmium plated.
 4. Outlet seal gasket with spring to prevent bypassing.
 5. Copper fittings brazed to steel shell, suitable for soldering with Sil-Fos or Phos-Copper solder.
 6. Molded porous core elements.
 7. Tie rod assembly to permit external assembly with one piece insert.
 8. Bolt and nut attachment.
 9. Size for refrigerant capacity and tonnage at 2 psi pressure drop.
 10. Acceptable Manufacturers: Sporlan, Alco, Hubbell, Phillips, Henry.
- C. Moisture and Liquid Indicators:
1. Suitable for R-407c.
 2. Accurately calibrated to change color for indication of moisture.
 3. Large full view sight glass.
 4. Removable indicator element for sizes 1-3/8" and up. Remove before soldering.
 5. Full line size for liquid lines up to 2-1/8" O.D. 3/8" bypass indicator with preformed installation kit on larger sizes.
 6. Acceptable Manufacturers: Sporlan, Alco, Hubbell, Phillips, Henry.
- D. Sight Glasses:
1. Similar to Sporlan "See-all" moisture and liquid indicator with solder type connections.
 2. Install sight glass of the same size as the liquid line.
- E. Miscellaneous Valves and Accessories:
1. Drain valves for all pressure vessels.
 2. Dual pressure relief valves with manifold for all pressure vessels.
 3. Refrigerant service valves where indicated.
 4. Pressure - Temperature Test Ports and Test Kit:
 - a. Brass or stainless steel body with threaded cap and gasket.
 - b. Two self closing valves with intermediate pocket for added pressure protection.
 - c. Pressure temperature test kits consisting of 0- 150 psi pressure gauge with adapter, 25-125°F testing thermometer, 0-220°F testing thermometer, gauge adopted and protective carrying case (two required).
- F. Thermometers:
1. Red reading type, glass front, iron or phenol case, adjustable pattern, separable socket.

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2. Shall have 9 inch scale and 12 inch case.
 3. Operating range shall occur in middle half of total range
 4. Acceptable Manufacturers: Mueller, Taylor, Rochester.
- G. Gauges:
1. Liquid pressure gauges constructed with bronze tube, stainless steel movement, white dial, black micrometer, adjustable pointer, iron case with black flange iron or phenol screwed ring, bottom connection.
 2. Case diameter size shall be 4-1/2 inches minimum.
 3. Operating range shall occur in middle half of total gauge range.
 4. Provide needle valve for all gauges.
 5. Acceptable Manufacturers: Crosby-Ashton Type AAO, Ashcroft, Lonegran
- H. Refrigerant Charge: Complete operating charge of R-410A.
- I. High pressure receiver designed and constructed for 300 psi design working pressure with liquid seal float control, automatic liquid feed valve, drain and equalizer connections, liquid line filter-drier, moisture indicator, three service and bypass valves, charge valve and manual purge valve.
- J. Locking Refrigerant Caps: Precision machined from high grade brass surrounded by a protective aluminum shroud. Provide a 3 year warranty. Provide one multi key per project to maintenance personnel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
 2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
 3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
 4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
 5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
 6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
 7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter.

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- Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
 9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
 10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
 11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
 12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
 13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
 14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
 15. Avoid bushings. Reducing fittings shall be used wherever practical.
 16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
 17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
 18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
 19. Change in direction shall be made with fittings, except that bending of steel and

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copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.

20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Valve and Specialties Applications

1. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
2. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
3. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
4. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - a. Install valve so diaphragm case is warmer than bulb.
 - b. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line. Verify proper location for the bulb with the valve manufacturer
 - c. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
5. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety relief-valve discharge line to outside according to ASH RAE 15.
6. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube on each circuit.
7. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - a. Solenoid valves.
 - b. Thermostatic expansion valves.
 - c. Hot-gas bypass valves.
 - d. Compressor.
8. Install filter dryers in liquid line between compressor and thermostatic expansion valve on each circuit.
9. Install receivers sized to accommodate pump-down charge.
10. Install flexible connectors at compressors.
11. Locking Refrigerant Caps: Provide at all exterior refrigerant service access ports (Schrader valves).

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12. Install gauges with dial in vertical position. Locate between shut-off valve and equipment directly adjacent to equipment within normal visual range of operator standing on floor.
13. Provide gauges where shown on drawings, including the following locations:
 - a. Ice builders; leaving each builder on the pumped liquid return header.
 - b. Barrel chiller; entering and leaving the pumped liquid lines.
 - c. Compressor oil coolers; entering and leaving condenser water lines.
 - d. Evaporative condenser; entering and leaving refrigerant lines.
 - e. Refrigerant pumps; entering and leaving the pumped liquid lines.
14. Provide nickel plated brass escutcheons or floor plates, around pipes piercing floors and walls in finished spaces. Fit around insulation or around pipe if uninsulated. Secure to pipe with setscrew. Provide deep escutcheon where sleeve projects beyond finished surface

C. Refrigerant Systems Additional Requirements:

1. Installation shall be in accordance with ANSI B31.5 Refrigeration Piping, unless specified otherwise herein.
2. Brazing procedures and operators shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
3. Refrigerant pipeline accessories that may be damaged by heat shall be disassembled prior to joint brazing. Reassemble accessories after joint brazing operations are completed.
4. Joints shall be made with solder-type fittings. The outside surface of the tube where engaged in the fitting, and the inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before brazing. Self-cleaning compounds are not allowed. Care shall be taken to prevent annealing of tube and fittings when making connections. Brazed joints shall be made with flux and the previously specified silver-brazing alloy. The brazing alloy shall be applied and drawn through the full fitting length. Excess brazing alloy shall be wiped from the joint before the brazing alloy hardens. Joints shall be made with heat applied uniformly around the entire circumference of the tube and fittings. Remove all excess flux for a clear visual inspection of all brazed connections.
5. Refrigerant piping installed below concrete slab- on-grade shall be installed in continuous runs without joints, and shall be encased in PVC plastic conduit. Ends of conduit shall be sealed watertight.

3.2 BRAZING AND SOLDERING

- A. Operator and Procedure Qualifications: All brazing operators and all brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
- B. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".
- C. Soldering:
 1. Joints in copper tubing shall be made with solder- type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made

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with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

- A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
 - 1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
 - 2. Refrigerant Piping Systems shall be tested with dry carbon dioxide, or nitrogen, at 315 psig for the high side, and at 245 psig for the low side. If leaks are to be detected by use of an electronic halogen detector, or a halide torch, the system shall be pressurized with refrigerant gas prior to introduction of dry carbon dioxide or nitrogen into the system. Pre-charging of system with refrigerant gas is not necessary for soap bubble leak detection method.
 - 3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
- B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
- C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.
- D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
- E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.
- F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
- G. During tests, isolate system components that have test pressures less than pressures specified for system tests.
- H. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION 23 23 00

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

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 WORK INCLUDED

- A. Single Wall Round or Flat Oval Galvanized Steel Ductwork and Fittings.
- B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings.
- C. Insulated Round Flexible Ductwork.

1.3 QUALITY ASSURANCE

- A. All ductwork shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.
- B. All ductwork shall be fabricated to withstand the pressure and velocity required on this project.
- C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.
- D. All ductwork shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.
- E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

1.4 SUBMITTALS

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

1.5 SHOP DRAWINGS

- A. Shop Drawings: Provide shop drawings of ductwork as follows:
 - 1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.

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2. Show duct sizes.
 3. Show fitting details.
 4. Show lighting and ceiling diffusers.
- B. Coordinated Shop Drawings: Provide coordinated shop drawings for sheet metal work in mechanical equipment rooms and other congested areas listed.
1. Draw to a scale of 1/4 inch to 1 foot on the same size sheets as the contract drawings.
 2. Show duct sizes.
 3. Show bottom duct elevations from finished floor.
 4. Show lighting, equipment, piping, columns and beams, with mounting heights.
 5. Show construction details of all fittings.
 6. Show construction details of plenums and casings.
- C. Floor Plans: Provide sheet metal floor plans drawn to the same scale as the contract drawings.
1. Use contract drawing sheet size.
 2. Show on each floor plan the floor penetrations, fire dampers and access doors, ducts with sizes and bottom elevations, terminal types and air quantities.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Single Wall Round or Flat Oval Galvanized Steel Ductwork and Fittings:
1. Autoduct, Inc.
 2. Hamlin Sheetmetal, Inc.
 3. Impulse Air.
 4. Lindab
 5. Semco Manufacturing, Inc.
 6. United McGill
 7. Eastern Sheet Metal
- B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:
1. Alco Manufacturing Company.
 2. Crown Products Company.
 3. Hughes.
- C. Insulated Round Flexible Ductwork:
1. ATCO Rubber Products, Inc.
 2. Flexmaster USA, Inc.
 3. Flexible Technologies - Thermaflex®

2.2 FABRICATION

- A. Single Wall Round or Flat Oval Ductwork and Fittings:
1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.
 2. Metal Gauges: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal

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and Flexible, latest edition. The following table shall establish a minimum guideline unless the manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

Pipe Diameter	Positive Internal Static Pressure in W.G.					
	0" - 2.0"		2.1" - 4.0"		4.1" - 10.0"	
	Spiral		Spiral		Spiral	
	Pipe	Fittings	Pipe	Fittings	Pipe	Fittings
6" - 10"	28	26	28	24	28	24
12"	28	26	28	24	26	24
14"	28	26	26	24	26	24
16"	26	24	26	22	24	22
18" - 26"	26	24	24	22	24	22
27" - 36"	24	22	22	20	22	20
37" - 50"	22	20	20	20	20	20
51" - 60"	20	18	18	18	18	18
61" - 84"	18	16	18	16	18	16

Major Axis Dimension	Positive Internal Static Pressure in W.G.					
	0" - 2.0"		2.1" - 4.0"		4.1" - 10.0"	
	Flat Oval		Flat Oval		Flat Oval	
	Pipe	Fittings	Pipe	Fittings	Pipe	Fittings
6" - 24"	24	20	24	20	24	20
25" - 36"	22	20	22	20	22	20
37" - 48"	22	18	22	18	22	18
49" - 60"	20	18	20	18	20	18
61" - 70"	20	16	20	16	20	16
71" - Up	18	16	18	16	18	16

3. Duct Construction: Spiral wound, lockseam construction, slip joint or flanged connections as noted below under couplings.

4. Fitting Construction:

- a. 90 Deg. and 45 Deg. Ells: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Radiused ells to be full radiused unless otherwise noted, mitered ells to have single thickness, turning vanes, slip joint or flanged connections.
- b. Tees or Crosses: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Tangential, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180 Deg. or 45 Deg. as indicated.
- c. Bellmouth: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Spun metal, smooth converging bellmouth, round, gauge equal or greater than connecting duct.
- d. Access Section:
 - 1) 7" Diameter and Less: Minimum 12" long flanged section, minimum four bolts per flange.
 - 2) 8" Diameter and Larger: Round or rectangular access cover, on

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welded raised section, pressure sensitive release suitable for manual release or emergency vacuum release, chain retainer, (see Para. 3.5: Schedules for Sizes).

e. Couplings:

- 1) Joints 36" or less shall have 2" slip coupling.
- 2) 38" or over shall be spiral mate or oval mate.

B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:

1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.
2. Metal Gauges: Minimum of 26 gauge, with remaining sizes conforming to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards Metal and Flexible, latest edition. The following table shall establish a minimum guideline:

Round Ducts:

Duct Diameter	Spiral Pipe	Fittings and Longitudinal Seam Pipe
3" thru 14"	26	24
15" thru 26"	24	22
27" thru 30"	22	20

3. Duct Construction: Snaplock seam construction, slip joint or flanged connections.
4. Fitting Construction:
 - a. 90 Deg. and 45 Deg. Ells: Adjustable ells to be full radiused unless otherwise noted, slip joint or flanged connections.
 - b. Tees or Crosses: Adjustable, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180 Deg. or 45 Deg. as indicated.

C. Insulated Round Flexible Ductwork:

1. Low Pressure Application:
 - a. Factory fabricated assembly of a trilaminate of aluminum foil, fiberglass and polyester with a perm rating of .02, high tear strength and properties to resist temperature change, mildew and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface. It shall be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating not less than 6" w.g. positive pressure and -3" w.g. negative pressure through a temperature range of -20°F to +250°F.
 - b. The duct material shall be factory wrapped in a blanket of fiberglass insulation with a C factor of .23 or less. The insulation shall be encased in a fire retardant reinforced aluminum material vapor barrier with a perm rating of not over .05 grains per square ft. per hour per inch of mercury.
 - c. Based on Type 5M as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #036, Omni Air 1200, or Flexible Technologies – Thermaflex M-KF or approved substitution.

D. Ductwork, General: Each duct section shall have both ends covered with polyethylene or

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other suitable material to protect against the entrance of dirt, debris or water during shipment and storage prior to installation.

- E. DUCT SEALANT: Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, used indoors or outdoors. Foster 32-19 Duct Fas, Childers CP-146 Chil Flex or Duro Dyne SAS.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

- A. Install in strict accordance with the manufacturer's written installation instructions.
- B. The drawings, due to their small scale, are diagrammatic in nature and are not necessarily complete in all details. For this reason not all necessary offsets, rises or falls are shown. Coordinate the installation of the ductwork with all other trades and to provide all necessary offsets, etc. as required for completion of this project without any additional cost to the Owner, Architect or Engineer.
- C. All ductwork shall be run parallel or perpendicular to building structure and seams or spirals shall be aligned whenever possible.
- D. All sizes indicated on the drawings are inside clear dimensions.
- E. All ductwork shall be properly sealed in a neat clean manner with all excess sealer wiped clean.
- F. Coordinate the location of, provide the necessary access and install all devices provided in other specification sections within Division 23, including but not limited to fire, smoke and/or balancing dampers, access and mounting for control devices, air flow measuring stations, etc., as apply to this project.
- G. All ducts passing through partitions or walls shall be properly and neatly sealed. If partition or wall carries a fire rating (fire damper indicated or if architectural plans indicate a rated wall) the duct shall be sleeved with the space between the sleeve and duct properly sealed with firestopping material under Division 07 Firestopping. The sleeve shall be permanently affixed to the wall (Refer to Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment).
- H. Coordinate the proper duct pressure classification with the system served and to provide the proper ductwork to withstand these pressures. (See Para. 3.5 Schedules: System Pressure Classification and Duct Material Schedule.)

3.2 CLEANING AND PROTECTION

- A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of dust, debris or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork system the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.
- B. During field investigations, if the Owner or Engineer inspect ductwork and find dust,

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debris, water or any other contaminant the contractor will be responsible for cleaning or replacing, at the discretion of the Owner and Engineer, the ductwork section at the contractor's expense.

3.3 LEAK TESTING

- A. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.
1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
 2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
 3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.
 4. Refer to specification section 23 05 93 for more information.

3.4 INSTALLATION

- A. General:
1. Install generally as indicated.
 2. Conceal ductwork in finished spaces unless indicated otherwise.
 3. Do not install ductwork in or allow to enter or pass through electrical rooms, elevator machine room, or spaces housing switchboards, panelboards or distribution boards, except ductwork that serves electrical rooms, elevator machine rooms or spaces.
 4. Exercise special care to provide tight fitting well fabricated, well braced ductwork systems.
 5. Field assemble rectangular, round or flat oval ductwork as follows:
 - a. Use slip joints, couplings, etc. sealed with adhesive pre-applied to couplings or duct mate spiralmate or oval mate on duct sizes 1" and larger.
 - b. Isolate dissimilar metals with elastomeric sealant tape or fiber gaskets and gaskets and washers for bolts.
 6. In high pressure ductwork (above 2" w.g.), do not use 2 piece mitered 90 degree elbows with or without vanes unless approved by engineer.
 7. Make duct connections from hoods, openings, fans and other devices.
- B. Insulated Round Flexible Ductwork:
1. Provide where indicated or required on supply air ducts.

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2. Coordinate the insulation requirements as to assure a continuous and consistent thermal resistance and vapor barrier.
3. Maximum length shall be 5'-0".
4. Maximum turn or bend shall be no more than 90 Deg. Provide rigid elbows where 90 Deg. turns are indicated on the drawings or more than one 90 Deg. turn is required.
5. Flexible ductwork shall be cut to the proper length. Coiling or unnecessary offsets will not be permitted.
6. Provide Stainless steel draw band to seal inner liner tight to connecting duct. Pull insulation over inner liner and fold vapor barrier over end of insulation. Secure with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth.
7. High pressure flexible duct to be provided upstream of all terminal boxes. Low pressure flexible duct may be used downstream of terminal box.
8. Rigid round ductwork may be substituted in lieu of flex unless the flex duct is used for vibration isolation or otherwise detailed. If omitted, external insulation must be provided. (Refer to Section 23 07 00 for HVAC Insulation)

3.5 SCHEDULES

A. System Pressure Classification and Duct Material Schedule:

<u>System I.D. No.</u>	<u>System</u>	<u>Section</u>	<u>Maximum Pressure</u>	<u>Duct Material</u>
1.	Supply	AHU to Terminal	3" pos.	A
2.	Supply	Terminal to Diffuser	1" pos.	A
3.	Return	Terminal to AHU	2" neg.	A

Schedule Legend:

Duct Material

A Galvanized Steel

B. Access Door Schedule:

1. Round Duct:

	<u>Duct Size</u>	<u>Access Door Size</u>
a.	up to 7" dia.	12" long removable section
b.	8" to 12" dia.	8" x 12"
c.	13" to 18" dia.	12" x 12"
d.	19" dia. and up	14" x 20"

END OF SECTION 23 31 00

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SECTION 23 31 01
SHOP FABRICATED DUCTWORK

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 WORK INCLUDED

- A. Galvanized Steel Rectangular Ductwork.

1.3 QUALITY ASSURANCE

- A. All ductwork shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.
- B. All ductwork shall be fabricated to withstand the pressure and velocity required on this project.
- C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.
- D. All ductwork shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.
- E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

1.4 SUBMITTALS

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

1.5 SHOP DRAWINGS

- A. Shop Drawings: Provide shop drawings of sheet metal ductwork as follows:
 - 1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.
 - 2. Show duct sizes.
 - 3. Show fitting details.
 - 4. Show lighting and ceiling diffusers.

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- B. Shop Drawings for Field Erected Casings: Submit shop drawings for air handling unit casings, field erected casings and plenums.
 - 1. Draw to scale of 1/2 inch to 1 foot on the same size sheets as the contract drawings.
 - 2. Show plan, sections, elevations and details of all joints and casings.
 - 3. Detail access doors and hardware.
 - 4. Detail coil, damper, humidifier, filter and fan installations. Provide access doors.
- C. Floor Plans: Provide sheet metal floor plans drawn to the same scale as the contract drawings.
 - 1. Use contract drawing sheet size.
 - 2. Show on each floor plan the floor penetrations, fire dampers and access doors, ducts with sized and bottom elevations, terminal types and air quantities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Ductwork:
 - 1. Interior, exposed or concealed: Hot rolled steel continuously annealed and hot dipped galvanized sheet or coil, minimum G-90, 0.90 oz/sf coating suitable for forming without flaking or peeling, suitable for welding or soldering. Zinc coating shall not be impaired from double seaming, breaking or roll forming. 14 ga. and lighter conforming to ASTM A653. 13 ga and heavier conforming to ASTM A653.
 - 2. Exterior or Areas Requiring Painting: Hot rolled steel continuously annealed and hot dipped galvanized sheet or coil, minimum G-90, 0.90 oz/sf (.001 inch thick/side) coating with a mill applied phosphate film suitable for insulating the paint from the drying action of the zinc, capable of forming without flaking or peeling, suitable for welding or soldering. Zinc coating shall not be impaired from double seaming, breaking or roll forming. 14 ga. and lighter conforming to ASTM A653. 13 ga. and heavier conforming to ASTM A653.
- B. Duct Sealants: Provide sealants with a maximum 25 flame spread, and maximum 50 smoke in the dry state, conforming to ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials", and fire resistive and non-flammable in accordance with ASTM D 93, "Standard Test Methods for Flash Point" by "Pensky-Martens Closed Tester", when wet.

2.2 FABRICATION

- A. Galvanized Steel Ductwork:
 - 1. Fabricate ductwork as indicated on the drawings. Sizes given are inside clear dimensions. Allowances must be made for duct liner if indicated. Unless otherwise indicated on the drawings, the metal gauge shall be in accordance with SMACNA-HVAC Duct Construction Standards - Metal and Flexible, Latest Edition.
 - 2. Elbow Fabrication:
 - a. 90 deg. elbows 12" or less in width shall be radiused whenever possible.
 - b. All radiused elbows shall be full radiused (R=1.5).
 - c. All mitered 90 deg. elbows shall have turning vanes. Ducts with a

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width/depth ratio of 1 or more shall have double thickness turning vanes; single thickness is permissible for less than 1.

3. Tee or Take-off Fabrication:
 - a. Take-off to round run-outs shall be conical or bell mouth. Where conical or bellmouth fittings can not be used due to take-off size to main, provide factory fabricated side takeoff fitting equal to Flexmaster U.S.A., Inc. Type "STO". Provide with handle extension for insulated ducts to clear the insulation thickness specified.
 - b. Take-off to square or rectangular shall be 45 deg. clinch collar or proportional divisions.
 - c. A volume damper shall be located downstream of each take off on square and rectangular take-offs, and integral to round run-outs.
 4. Transitions:
 - a. Concentric Transition: Maximum angle 45 deg. diverging, 60 deg. converging (SMACNA Fig. 2-7).
 - b. Eccentric Transition: Maximum angle 30 deg. diverging or converging (SMACNA Fig. 2-7).
 5. At the Contractor's option, ductwork may be joined at the transverse joints with prefabricated galvanized Ductmate Industries, Inc. ("25" or "35") or Ward Industries, Inc. sections, or with fabricated TDF or TDC T-24 type flanged transverse joints with bolted corners, gaskets, and sealants, constructed in accordance with the SMACNA HVAC Duct Construction Standards - Metal and Flexible, latest edition, Table 1-12. Ductmate "25" may be used only on ductwork with a pressure classification of 2" w.g. or less on the discharge side of air handling units or fan power terminal units. Plastic joint clips are not acceptable. Flanged and prefabricated joints by different manufacturers shall not be jointed. Formed on flanges shall not be used.
- B. Ductwork, General: Each duct section shall have both ends covered with polyethylene or other suitable material to protect against the entrance of dirt, debris or water during shipment and storage prior to installation.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install in strict accordance with the Sheet Metal and Air Conditioning Contractor's National Association, Inc.'s (SMACNA) recommendations.
- B. The drawings, due to their small scale, are diagrammatic in nature and are not necessarily complete in all details. For this reason not all necessary offsets, risers or falls are shown. Coordinate the installation of the ductwork with all other trades and to provide all necessary offsets, etc. as required for completion of this project without any additional cost to the Owner, Architect and/or Engineer.
- C. All ductwork shall be run parallel or perpendicular to building structure whenever possible.
- D. All ductwork shall be properly sealed.
- E. Coordinate the location, provide the necessary access and install all devices provided in

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other specification sections within Division 23. Including but not limited to fire, smoke and/or balancing dampers, access and mounting for control devices, air flow measuring stations, etc. as apply to this project.

- F. All ducts passing through partitions or walls shall pass through at a 90 degree angle. The duct shall be sleeved with the space between the sleeve and duct properly sealed with firestopping material under Division 7 Firestopping. The sleeve shall be permanently affixed to the wall (see Section 23 05 29 - Hangers and Supports for HVAC Systems for sleeve specifications).
- G. Coordinate the proper duct pressure classification with the systems served and to construct the ductwork to withstand these pressures. (See 3.6 Schedules; System Pressure Classification and Duct Material Schedules.)
- H. All ducts located outdoors and not of welded construction shall have seams and transverse joints sealed water tight with duct sealer, arranged to shed water and finished with insulating duct coating as specified in Section 23 33 00 - Air Duct Accessories.

3.2 CLEANING AND PROTECTION

- A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of duct, debris or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork system, the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.

3.3 DUCT SEALING REQUIREMENTS

- A. All ducts shall have SMACNA Seal Class A (all transverse joints, longitudinal seams and duct wall penetrations).

3.4 LEAK TESTING

- A. Ductwork rated at over 3" positive pressure shall be leak tested using a test rig as described in the SMACNA Balancing Manual.
- B. Test ductwork that is rated over 3" positive pressure at 25% above specified operating pressure. Ductwork to be tested in segments and CFM leakage shall be limited to 5% of the system airflow for that section.
- C. Leaks must be located and sealed. All audible leaks, regardless of size, must be sealed.
- D. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.

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1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
1. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.
2. Refer to specification section 23 05 93 for more information.

3.5 INSTALLATION

A. Galvanized Steel Ductwork:

1. Install ductwork as indicated on the drawings. If any conflict occurs notify the Owner's Representative prior to any extensive rerouting.
2. Install ductwork to allow clearance for the installation of duct insulation.
3. Provide duct liner as specified and/or detailed. (See 3.6 Schedule for liner requirements.)

3.6 SCHEDULES

A. Ductwork shown to be round or oval is to be provided under Section 23 31 00 – HVAC Ducts and Casings.

B. System Pressure Classification and Duct Material Schedule for Shop Fabricated Ductwork:

	<u>System</u>	<u>Section</u>	<u>Maximum Pressure</u>	<u>Duct Material</u>
1.	Outside Air Duct		2" neg.	A
2.	Supply To Terminal	A.C Unit	3" pos.	A
3.	Supply	Terminal to Diffuser	1" pos.	A
4.	Supply	AHU to grille	3 pos.	A
5.	Return	Inlet Grille to Terminal	2" neg.	A
6.	Return	All AHU Return	1" neg.	A
7.	Gen. Exh.	Inlet to Unit	1" neg.	A

Schedule Legend:

Duct Material

A Galvanized Steel

END OF SECTION 23 31 01

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SECTION 23 33 00
AIR DUCT ACCESSORIES

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 WORK INCLUDED

- A. Duct access doors.
- B. Fire dampers.
- C. Smoke dampers.
- D. Smoke/Fire dampers.
- E. Backdraft dampers.
- F. Volume dampers.
- G. Flexible duct connectors.
- H. Hardware cloth.
- I. Install miscellaneous control devices.

1.3 QUALITY ASSURANCE

- A. All products provided for enhancement of Life Safety shall be UL listed and bear the appropriate label stating compliance.
- B. All Products to have a Florida Product Approval Number, as required by the Florida Building Code (FAC 9N-3).
- C. All products located in the conditioned air stream or located in return air plenums shall conform to the NFPA 90A Flame/Smoke/Fuel Contribution of 25/50/0 and all other applicable requirements of NFPA 90A.
- D. Smoke and Smoke/Fire dampers shall be provided with a 60 month from the date of shipment parts only warranty, including freight for all components, including damper operators.

1.4 SUBMITTALS

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 - PRODUCTS

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2.1 ACCEPTABLE MANUFACTURERS

A. Duct Access Doors:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

B. Fire Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

C. Smoke Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

D. Smoke/Fire Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

E. Backdraft Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

F. Volume Dampers:

1. Air Balance, Inc.

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2. Arrow United Industries, Inc.
3. Cesco Products
4. Greenheck, Inc.
5. Nailor Industries, Inc.
6. Prefco Products, Inc.
7. Ruskin Manufacturing, Co.
8. Pottorff

G. Flexible Duct Connectors:

1. Ductmate Industries, Inc.
2. Duro-Dyne
3. Elgen
4. Ventfabric

H. Hardware Cloth:

1. McNichols Co.
2. Approved Owner Substitution.

2.2 FABRICATION

A. Duct Access Doors:

1. Low Pressure Ductwork:

- a. Rating up to 2" wg positive or negative.
- b. Frame: Minimum 22 gauge galvanized steel or aluminum, minimum 5/8" knock over edge, neoprene gasket between frame and duct and frame and door.
- c. Door: Minimum 24 gauge galvanized steel or aluminum, continuous hinge and cam latches or minimum 2 cam latches, double wall construction, fiberglass insulated thickness to match ductwork.
- d. Based on Ruskin Manufacturing Co. ADH24 or approved substitution.

B. Fire Dampers:

1. Rating: 1-1/2 hours (UL approved for installation in 2 hour walls).
2. Construction: Minimum 24 gauge galvanized steel frame suitable for connection to ductwork without transition, minimum 24 gauge galvanized steel curtain type blades located out of the airstream, thickness coordinated with wall construction. Where an active smoke control system exists (Refer to Section 23 09 93) the damper shall be capable of closing in an airstream moving at a minimum of 2000 feet per minute and operating at 4" w.g. pressure (dynamic damper).
3. Sleeves: UL listed minimum gauge galvanized steel with welded construction corners. Rollformed sleeves will not be acceptable unless contractor guarantees in writing to seal voids in sleeve with UL approved sealer to limit air leakage. Length of sleeve shall be coordinated with the wall or floor.
4. Operation: Stainless steel constant force closure spring.
5. Link Setting: 160 or 165°F.
6. Based on Ruskin Manufacturing Co. IBD2 Style B. (Static Systems) or approved substitution.
Based on Ruskin Manufacturing Co., DIBD2 Style B. (Active smoke control systems only) or approved substitution.

C. Smoke Dampers:

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1. Low and Medium Pressure Ductwork:
 - a. UL labeled under UL 555S low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000°F for 1 hour (non-degradable). Classified for both horizontal and vertical mounting.
 - b. Construction:
 - 1) Frame 16 galvanized steel.
 - 2) Damper Blades: 14 gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free silicone rubber edge type for a smoke seal to 450°F incorporated into blade and frame shapes. Blade shall be suitable for installation in systems with a maximum velocity of 4,000 FPM and 8" w.g. pressure at closure.
 - c. Damper operation by means of an electric actuator 120V AC, 24V AC or signal from smoke detector alarm circuit. Electric motor actuator to be UL listed with damper assembly for power open, spring closed operation with a maximum travel time of 15 seconds. Motor furnished with all connecting linkage and mounting hardware.
 - d. Damper and actuator shall be provided with a 60 month warranty as described in Paragraph 1.3.C.
 - e. Based on Ruskin Manufacturing Co., SD60-II or approved substitution.

D. Smoke/Fire Dampers:

1. Low and Medium Pressure Ductwork:
 - a. UL labeled under the following standards:
 - 1) UL 555 - 1-1/2 hr. fire endurance.
 - 2) UL 555S - Low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000°F for 1 hour (non-degradable).
 - 3) Classified for both horizontal and vertical mounting.
 - b. Construction: Single damper designed and rated for combination smoke/fire duty.
 - 1) Frame: 16 ga. galvanized steel.
 - 2) Damper Blades: 14 gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free inflatable silicone coated fiberglass material to maintain smoke leakage rating to a minimum of 450°F and galvanized steel for flame seal to 1900°F. Blade shall be suitable for installation in systems with a maximum velocity of 2,000 FPM and 4" w.g. pressure at closure.
 - 3) Duct sleeve provided by others.
 - c. Operation:
 - 1) Smoke/fire damper operation by means of an integral resettable and re-useable UL listed electric-ambient temperature link, UL listed releasing device and mechanical lock assembly. Link activated by either electric, 120V AC or 24V AC signal from smoke detector alarm circuit or 350°F duct ambient temperature. Damper

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shall be capable of being reopened by remote signal when the duct temperature drops to 150°F. Electric motor actuator shall be UL listed with the damper assembly for power open/spring closed operation. Motor actuator shall be factory furnished with all connecting linkage and mounting hardware and shall be factory tested for proper operation.

- 2) Damper and actuator shall be provided with a 60 month warranty as described in Paragraph 1.3.C.
- 3) Based on Ruskin Manufacturing, Co., FSD60-2 or approved substitution.

E. Backdraft Dampers:

1. Low Pressure Ductwork:

- a. Rating: Up to 1" wg positive or negative.
- b. Frame: Minimum 16 gauge (.064") galvanized steel or extruded aluminum.
- c. Blades: Minimum 16 gauge (.064") galvanized steel or extruded aluminum parallel blade action, brass bearing, non-ferrous or de-iron pivot pins, gasketed blades.
- d. Accessories: Counter balance and weights suitable for assisting or retarding as indicated on the drawings.
- e. Based on Ruskin Manufacturing, Co. CBD4 or approved substitution.

F. Volume Dampers:

1. Provide volume dampers where indicated and construct as follows:

- a. Provide single blades to a maximum of 10 inch blade width.
- b. Provide inside end synthetic bearings and locking quadrants with wing nuts.
- c. Friction locks are not permitted.
- d. Break damper blades on both edges for stiffness.
- e. Provide multi-blades on dampers 12 inches and larger with inside pins and molded synthetic bearings, and 2 inches wide by 1/8 inch thick structural galvanized channel frame.
- f. Provide galvanized connecting bar with molded synthetic bearings on multi-blade dampers.
- g. Provide stand off bracket for installation in externally insulated duct.
- h. Based on Ruskin Manufacturing, Co. MD35 for rectangular ducts (MDSR25 for round ducts) with velocities up to 1500 feet per minute or approved substitution.
- i. Based on Ruskin Manufacturing, Co. CD30AF1 for rectangular ducts (CDR82 for round ducts) with velocities over 1501 feet per minute or approved substitution.

G. Flexible Duct Connectors:

1. Indoor Applications:

- a. Material: Heavy glass fabric double - Coated with neoprene, Minimum of 30 oz/sy, Resistant to abrasion and damage due to repeated flexing, waterproof and air tight, minimum 26 gauge galvanized steel or .032" aluminum edge a minimum of 2-1/2" wide each side, coordinate flex width with schedule in 3.3: Schedules.
- b. Rating:

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- (1) Temperature: -10°F to 200°F
- (2) Pressure: 10" positive
10" negative
- (3) Based on Ventfabric and Ventglass or approved substitution.

2. Outdoor Applications

a. Material: Heavy glass fabric double-coated with hypalon minimum of 26 oz/sy resistant to abrasion and damage due to repeated flexing, water proof, airtight and resistant to damage from direct sunlight, minimum 26 gauge galvanized steel or .032" aluminum edge at minimum of 2-1/2" wide each side. Coordinate flex width with schedule in 3.3 schedule.

b. Rating:

- 1) Temperature: -10°F to 250°F
- 2) Pressure: 10" positive
10" negative
- 3) Based on Ventfabrics Ventlon or approved substitution.

H. Hardware Cloth: 4 mesh galvanized steel, plain weave with .035 wire.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install all products in strict accordance with the manufacturer's written installation instructions.
- B. Coordinate the installation of products provided within other sections of Division 23 including but not limited to control dampers, airflow measuring stations, etc.

3.2 INSTALLATION

A. Duct Access Doors:

- 1. Coordinate the proper class access door with the system requirements.
- 2. Duct access doors shall be mounted so as to allow maximum access and/or door swing while also providing easy access from the floor or other personal accessible structures.
- 3. Duct access doors shall be provided wherever required for proper maintenance of equipment, access to duct mounted control devices, or visual inspection and setting of dampers, etc. All doors, due to the small scale of the drawings, may not be shown, it is the contractor's responsibility to coordinate with all trades concerned to provide the necessary quantity and properly locate all doors.

B. Fire Dampers:

- 1. Fire dampers shall be provided where indicated.
- 2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
- 3. All fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
- 4. The fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly sealed with fire barrier material. (Refer to Division 7)

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5. Ductwork shall be attached to the fire damper by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all fire damper locations.

C. Smoke Dampers:

1. Provided where indicated. See combination smoke/fire damper for assemblies in fire rated barriers.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. Provide access doors or access sections at all damper locations.
4. Coordinate the provision of the smoke damper actuator with the automatic temperature control and fire alarm system and ensure adequate space for the mounting of the actuator during installation of the damper and ductwork.

D. Smoke/Fire Damper:

1. Provided where indicated. All smoke dampers in fire rated barriers to be combination type.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. All smoke/fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
4. The smoke/fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly sealed with fire barrier material. (Refer to Division 7)
5. Ductwork shall be attached to the smoke/fire damper by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all smoke/fire damper locations.
7. Coordinate the provision of the smoke damper actuator with the Building Control System and assure adequate space for the mounting of the actuator during installation of the smoke/fire damper and ductwork.
8. If pneumatic actuator is provided, all control tubing outside of the rated shaft shall be copper with 95-5 solder.

E. Backdraft Damper:

1. Securely attach backdraft damper to wall with a suitable sleeve and retaining angles and seal all voids between damper and wall.
2. Adjust damper to open or close under the design conditions.

F. Volume Dampers: Install at branch take-offs.

1. Install a 24" long yellow strip of material to each damper handle for easy visual location. These strips must be in place prior to Substantial acceptance.

G. Flexible Duct Connectors:

1. Flexible duct connectors shall be omitted where air handling units are provided with internally isolated fans and internal isolation.
2. Provide flexible duct connectors immediately adjacent to all in-line or ductwork connected fans and/or fan equipped units without internal vibration isolation.
3. Flexible duct connectors shall be properly selected and installed to ensure against collapsing under negative pressure and unacceptable ballooning under positive pressure. Leakage is not permissible. See width schedule in 3.3: Schedules.

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- H. Hardware Cloth: Install over all open ended ducts. Provide sheetmetal pocket over raw edges and secure with sheetmetal screws through the metal edge cover.
- I. Install Miscellaneous Control Devices:
 - 1. Install dampers furnished under Section 23 09 00. Provide necessary blank off sections where dampers are installed in factory fabricated mixing box openings.
 - 2. Install air flow measuring stations furnished under Section 23 09 00. Coordinate size and location with proper access before approving release of units for fabrication and shipment.
 - 3. Install duct smoke detectors provided under Division 26.

3.3 SCHEDULES

A. Access Door Schedule:

- 1. Square or Rectangular Duct work:

Access Door Mounting

	<u>Surface Max. Dim.</u>	<u>Access Door Size</u>
1.	6"	12" long Remov. Section
2.	7" to 8"	6" x 6"
3.	9" to 12"	8" x 8"
4.	13" to 18"	12" x 12"
5.	19" and up	16" x 16"
6.	Special Situations	See Plans

B. Flexible Duct Connector Schedule

- 1. Indoor and Outdoor Material Width Schedule

	<u>Duct Size</u> <u>(Max. Dim.)</u>	<u>Pressure</u> <u>(Max.)</u>	<u>Width</u>
a.	12" and less	positive	3"
b.	13" and up	positive	6"
c.	12" and less	negative	3"
d.	13" and up	negative	3"

END OF SECTION 23 33 00

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SECTION 23 34 00
HVAC FANS

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 WORK INCLUDED

- A. Centrifugal downblast roof exhaust fans.

1.3 QUALITY ASSURANCE

- A. All electrical components shall be UL listed or labeled.
- B. All fans shall be AMCA certified.
- C. All components in the conditioned air stream shall conform to the NFPA-90A Flame/Smoke/Fire Contribution Rating of 25/50/0.
- D. All electrical devices shall conform to NEMA standards.
- E. All wiring shall conform to the NEC.
- F. Provide Florida Product Approval Numbers for all Products required by the Florida Building Code (FAC 9N-3).
- G. Except where special motors are specified or required for the fan duty, all integral horsepower motors to be high efficiency type as specified in Section 23 05 15 – Common Motor Requirements for HVAC Equipment.
- H. Provide shaft grounding rings on all motors driven by a VFD. Typically to an AEGIS – SGR model.

1.4 SUBMITTALS

- A. Submit dimension drawings, performance and product data for acceptance. Include fan curves with the system design point plotted, and second point showing compliance with 110% of design static pressure as required by paragraph 3.1 B. Also include fan efficiency and horsepower clearly indicated.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.
- D. Submit construction details and dimensional data including weights.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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- A. Centrifugal Downblast Roof Exhaust Fans:
 - 1. Acme Engineering and Manufacturing Corp.
 - 2. Barry Blower
 - 3. Greenheck Fan Corp.
 - 4. Loren Cook Co.
 - 5. Penn Ventilator Co., Inc.

2.2 CONSTRUCTION

- A. Centrifugal Downblast Roof Exhaust Fans:
 - 1. Direct or adjustable pitch belt drive as scheduled.
 - 2. Housing heavy gauge, aluminum, weatherproof.
 - 3. Wheels centrifugal type.
 - 4. Motor outside of air stream in isolated motor compartment with forced outside air cooling fan motor.
 - 5. Fan and motor on vibration isolation mounts.
 - 6. Motors continuous duty type permanently lubricated bearings factory wired to junction box with disconnect switch.
 - 7. Tip speed and motor horsepower shall not exceed catalog ratings.
 - 8. Accessories to include 18" sound attenuating curb, bird screen, back draft damper and hinged sub-base for damper access.
 - 9. Based on Loren Cook ACEB/ACED or Greenheck GB/G or approved substitution.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions.
- B. Provide fans capable of accommodating static pressure variations of plus 10 percent.
- C. Provide matched belts and balanced variable sheaves for motors 15 hp and under, and fixed sheaves for 20 hp and over. Provide belt and sheave changes if required for proper air balancing.
- D. Provide belt guards on belt driven fans.
- E. Provide safety screen where inlet or outlet is exposed.
- F. Provide flexible connections on inlet and outlet of fans connected to ductwork as specified in Section 23 33 00 – Air Duct Accessories.

END OF SECTION 23 34 00

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SECTION 23 37 13
DIFFUSERS, REGISTERS AND GRILLES

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 WORK INCLUDED

- A. Grilles.
- B. Registers.
- C. Diffusers.

1.3 QUALITY ASSURANCE

- A. Manufacturer shall certify cataloged performance and ensure correct application of all air outlet types.
- B. All components within the conditioned air stream or exposed in active or non-active plenums shall conform to the NFPA 90A standard for Flame/Smoke/Fire Contribution of 25/50/0.

1.4 SUBMITTALS

- A. Submit schedule and product data for acceptance. Coordinate submittal by "G" number and include construction details, capacity ratings including air side pressure drops and NC levels.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Grilles:
 - 1. Anemostat.
 - 2. Price Industries
 - 3. Krueger.
 - 4. Metal Aire Division of Metal Industries, Inc.
 - 5. Titus.
 - 6. Trox
- B. Registers:
 - 1. Anemostat.
 - 2. Price Industries
 - 3. Krueger.

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4. Metal Aire Division of Metal Industries, Inc.
5. Titus.
6. Trox.

C. Diffusers:

1. Anemostat.
2. Price Industries
3. Krueger.
4. Metal Aire Division of Metal Industries, Inc.
5. Titus.
6. Trox.

2.2 FABRICATION

- A. Refer to the drawings for fixture designations.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all devices in strict accordance with the manufacturer's written installation instructions.
- B. Coordinate the proper grille style and frame style with the final approved ceiling construction and install grilles, registers and diffusers in accordance with the requirements of the architectural reflected ceiling plan.
- C. Due to the small scale of the drawings the contractor shall assume the responsibility to coordinate the air outlet and inlet locations with the reflected ceiling plans, lighting plans, sections and or details.
- D. Any unlined or otherwise exposed parts beyond the grille, register or diffuser face exposed to sight shall be painted black.
- E. Coordinate the color requirements for all grilles, registers and diffusers with the Owner's Representative.
- F. Insulate the back pans of all diffusers per the requirements of Specification Section 23 07 00.
- G. Air distribution devices installed in lay-in ceilings shall have a 24"x24" extended panel.
- H. Devices installed in sheetrock or other hard ceilings shall be surface mount type.

END OF SECTION 23 37 13

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SECTION 23 81 26
SPLIT SYSTEM AIR CONDITIONERS

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 WORK INCLUDED

- A. Packaged Split System Air Conditioning Unit, Air Cooled.

1.3 QUALITY ASSURANCE

- A. All electrical components shall be UL listed or labeled.
- B. All direct expansion coils shall be ARI certified.
- C. All components in the air stream shall conform to the NFPA 90A Flame/Smoke/Fire contribution of 25/50/0.
- D. All electrical devices shall conform to NEMA standards.
- E. All wiring shall conform to the NEC.
- F. After installation, the manufacturer's representative of all equipment provided in this section shall certify in writing to the Owner's representative that the equipment has been assembled and installed within the guidelines of the manufacturer's written installation instructions and that its performance meets or exceeds the operating characteristics specified and/or scheduled.

1.4 SUBMITTALS

- A. Submit dimension drawings, performance and product data for acceptance. Include fan curves with the system design point plotted, and clearly indicate fan efficiency.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Packaged Split System Air Conditioning Unit, Air Cooled:
 - 1. Trane
 - 2. Carrier
 - 3. Rheem

2.2 EQUIPMENT

- A. Packaged Split System Air Conditioning Unit, Air Cooled:

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1. Provide an air-to-air electric condensing unit (outdoor unit) in combination with a direct expansion fan coil (indoor unit), fully piped, wired and operational. Condensing unit shall be designed, tested, and fully charged for use with R-410A refrigerant. Combination unit shall be designed certified by UL and ARI, and complete package to have one (1) year limited parts warranty and compressor to have a four (4) year extended parts warranty.
2. Outdoor Section:
 - a. Cabinet shall be constructed of commercial grade galvanized steel, primed and painted to manufacturer's standard color. Access doors with neoprene gaskets shall be provided to allow access to coil, fan, motor and controls. Mounting legs shall be provided.
 - b. Compressor shall be high efficiency hermetic reciprocating type or scroll type equipped with a crankcase heater, automatically reversible oil pump, internal high pressure protection, and internal vibration isolation. Compressor motor shall have both thermal and current sensitive overload protection.
 - c. Outdoor coil shall be constructed of copper tubing with mechanically bonded aluminum fins having all joints brazed, factory installed coil refrigerant metering device to be mounted on unit liquid service valve, with device internal components to be removable for cleaning or replacement. Coil to be protected by a vinyl coated grille.
 - d. Outdoor fan shall be propeller type, direct driven, balanced statically and dynamically, and arranged for vertical air discharge. Fan shall be weatherproofed and approved for outdoor use. Fan motor shall be factory lubricated and internally protected.
 - e. Controls shall provide compressor short cycle protection and shall prevent compressor restart for a minimum of five minutes after shutdown. Liquid line low pressure switch, suction line accumulator with positive oil return, pressure relief switch and a loss of pressure indicator shall be provided.
 - f. Unit shall be equipped with filter drier, schrader access valves, refrigerant check valves in the refrigerant line, hot gas piping connection and valving, and expansion devices with interconnecting tubing to provide proper refrigerant flow control.
 - g. Low refrigerant and high refrigerant cut-outs to be arranged in lock out circuit for manual reset. Control wiring terminal board and 24 volt control circuit transformer to be provided. Terminal board shall be designed to match indoor unit terminal board and furnished complete with factory wiring from board to all internal components and accessory thermostat terminals for standardized point-to-point connectors.
 - h. Units with multiple compressors shall have independent refrigerant circuiting.
3. Indoor Section:
 - a. Cabinet shall be constructed of commercial grade galvanized steel, primed and painted to manufacturer's standard color, and insulated with fireproof, permanent, odorless glass fiber material. Access to be all components shall be provided with neoprene gasketed access panel(s).
 - b. Indoor coil shall be constructed of copper tubing with mechanically bonded aluminum fins having all joints brazed. Factory installed refrigerant metering device, refrigerant line fittings which permit mechanical connection on the liquid line and female sweat or mechanical connection on the gas line, and condensate pan with primary and auxiliary drain connections shall be provided. Unit shall also be equipped with hot gas reheat coil installed in the

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- unit.
- c. Fan shall be forward curved, centrifugal type, driven by factory lubricated single speed, three phase fan motor complete with internal overload protection, and resiliently mounted. Fan shall have horizontal air discharge or vertical air discharge as shown on the Contract Documents.
- d. Unit shall be provided with factory installed electric heater for supplemental heating to mount in discharge air passage. Elements to be of heavy duty nichrome internally delta-connected on three phase. Heater to have line break high limit controls.
- e. Certain units require multiple power connections for energy management purposes and are indicated on the schedules. Coordinate this requirement.
- f. Unit shall be provided with 1 inch medium efficiency throwaway filters. Initial and one replacement set to be provided with unit. Filter retaining rack to be arranged for removal and replacement in space allotted.
- g. Unit control shall be through the Building Automation System furnished in Specification Section 23 09 00. Provide a clearly marked terminal strip with each unit for connection to BCS system.

- 4. Unit Accessories: Refer to Schedules shown on the Contract Documents.

PART 3 - EXECUTION

3.1 GENERAL

A. Packaged Split System Air Conditioning Unit, Air Cooled:

- 1. Install in accordance with manufacturer's recommendations.
- 2. All openings made in walls or the roof the piping/electrical shall be patched and sealed completely, using materials of similar to existing type construction, to the Owner's satisfaction.
- 3. All refrigerant piping shall follow refrigerant piping techniques.
- 4. Condensate traps shall be minimum 4 inches deep and shall be field installed. Install plug in condensate drain on opposite side of unit from traps. Condensate drain connection shall be not less than 3/4".
- 5. All wiring shall comply with applicable local and national codes. Final connections shall be made with greenfield type electrical conduit for ease in removal.
- 6. Maintain necessary access space for filter change and normal maintenance. Piping and electrical connections shall be so located as to eliminate any interference with removal and replacement of filter.
- 7. Maintain space clearances around heat pump per manufacturer's recommendation.
- 8. After installation of unit, all interconnecting piping, controls and wiring, check each unit for satisfactory operation of fan on continuous and automatic control setting, unit operation on cooling, change over and heating and so indicate on tag pasted on unit indicating: "Checked for proper operation on Date by Name ."
- 9. Insert installation and maintenance instructions and parts lists in a one inch ring binder marked "OPERATION AND MAINTENANCE INSTRUCTIONS" and furnish to Owner.
- 10. Manufacturer shall review the drawings for piping distances. Contractor shall provide pipe sizes and any necessary accessories required by the Manufacturer as the result of their review.

END OF SECTION 23 81 26

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SECTION 23 81 29
PACKAGED 100% OUTSIDE AIR UNITS, SPLIT SYSTEM

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 WORK INCLUDED

- A. Packaged 100% Outside Air Units, split system.

1.3 QUALITY ASSURANCE

- A. Units shall be listed and labeled by U.L., ETL or a Nationally Recognized Testing Laboratory (NRTL).
- B. Units shall be ARI certified.

1.4 SUBMITTALS

- A. Submit dimension drawings, performance and product data for acceptance. Include wiring diagrams.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Packaged 100% Outside Air Units, Split System:
 - 1. Trane
 - 2. Addison
 - 3. Desert Aire

2.2 FABRICATION

- A. Packaged 100% Outside Air Units, Split System:
 - 1. Indoor Unit:
 - a. Unit shall be design certified by UL and ARI specifically for indoor installation, completely assembled on a rigid base for one-piece rigging, wired and tested by the manufacturer before shipment. Complete unit to have a 1-year limited parts warranty and compressor to have a 4-year extended parts warranty.
 - b. Cabinet shall be constructed of a minimum of 16 gauge commercial grade galvanized steel, primed, and painted to manufacturer's standard color. Indoor air section shall be completely insulated with fireproof, permanent, odorless 3/4" thick engineered polymer foam insulation. Neoprene

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gasketed access doors shall provide access to all components. All fasteners shall be stainless steel.

- c. Evaporator Dehumidifier Coil Fins: Fins shall be die-formed, copper and shall be damage resistant. Fin spacing shall be a maximum of 10 FPI (fins per inch). Coil shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the fins to form a permanent metal-to-metal bond for maximum heat transfer and stability. The coil shall be a minimum of six (6) rows deep. Coils shall be leak tested with 420 psig nitrogen. After testing, coils shall be sealed.
- d. Reheat Coil Fins: Fins shall be die-formed, copper and shall be damage resistant. Fin spacing shall be a maximum of 12 FPI (fins per inch). Coil shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the fins to form a permanent metal-to-metal bond for maximum heat transfer and stability. The coil shall be a minimum of two (2) rows deep.
- e. Electric Heating Coil: An internal electric heating coil shall be installed downstream from the hot gas reheat coil. The auxiliary heating coil shall be controlled by the systems controller. The binary control signal shall be a dry contact closure.
- f. Compressors (7.5 to 30 HP): The compressors shall be a tandem pair, heavy-duty scroll type. The compressors shall be staged by a factory mounted sensor to deactivate one compressor when the load reaches the mid-range of the systems capacity. The compressor shall be equipped with high and low vibration isolated. A standard factory two-year compressor warranty shall be included. The unit shall be provided with hot gas bypass for each system compressor. The use of semi-hermetic compressors is not acceptable.

Compressor (<6 HP): The compressor shall be heavy-duty scroll type, single compressor complete with start kit on single-phase motors. The compressor shall be equipped with low and high pressure safety switches, with internal protection from overheating. The compressor shall be externally vibration isolated. A standard factory two-year compressor warranty shall be included. The unit shall be provided with hot gas bypass for each system compressor. The use of semi-hermetic compressors is not acceptable.

- g. Receiver: The unit shall be provided with a refrigerant receiver. The receiver shall assist the unit in operating at the highest efficiency over the full range of load conditions. Units 7.5 HP and larger shall have a full capacity receiver with service valves.
- h. Electrical Control Panel: The electrical control panel shall be easily accessible on one side so that all service can be performed from the side of the unit. It shall be of adequate size so as to house all electrical controls and devices. The unit shall be provided with single point power connection factory wired to the power connection lug set. The electrical controls shall include low voltage transformers to supply 24 VDC control power, clearly labeled high and low voltage terminal strips, high and low pressure control (with manual reset of the high pressure cutout and automatic reset of low pressure cutout), and an anti-short cycling timer to protect against compressor cycling. Unit shall include factory-mounted temperature and humidity sensors in the filter section, pre-wired to controller in panel for actuation of compressor in ambient temperatures above 55F dewpoint. A factory-provided, field-installed discharge temperature sensor provides the feedback to the controller to automatically control the leaving air temperature to the desired set point. An adjustable potentiometer shall

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- allow easy field changes in LAT set point.
 - i. Condensate Drain Pan: The drain pan shall be 20-gauge stainless steel, sloped, and positioned under the dehumidifier coil. It shall be silver-solder welded and securely attached to the evaporator end plates to avoid shifting. The drain pan shall be fitted with a minimum 1" MPT non-corrosive plastic drain connection. The drain pan shall meet all the requirements of ASHRAE 62.
 - j. Blower Assembly: The blower housing shall be made of galvanized steel and mounted on permanently lubricated sealed ball bearings. The blower assembly shall be forward curved, centrifugal; it shall be dynamically and statically balanced. The blower housing shall be vibration isolated. The driver pulley and the blower pulley shall be made of cast iron. The motor sheave shall be a variable pitch type to allow for field adjustment of CFM and external static pressure, and shall be dynamically and statically balanced. The drive overload service factor shall be 1.4 minimum. The motor shall be ODP (indoor) or TEFC (outdoor), class B insulated, continuous duty, 40C ambient, three-phase overloads. The motor shall be UL listed.
 - k. Air Filters: Filters shall consist of 4" disposable pleated, 25 to 30% average atmospheric efficiency.
- 2. Outdoor Condenser:
 - a. Cabinets shall be constructed of heavy-gauge galvanized steel. Sides shall be one-piece construction. Units shall be provided with lifting lugs for ease of installation.
 - b. Condenser coils shall be of copper tubing in a staggered design. Tubes shall be mechanically expanded into full-collared plate type aluminum fins. Coils shall be factory leak-tested and sealed with caps.
 - c. Fan motors shall be heavy-duty PSC or three-phase depending on voltage scheduled with permanently lubricated ball bearings and built-in overload protection. All motors shall be factory-wired with leads terminating in a weatherproof junction box located on the outside of the unit cabinet.
 - d. Fan diameter shall not exceed 30 inches. All units shall have dynamically balanced fans with aluminum blades and painted steel hubs. Guards shall be heavy-gauge, close-meshed steel wire with vinyl coating. Guards shall be contoured for maximum rigidity.
 - e. Fans shall be cycled based on internal head pressure on multiple fan units.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Packaged 100% Outside Air Units, Split System:
 - 1. Install in accordance with manufacturers recommendations.
 - 2. All openings made in walls or roof for piping/electrical shall be patched and sealed completely, using materials of similar to existing type construction, to the Owner's satisfaction.
 - 3. All refrigerant piping shall follow refrigerant piping techniques.
 - 4. Condensate trap shall be minimum 4 inches deep and shall be field installed. Install plug in condensate drain on opposite side of unit from trap. Condensate drain connection shall not be less than 3/4".
 - 5. All wiring shall comply with applicable local and national codes. Final connections shall be made with Greenfield type electrical conduit for ease of removal.
 - 6. Ductwork shall be attached to the curb and sealed completely. Counter-flashing

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- shall be provided around the roof curb.
7. Thermostat and sub-base for wall mounting shall be as detailed on plans.
 8. Maintain necessary access space for filter change and normal maintenance. Piping and electrical connections shall be so located to eliminate any interference with removal and replacement of filter.
 9. Maintain space clearance around heat pump per manufacturer's recommendations.
 10. After installation of unit, all interconnecting piping, controls and wiring, check each unit for satisfactory operation of fan on continuous and automatic control setting, unit operation on cooling, change over and heating and so indicate on tag pasted on unit indicating: "Checked for proper operation on Date by Name ."
 11. Insert installation and maintenance instructions and parts lists in a one inch ring binder marked "OPERATION AND MAINTENANCE INSTRUCTIONS" and furnish to Owner.

END OF SECTION 23 81 29

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SECTION 23 81 30
VARIABLE REFRIGERANT FLOW AIR CONDITIONING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

- A. Bidders shall provide the minimum system as indicated on drawing, including Heat Recovery or Heat Pump systems as defined by model and family numbers. All systems shall be capable of providing the scheduled capacity at the location of the indoor unit regardless of pipe length. Nominal or catalog capacities will not be accepted.
- B. Heat Recovery systems shall be capable of simultaneous cooling and heating.
- D. The Heat Recovery system shall be capable of transferring heat between individual indoor units, and between individual control units.
- E. To ensure maximum occupant comfort, Heat Recovery systems may have a space temperature controller for each connected indoor unit. Each individual space temperature controller shall be capable of automatically satisfying heating or cooling regardless of time of day, occupancy, or season without inhibiting or affecting other space temperature controllers.
- F. Heat Pump systems shall not be used for systems requiring simultaneous heating and cooling.
- G. If the application calls for simultaneous heating and cooling with multiple zones and multiple controllers, and the installing contractor submits a Heat Pump system, the submittal shall be summarily rejected. The contractor shall then be required to resubmit and install a simultaneous heating and cooling system. The contractor shall bear all additional costs required to provide a simultaneous heating and cooling system, with no additional cost to the owner.

1.2 QUALITY ASSURANCE

- A. System efficiencies for units less than 65,000 BTUH (SEER and HSPF) shall be certified by AHRI standard 210-240. Equipment that is “rated” in accordance with AHRI Standard 210-240, but not published for public review by AHRI shall not be accepted
- B. System efficiencies for units greater than 65,000 BTUh (IEER and SCHE) shall be certified by AHRI standard 1230. Equipment that is “rated” in accordance with AHRI Standard 1230, but not published for public review by AHRI shall not be accepted.
- C. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
- D. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- E. Project shall comply with the applicable version of ASHRAE standard 15.
- F. Project shall comply with the applicable version of ASHRAE 90.1
- G. The VRF manufacturing facility shall be registered to ISO 9001 and ISO14001.
- H. All components shall be provided by one manufacturer including but not limited to:
 - 1) Outdoor Units
 - 2) Indoor Units
 - 3) Control Units

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- 4) All necessary and applicable controls for the VRF System
- 5) Factory refrigerant charge for condensing unit(s) only
- 6) Y and or T-Branch(s) (field fabrication of Y or T branches is not acceptable)
- 7) Condensate Lift Pump(s) as shown on the contract documents
- 8) Refrigerant Ball Valves as shown on the contract documents
- 9) Service Software

1.3 DELIVERY, STORAGE AND HANDLING

- A. Installing contractor will take all reasonable and appropriate care to store and handle equipment per the manufacturer's recommendation.

1.4 SUBMITTALS

- A. Installing contractor shall provide the following:
 - 1) VRF Guide Specification
 - 2) VRF Dimensional Data for all products submitted
 - 3) VRF Product Data for all products submitted.
 - 4) VRF Select report showing design conditions, total load profile, and actual capacity at actual Indoor Unit location,
 - 5) VRF Select Piping and Wiring layout showing estimated piping, wiring sizes, equipment quantities, piping length estimate, and additional refrigerant charge.
 - 6) VRF Select Schedule showing the performance for all pieces of equipment.

1.5 INSTALLATION AND OPERATION MANUALS

- A. Owner shall be provided with a complete and comprehensive electronic set of Installation and Operation Manuals.

1.6 QUALIFICATIONS

- A. Manufacturer shall have a minimum of twenty-five (25) years of HVAC experience in the North America market.
- B. Manufacturer to have Local Factory Service within seventy-five (75) miles of jobsite.
- C. The VRF system shall be installed by a certified installer with extensive VRF installation and service training. The mandatory contractor service and install training shall be performed by the manufacturer.

1.7 WARRANTY

- A. The units shall be covered by the manufacturer's standard limited warranty for a period of 12 months from date of installation. If during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.
- B. The units shall carry an extended manufacturer's functional parts warranty for a period of 5 years from date of installation.
- C. The following steps shall be taken by the contractor to ensure systems are eligible for extended warranty.
 - 1) System is designed and submitted using an approved application tool.

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- 2) System installed by a contractor who has successfully completed the manufacturer's training class.
- 3) Upon completion of installation and prior to final commissioning, contractor shall provide revised piping layout reflecting actual installation conditions to manufacturer's technician for submittal to manufacturer's service department.
- 4) Provide a verified and submitted commissioning report to manufacturer's service department.

D. The contractor shall provide labor warranty as specified in the general conditions for this project.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Basis of design shall be: Trane VRF
- B. The following manufacturers are approved for use provided they meet the scheduled performance indicated on the drawings:
 - 1) Daikin
 - 2) Mitsubishi

2.2 HEAT RECOVERY OUTDOOR UNITS

- A. The Heat Recovery outdoor unit shall be used specifically with Heat Recovery systems (simultaneous heating and cooling). The outdoor unit electrical power shall be 208-230 volts or 460 volts, 3 phase, 60 hertz as specified.
- B. To ensure maximum occupant comfort, Heat Recovery systems may have a space temperature controller for each connected indoor unit. The Heat Recovery system shall provide simultaneous heating and cooling without the use of reheat.
- C. In order to ensure maximum Simultaneous Cooling and Heating Efficiencies (SCHE), Heat Recovery outdoor units will feature a low temperature/low pressure gas line, high temperature/high pressure gas line, and a medium temperature/high pressure liquid line. All three lines will connect from the condensing unit to each mode control units, (Hybrid Piping Layout.)
- D. The Heat Recovery outdoor units shall be equipped with multiple circuit boards. These boards shall perform all functions necessary for operation of the outdoor units.
- E. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.
 - 1) The combination ratio of the nominal indoor cooling capacity versus the nominal outdoor rated cooling capacity shall range from 50% to 130%.
 - 2) Outdoor unit shall have a sound rating no higher than 62/83(Pressure/Power) dB(A).
 - 3) Unit shall have a night quiet setting to reduce nighttime sound levels.
 - 4) All refrigerant lines from the outdoor unit to the MCU (Mode Change Unit) shall be field insulated.
 - 5) The outdoor unit shall have an accumulator with crank case heater and controls.
 - 6) The outdoor unit shall have a high pressure safety switch, fuse, over-current protection and crank case heater.
 - 7) If the outdoor unit is below the indoor unit, the outdoor unit shall have the ability to operate with a maximum height difference of 131 ft.

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- 8) The system shall have a maximum total refrigerant tubing length of 3281ft.
- 9) The maximum length between outdoor unit and the furthest indoor units is not to exceed 656 ft (722 equivalent feet).
- 10) The maximum height difference between MCU boxes shall be 49 ft.
- 11) The maximum height difference between indoor units shall be 49 ft.
- 12) The outdoor unit shall be capable of operating in cooling mode from 23°F to 120°F.
- 13) The outdoor unit shall be capable of operating in heating mode from 75°F to -13°F ambient temperatures without additional low ambient controls, additional modules, or low ambient accessories.
- 14) The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
- 15) The outdoor units shall provide continuous heating during oil return and the defrost cycle through the use of rotational defrost. (multiple module systems)

F. The unit casing(s) shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

G. The outdoor condenser fan shall be furnished with direct drive motors(s). All fan motors shall have inherent motor protection, and permanently lubricated bearings. All fan motors shall be mounted for quiet operation. All fans shall be provided with a raised guard to prevent contact with moving parts. The fans shall have vertical discharge airflow.

H. R410A refrigerant shall be required for VRF outdoor unit systems. Manufacturer shall only provide the refrigerant as required for unit charge. Contractor shall be required to provide additional refrigerant as specified in VRF Select reports.

I. The outdoor condenser coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing. The condenser coil shall have Blue Fin anti-corrosion protection as a standard feature. The coil shall be protected with an integral metal guard. The coil fins shall be coated with hydrophilic paints.

J. The VRF Heat Recovery outdoor units shall be equipped with inverter driven vapor injection asymmetric scroll compressor(s). The asymmetric design will allow for only one point of contact for the scroll compressor blades resulting in reduced friction, and increased efficiency. Conventional scroll compressors with 2-points of contact will not be allowed due to their inherent inefficiency.

- 1) The outdoor unit compressor shall utilize inverter driven technology to modulate capacity. The compressors shall also utilize advanced technology adaptive sine wave control for reduced harmonics and faster frequency acceleration.
- 2) The compressor shall be capable of 1/60th second advanced micro-control.
- 3) The outdoor unit compressor shall utilize vapor injection technology which shall increase the mass flow rate of refrigerant, resulting in improved performance for low temperature conditions.
- 4) The compressor will be equipped with an internal thermal overload protection.
- 5) The compressor shall be mounted to avoid the transmission of vibrations.

K. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.

2.3 MCU (Mode Change Unit)

A. The MCU (Mode Change Unit) shall be used for applications requiring simultaneous heating and cooling. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.

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- B. MCUs require they be used in conjunction with VRF Outdoor Heat Recovery condensing units. These units shall be equipped with a circuit board that shall perform all functions necessary for operation.
- C. The MCU (Mode Change Unit) shall be completely factory assembled, internally piped and wired. Unit shall be run tested. This unit shall be mounted indoors.
- D. Each MCU shall be capable of transferring heat to connected associated indoor units, and to the connected outdoor condensing unit. This shall allow simultaneous heating and cooling without the need for reheat.
- E. Isolation valves with access ports shall be installed by the contractor on the entering and leaving refrigerant circuits as shown on the drawings.
- F. Additional subcooling shall be provided at the MCU. The additional subcooling is required to mitigate losses due to pipe length and heat gain. This will ensure scheduled capacity at the indoor unit.
- G. MCU (Mode Change Units) shall be available in three sizes, 4-port, 6-port, and dedicated 2-port, provide the size as shown on the drawings. The outdoor heat recovery condensing unit is capable of connecting to multiple MCUs (Mode Change Units).
- H. The 4-port MCU shall connect up to 4 indoor units when the sum of the indoor unit's capacity is less than 120 MBH. Optionally, the 6-port MCUs shall connect up to 6 indoor units where the sum of indoor unit's capacity is less than 180 MBH.
- I. The dedicated 2-port MCU shall be used to connect individual Indoor units whose capacity greater than or equal to 36 MBH, and where the sum of the MCUs capacity is less than 192 MBH.
- J. When connecting indoor units with capacities greater than 36 MBH to a 4-port, 6-port, or dedicated 2-port MCU, two ports shall be twinned together at the MCU to deliver the required refrigerant. The two MCU refrigerant valves shall operate simultaneously.
- K. IDUs with capacity in excess of 48MBH shall not be connected to 4-port or 6-port MCUs. They should be used exclusively with a dedicated 2-port MCUs.
- L. IDUS with capacity less than 36MBH indoor unit shall not be connected to a dedicated 2-port MCUs.
- M. The MCU casing shall be fabricated of galvanized steel. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves. The unit shall house two tube-in-tube heat exchangers (sub cooling) to ensure heating and cooling capacity at the indoor unit.
- N. The MCU shall be furnished with multiple two position refrigerant valves. Linear electronic expansion valves shall be used to control the variable refrigerant flow.
- O. An integral MCU condensate pan and drain connection shall be provided.
- P. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.

2.4 1-WAY SLIM CEILING CASSETTE INDOOR UNITS

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- A. A one-way cassette style indoor unit that recesses into the ceiling with a ceiling grille and shall have a 2000 step modulating expansion device. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
- B. The indoor unit shall be a factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart function.
- C. The unit cabinet shall be space-saving ceiling recessed. The one-way grille shall be fixed to bottom of cabinet allowing for one-way airflow.
- D. The indoor fan shall consist of a direct driven cross-flow fan with a single motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fan shall have high, medium, and low fan speeds. The fan speed shall be adjustable by an optional remote controller.
- E. Return air shall be filtered by means of a long-life washable permanent filter.
- F. The indoor coil shall be constructed as follows:
 - 1) The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
 - 2) The tubing shall have inner grooves for high efficiency heat exchange.
 - 3) All tube joints shall be brazed with phos-copper or silver alloy.
 - 4) The coils shall be pressure tested at the factory.
 - 5) A condensate pan and drain shall be provided under the coil.
 - 6) The factory installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.
 - 7) The coil fins shall be coated with hydrophilic paints.
 - 8) Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.5 4-WAY MINI/ 4-WAY CEILING CASSETTE INDOOR UNITS

- A. A four-way cassette style indoor unit that recess into the ceiling grid with an exposed ceiling grille and an integral 2000 step modulating expansion device. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
- B. The indoor unit shall be a factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function.
- C. The unit cabinet shall be a space-saving ceiling-recessed cassette. The cabinet panel shall have provisions for a field installed filtered outside air intake. Branch ducting shall be allowed from cabinet.
- D. The indoor fan shall consist of a turbo fan with a single direct drive motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fan shall have high, medium, and low fan speeds. The fan speed shall be adjustable

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by an optional remote controller. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution. If require the cassette shall be capable of closing off one or more vanes to prevent "stray airflow".

- E. Return air shall be filtered by means of a long-life washable permanent filter.
- F. The indoor coil shall be constructed as follows:
 - 1) The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
 - 2) The tubing shall have inner grooves for high efficiency heat exchange.
 - 3) All tube joints shall be brazed with phos-copper or silver alloy.
 - 4) The coils shall be pressure tested at the factory.
 - 5) A condensate pan and drain shall be provided under the coil.
 - 6) The coil fins shall be coated with hydrophilic paints.
 - 7) The factory installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.
 - 8) Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.6 SLIM DUCT /MEDIUM STATIC/ HIGH STATIC- DUCTED INDOOR UNITS

- A. A ducted indoor fan coil design that mounts above the ceiling. The unit shall have a 2000 step modulating expansion device. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
- B. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function.
- C. The unit cabinet shall be a space saving, ceiling-concealed, ducted unit. The cabinet panel shall have provisions for a field installed filtered outside air intake.
- D. The indoor unit fan shall consist of two or three fans, direct driven by a single motor. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall have high, medium, and low fan speeds. The fan speed shall be adjustable by an optional remote controller.
- E. The return air shall be filtered by means of a standard factory installed return air filter. An optional return filter box (rear placement) with high-efficiency filter shall be available for ducted indoor units. If using the optional return filter box, verify the filter/filter box performance is within the bounds of the unit's external pressure performance.
- F. The indoor coil shall be constructed as follows:
 - 1) The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
 - 2) The tubing shall have inner grooves for high efficiency heat exchange.
 - 3) All tube joints shall be brazed with phos-copper or silver alloy.
 - 4) The coils shall be pressure tested at the factory.
 - 5) A condensate pan and drain shall be provided under the coil.

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- 6) The coil fins shall be coated with hydrophilic paints.
 - 7) The optional field installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.
 - 8) Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.7 CEILING SUSPENDED (FLOOR) INDOOR UNITS

- A. A convertible unit that can be mounted on the ceiling in a horizontal configuration, or on the floor/wall in a vertical configuration. The unit electrical power shall be 208-230 volts, 1-phase, 60 hertz. The unit must be installed with the optional single room EEV (Electronic Expansion Valve) kit, or two or three rooms EEV (Electronic Expansion Valve) kits. (Two or three room EEVS are for HP systems only, not for use with HR systems).
- B. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function.
- C. The unit cabinet shall be an exposed ceiling suspended or wall/floor mounted configuration. With multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and four (4) directions for condensate drainage.
- D. The indoor unit fan shall consist of fans direct driven by a single motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fan shall have multiple speeds.
- E. Return air shall be filtered by means of an easily removable, washable filter.
- F. The indoor coil shall be constructed as follows:
- 1) The indoor coil shall be of nonferrous construction with Slit fins on copper tubing.
 - 2) The tubing shall have inner grooves for high efficiency heat exchange.
 - 3) All tube joints shall be brazed with phos-copper or silver alloy.
 - 4) The coils shall be pressure tested at the factory.
 - 5) A condensate pan and drain shall be provided under the coil.
 - 6) The coil fins shall be coated with hydrophilic paints.
 - 7) The optional field installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.
 - 8) Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.8 WALL MOUNTED INDOOR UNITS

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- A. A wall-mounted indoor unit section with a slim silhouette. The wall mounted indoor unit electrical power shall be 208-230 volts, 1-phase, 60 hertz. The 4TVW-C shall have a 2000 step modulating expansion device.
- B. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, internal piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function.
- C. The unit casing shall have a white finish, with multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and four (4) directions for condensate drainage. The unit shall be secured firmly to the wall with factory mounting plate.
- D. The indoor fan shall consist of a cross-flow fan with a single direct drive motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided to change the airflow from side to side (left to right) as desired. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution. The indoor fan shall have multiple speeds.
- E. Return air shall be filtered by means of an easily removable, washable filter.
- F. The indoor coil shall be constructed as follows:
 - 1) The indoor coil shall be of nonferrous construction with Slit fins on copper tubing.
 - 2) The tubing shall have inner grooves for high efficiency heat exchange.
 - 3) All tube joints shall be brazed with phos-copper or silver alloy.
 - 4) The coils shall be pressure tested at the factory.
 - 5) A condensate pan and drain shall be provided under the coil.
 - 6) The coil fins shall be coated with hydrophilic paints.
 - 7) The optional field installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.
 - 8) Both refrigerant lines to the indoor units shall be insulated.
- G. Use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire for communications wiring. Splicing of communication wiring shall not be permitted.
- H. This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system. Please refer to Part 3 of this guide specification for details on controllers and other control options.

2.9 ACCESSORIES

- A. Y-Joint Kits- provide for VRF-Systems with multiple evaporators and MCU's on the same system. Y-joints shall be provided for liquid, suction, and hot gas fittings as required. Y-joints shall be provided with polystyrene insulation. Y-branches shall facilitate different pipe sizes without having to braze additional fittings. Field fabrication or substitution of Y-Joints not provided by the manufacturer shall void warranty. Kits shall be installed per manufacturer guidelines. Requires field installation.
- B. T-Joint Kits – provide for VRF systems with multiple outdoor modules on a single system. The T-Joint shall be provided for liquid, suction, and hot gas fittings as required. T-Joints shall be provided with polystyrene insulation. T-Branches shall facilitate different pipe sizes without having to braze additional fittings. Field fabrication or substitution of T-joints not provided by the manufacturer shall void warranty. Kits shall be installed per manufacturer guidelines. Requires field installation.

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- C. EEV KITS- the EEV (Electronic Expansion Valve) provides refrigerant management of indoor units. The EEV shall be required for field installation on ceiling suspended (floor) indoor units. Heat Recovery systems shall require the single room EEV. Heat Pump systems (only) may also utilize the two or three room EEV kits. Kits shall be installed per manufacturer guidelines. Requires field installation.
- D. Condensate Drain Pumps shall be provided for field installation as required for efficient condensate management. Condensate pumps shall be capable of 29.5" of lift to allow condensate to reach the closest gravity drain line. Condensate pumps shall include a check valve to prevent water from flowing back into the indoor unit. Pump shall be mounted in the chassis of the indoor unit. Pump shall draw on required power from the associated indoor unit. Requires field installation (Standard factory installed for all ceiling cassettes).
- E. Refrigerant Isolation Ball Valves - shall be provided for field installation as specified by the contract documents. Valves shall utilize a uni-body full port design to minimize leaks and internal pressure drops. Valves shall be rated for 700PSIG, and are offered with an optional factory insulation package. Valves shall be factory tested under pressure. Valves shall require polytetrafluoroethylene (PTFE) seals and gaskets. No synthetic O-rings are allowed. Design shall permit valve operation without removal of seal cap. Valves shall have a temperature operation range of -40°F to 300°F. Requires field installation.
- F. Wired Remote Controller. Remote shall utilize a Multi-function LCD display and shall possess the following functionality:
 - 1) ON/OFF Control
 - 2) Mode Selection
 - 3) Temperature Set-point
 - 4) Fan Speed Setting
 - 5) ON/OFF Timer
 - 6) Up to 2 can be averaged as single controller
 - 7) Child Lock
 - 8) Dirty Filter Alert
- G. Auxiliary heat contact shall enable the operation of external auxiliary supplemental heat where specified.
- H. Standard Cassette Panels shall be required with as indicated for all 1-way, Mini 4-way, and 4-way ceiling cassettes.
- I. Hail guards shall protect the condenser coil from damaging hail. Requires field installation.

2.10 BAS MANUFACTURER CONTROLS

- A. The VRF System Network Controls shall be capable of supporting remote controllers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet®.

2.11 ELECTRICAL CHARACTERISTICS CONTROLS

- A. The VRF System Network Controls shall operate at 12VDC. Controller power and communications shall be via a common non-polar communications bus.
- B. Control wiring shall be installed in a system daisy chain configuration from the wired remote controller to the indoor unit, to the and to outdoor unit. Control wiring to wired remote

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controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

- C. Control wiring for system controllers, and centralized controllers shall be installed in a daisy chain configuration from interface module to interface module, to system controllers, to the power supply.
- D. For communication wiring between ODU's, IDU's, MCU, system controller, and remote controllers use 18 AWG, 25pF/ft nom., 60.7 Ω impedance, braid or foil shielded, twisted pair wire. Splicing of communication wiring shall not be permitted.
- E. Network wiring shall be CAT-5e with RJ-45 connection.

2.12 SYSTEM NETWORK CONTROLS

- A. The VRF System Network Controls consists of individual controllers, system controllers, and integrated management system. The VRF System Network Controls shall support operation monitoring, scheduling, error monitor, power distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using BACnet® interfaces.

2.13 VRF-SYSTEM CONTROLLER+BACnet®

- A. The VRF System Controller+BACnet is an intelligent field panel that communicates with VRF Outdoor Unit(s), Indoor Unit(s) and other VRF controllers. Additionally, it shall include a BACnet® IP (Internet Protocol) port to function as a communications gateway to other BACnet IP devices. The VRF System Controller+BACnet shall connect to associated indoor and outdoor units utilizing a dedicated control network. The controller utilizes the local area network (LAN) to provide a web page-based user interface available wherever the building's network access is available. The VRF System Controller+BACnet is housed in a protective enclosure suitable for wall-mounting in a mechanical or electrical equipment room. The VRF BACnet® Gateway shall be capable of controlling up to 256 indoor units/EEVs support.
- B. The VRF System Controller shall allow a building operator to view the system using a PC with a standard web browser, such as Windows® Internet Explorer or Mozilla Firefox.
- C. The VRF System Controller shall include a user interface that includes control and monitoring of each Indoor unit through a standard graphical display with convenient pop-up controller screen to adjust comfort settings for each zone.
- D. The VRF SC shall be capable of controlling a maximum of 256 indoor units via a PC. A field supplied PC shall be required. The VRF SC shall support operation superseding that of the remote controllers, system configuration, 1-day/daily/weekly scheduling, monitoring of operation status, error email notification, online maintenance tool and malfunction monitoring.
- E. The VRF SC shall have a basic set of operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 256 indoor units), or all indoor units (collective batch operation).
- F. The basic set of operation controls for the VRF SC shall include on/off, operation mode selection (auto, cool, heat, dry, and fan), temperature setting, fan speed setting, airflow direction setting, error email notification, and online maintenance.
- G. Since the VRF SC provides centralized control, it shall be able to enable or disable operation of local remote controllers via the PC. In terms of scheduling, the VRF SC shall allow the user to define 1-day, daily, and annual schedules with operations consisting of ON/OFF, mode selection,

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temperature setting, permit/prohibit of wireless/wired remote controllers.

- H. The system shall detect and store alarms in the Alarm Log. The Alarm Log shall display critical data about the alarm, including the location of the device, and the time of occurrence. Alarms shall be routed by e-mail to stationary or mobile devices. Capacity to store up to 1024 alarm events on time specific basis shall be required.
- I. Database changes made by other users shall automatically be reflected in the VRF System Controller without the need for a central server. The system database be capable of archiving or backing up data for local or offsite storage. This is desirable in the event the date is ever needed for restoring the system. A built-in SD card slot provides for on-board but removable data backup storage.
- J. A password shall protect the VRF control system from unauthorized access. Each operator is assigned a role. Roles are defined by access rights. Pre-defined roles shall be selected from the VRF System Controller interface. Operators shall have access only to those features which define their roles. Roles may also be customized. An operator with administrative-level security shall access all information on the system, and shall have the ability to alter passwords and create new security roles.

VRF System Controller+BACnet®			
Item	Description	Operation	Display
ON/OFF	Start stop operation for a single group	Each Group	Each Group
Operation Mode	Changes mode between Auto/Cool/Dry/Fan/Heat	Each Group	Each Group
Temperature Setting	Sets the temperature for a single group. Range of temperature settings: Auto/Cool/Dry: 64°F-86°F (18°C-30°C), Heat: 61°F-86°F (16°C-30°C)	Each Group	Each Group
Fan Speed Setting	Models with 3 air flow settings: High/Mid/Low	Each Group	Each Group
Air Flow Direction Setting	Air flow 2-step direction (Swing/Stop). Direct settings at a specific angle. Air flow operation varies depending on the model.	Each Group	Each Group
Web Server Function	Remote control with the public IP address. No management software required – PC-independent management	Each Group	Each Group
Accessible level/ Dynamic user security Management	Wireless/wired remote controller restriction setting Specifies the scope of control and monitoring unit on a per-user 3 accessible levels -Admin/Manager/User	Each Group	Each Group
Error	When an error is occurs on an outdoor unit, the affected unit and error code are displayed	Each Group	Each Group
Schedule Operation	Up to 256 schedule settings including weekly and daily schedule setting	Each Group	Each Group
External Contact Interface	Full indoor unit control with simple contact input (Emergency/Lock) State output (Operation/Error) for synchronous control. 6 digital outputs / 8 digital inputs	Each Channel	Each Channel
Smart Central Management	Control & monitoring zone edition. Wireless/wired remote control restriction. Temperature limit setting Operation mode restriction. Silent control setting	Each Group	Each Group
User editable	User can edit control logic with arithmetic/conditional	Each	Each

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VRF System Controller+BACnet®			
Item	Description	Operation	Display
control logic	operators and parameters. Efficient energy saving realization based on various operation conditions.	Group	Group
Data backup/ Useful history management	Important data is safely stored in SD memory card Record the operation history and error history	Each Group	Each Group
Multi language	English, Korean, Chinese, Spanish, Italian, Portuguese, Dutch, Hungarian, Polish, Russian		

Indoor Unit BACnet® Point List								
Instance Number	Object	Object Type	Object Name	Unit Inactive Text-1	Text-2	Text-3	Text-4	Text-5
1	Indoor Temperature	AI	AC_RoomTemp_xx_xxxxx	°C				
2	Set Temperature	AV	AC_Temp_Set_xx_xxxxx	°C				
3	Setting lower temperature limit	AV	AC_Cool_LimitTemp_xx_xxxxx	°C				
4	Setting upper temperature limit	AV	AC_Heat_LimitTemp_xx_xxxxx	°C				
5	IDU power usage after the basic date	AI	AC_Baseline_kWh_xx_xx xxx	kWh				
6	IDU hour usage after the basic date	AI	AC_Baseline_Minute_xx_xxxxx	Minute				
7	Power value within period	AI	AC_Period_kWh_xx_xxxxx	kWh				
8	IDU hour usage within period	AI	AC_Period_Minute_xx_xx xxx	Minute				
9	Power On/Off	BV	AC_Power_xx_xxxxx	Off	On			
10	Applying lower temperature limit setting	BV	AC_Cool_Limit_set_xx_xxxxx	False	True			
11	Applying upper limit temperature setting	BV	AC_Heat_Limit_set_xx_xxxxx	False	True			
12	Filter sign status	BI	AC_FilterSign_xx_xxxxx	False	True			
13	Filter sign reset	BO	AC_FilterSign_Reset_xx_xxxxx	False	True			

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Indoor Unit BACnet® Point List									
14	Operation mode status	MV	AC_Operatio n_Mode_xx_ xxxxx	Auto	Cool	Heat	Fan	Dry	
15	Fan speed status	MV	AC_FanSpee d_xx_xxxxx	Auto	Low	Mid	High		
16	Airflow direction status	MV	AC_FanFlow _xx_xxxxx	None	Vertic al	Horizon	All		
17	Operatiom mode limit status	MV	AC_Mode_Li mit_xx_xxxxx	No Limit	Cool Only	Heat Only			
18	Remote controller limit status	MV	AC_Remoco n_xx_xxxxx	Enable RC	Disabl e RC	Conditio nal RC			
19	Integrated error code of both indoor unit and outdoor unit	AI	AC_Error_Co de_xx_xxxxx	Refer to List of Error Codes					
20*	SPI setting	BV	AC_SPI_xx_ xxxxx	False	True				
21*	Human Sensor setting	BV	AC_MDS_xx_ xxxxx	False	True				
22*	AC Indoor Notify	NC	AC_Notify_xx_ xxxxx	When the error occurred, send event to list of destination in the recipient list. (Max:8)					

*Optional

Outdoor Unit BACnet® Point List								
Instance Number	Object	Object Type	Object Name	Unit Inactive Text-1	Text-2	Text-3	Text-4	Text-5
1	Outside Temperature	AI	ODU_Outsid e_Temp_xx_ xxxxx	°C				
2*	Cool capacity compensation	AV	ODU_Cool_C ompensation _xx_xxxxx	0:5~7°C/1:7~9°C/2:9~11°C/3:10~12°C/ 3:11~13°C/5:12~14°C/6:13~15°C/ 14:Auto control (from ODU)				
3*	Heat capacity compensation	AV	ODU_Heat_ Compensatio n_xx_xxxxx	0:25kg/cm ² /1:26kg/cm ² / 2:27kg/cm ² /3:28kg/cm ² / 4:29kg/cm ² /5:30kg/cm ² / 6:31kg/cm ² /7:32kg/cm ² / 8:33kg/cm ² /14:Auto control (from ODU)				
4	Setting upper temperature limit	BI	AC_Heat_Li mitTemp_xx_ xxxxx	False	True			

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Outdoor Unit BACnet® Point List								
Instance Number	Object	Object Type	Object Name	Unit Inactive Text-1	Text-2	Text-3	Text-4	Text-5
5	Compressor Status	AI	ODU_Comp_Status_xx_xx xxx	Refer to the list of the integrated error codes				
6	Interface module notify	NC	IM_Notify_xx _xxxx	When the error occurred, send event to list of destination in the recipient list. (Max:8)				

*Optional

PART 3 – EXECUTION

3.1 INSTALLATION

- A. System shall be installed in accordance with manufacturer’s guidelines.
- B. Installing contractor shall attend and successfully complete the VRF Installation factory training class. Contractor shall submit certificate of completion as part of project closeout documents.
- C. Installing contractor shall install units to comply with building codes.
- D. VRF systems shall be installed in such a way as to permit access for routine maintenance.

3.2 COMMISSIONING

- A. Upon completion of installation and prior to final commissioning, contractor shall provide revised piping layout reflecting actual installation conditions to VRF technician.
- B. The system shall then be reviewed and commissioned by a Factory VRF Technician. Contractor shall provide a verified and submitted commissioning report to Factory Service Department, and to the owner’s agent verifying the system has met the requirements for proper installation, and function.
- C. Engage a Factory VRF Technician to train Owner’s maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 30

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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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 26 Section.
- 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 may be submitted in PDF electronic format.
- B. Submittals shall consist of a PDF Format sheets sized at 8-1/2" x 11" sheets and organized in an "ELECTRICAL SUBMITTALS" (Power and Lighting) zip file.
 - 1. Each Specification section shall be in individual PDF "binder".
- C. 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 individual binder sheets tabbed with the appropriate specification reference

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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. U.L. listed fire and smoke stopping assemblies for each applicable penetration
 - k) See specific sections of Specifications for further requirements.
6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
 - a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
 - b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
 - c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract and this section of the

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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. Long Lead Items
 6. 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. |
| 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

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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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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. System: 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 Orange County Project Manager and Engineer at least 72 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.

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. Alarm and bells.
 - 2. Fire detection devices, smoke detection devices.
 - 3. Controls and alarms.
 - 4. Outlets: Convenience.
 - 5. Switches: Regular, time.
 - 6. 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. Fire Alarm System:
 - a) Test each pull station. Record location of each tested device; note either operational or non-operational.
 - b) Test each heat detector. Record location of each tested device; note either operational or non-operational.
 - c) Test each duct mounted smoke detector with canned smoke and verify alarm activation, remote pilot light activation and damper operation. Record location of each tested device; note either operational or non-operational.

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- d) Test each smoke detector with canned smoke. Record location of each tested device; note either operational or non-operational.
 - e) Test tamper switches by closing the valve until signal is activated and verify trouble signal indication at the fire alarm control panel and annunciators. Record location of each tested device; note either operational or non-operational.
 - f) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.
 - g) Test Fire Alarm System sufficiently to determine existing operating condition of system. Pull the pull stations, check automatic detectors. Test minimum of one manual device per zone, and one automatic device per zone.
 - h) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.
 - i) Check main equipment cabinet for general operation of all components.
2. Lighting and Exit Lighting Fixtures In Areas of Remodel and/or Renovation:
- a) Test all lighting fixtures and exit lights for proper operation, list bad ballasts, lamps or broken lenses. Record location of fixtures tested.
 - b) Test light switches, relay controls, and photo cell controls for proper operation. Record location of tested device; note operational or non-operational.
3. Wiring Devices (Outlets) In Areas of Remodel and/or Renovation:
- a) Test receptacles for continuity, open grounds, open neutrals etc. Use circuit testers and record location and results of tested device.
4. Ground System:
- a) Test ground system at each permanent building and at each 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 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

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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

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.

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

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

1.4 WORK SEQUENCE

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

1.5 CODES, FEES, AND STANDARDS

- A. Conform to all applicable requirements of Section Reference Standards and Regulatory Requirements.
- B. Obtain permits and request inspections from authority having jurisdiction and applicable utility companies.
- C. Pay for all required licenses, fees, and inspections.

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- D. Contact the utility companies to determine if fees, charges or costs are required by the utility company for any shut-downs required for work in the MDP. These fees, charges or costs shall be included in Contractor's bid.
- E. Material shall be new and free of defects with UL listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if UL listing is not available for material.

1.6 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.
- B. The Contractor shall install all equipment so that all Code required and manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.
- C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.7 INVESTIGATION OF SITE

- A. Check site and existing conditions thoroughly before bidding. Advise A/E of discrepancies or questions noted.
- B. Each Bidder shall visit the site and shall thoroughly familiarize himself with existing field conditions and the proposed work as described or implied by the Contract Documents. During the course of the site visit, the electrical bidder shall verify every aspect of the proposed work and the existing field conditions in the areas of construction and demolition which will affect his work. The Contractor will receive no compensation or reimbursement for additional expenses he incurs due to failure to make a thorough investigation of the existing facilities. This shall include rerouting around existing obstructions.
- C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.
- D. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Contractor shall field verify dimensions of all site utilities, conduit routing, boxes, etc., prior to bidding and include any deviations in the contract. Notify A/E if deviations are found.
- E. All existing electrical is not shown. The Contractor shall become familiar with all existing conditions prior to bidding, and include in his bid the removal of all electrical equipment, wire, conduit, devices, fixtures, etc. that is not being reused, back to its originating point.
- F. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.
- G. Remove existing power, lighting, systems, material and equipment which are made obsolete or which interfere with the construction of the project. Reinstall power, lighting, systems, materials and equipment which are required to remain active for the facility to be fully functional.
- H. All items removed and not re-used shall be immediately turned over to Owner as they are made available by renovation. Remove items from job site and deliver to Owner's storage location(s)

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as directed by project manager. Discard complete items which Owner elects to refuse.

- I. Investigate site thoroughly and reroute all conduit and wiring in area of construction in order to maintain continuity of existing circuitry. Existing conduits indicated in Contract Documents indicate approximate locations only. Contractor shall verify and coordinate existing site conduits and pipes prior to any excavation on site. Bids shall include hand digging and all required rerouting in areas of existing conduits or pipes.
- J. Work is in connection with existing buildings which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. Notify Owner 72 hours in advance of any shut-down of existing systems. Perform work during non-general office operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.
- K. Bid shall include all removal and relocation of all piping, fixtures or other items required for completion of alterations and new construction.
- L. See Section Minor Electrical Demolition for Remodeling for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

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

1.9 MATERIALS AND EQUIPMENT

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

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1.10 MISCELLANEOUS CIRCUITS REQUIRED

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

1.11 SUPERVISION OF THE WORK

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

1.12 COORDINATION

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

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2. Mechanical Division of the Specifications
 3. Interior Design Drawings
 4. Millwork Design Drawings and Shop Drawings
- B. Contractor shall obtain set of Contract Documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Division 26 Sections or not.
 - C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.
 - D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.
 - E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
 - F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
 - G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design.
 - H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.
 - I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes due to these coordination efforts shall be made at no additional cost to the Owner.

1.13 PROVISION FOR OPENINGS

- A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.
- B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.
- C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.14 CONCRETE PADS

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- 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.

1.15 SURFACE MOUNTED EQUIPMENT

- A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

1.16 CUTTING AND PATCHING

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

1.17 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

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schedule.

1.18 PROGRESS AND RECORD DRAWINGS

- A. Keep two sets of blueline prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.
- B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:
 - 1. All raceways 1-1/2" and above, exactly as installed.
 - 2. All site raceways exactly as installed.
 - 3. Any combining of circuits (which is only allowed by specific written permission) or change in homerun outlet box shall be made on as-builts.
 - 4. Any circuit number changes on plan shall be indicated on as-builts.
 - 5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..
- C. Marked up prints as noted above are to be submitted to A/E for review.. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.
- D. The changes and alterations shall be transferred to CAD (AutoCAD Release 2006 or higher). Obtain CAD disk of the construction documents by the A/E, from the A/E. Generate/update the CAD disks to include all changes, additions, etc. on the accepted marked up prints. Label each drawing "As-Built" and date. Submit as-built CAD disk and reproducible of the as-builts.
- E. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit set prior to request for final payment and/or request for final observation.
- F. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

1.19 "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.

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1.20 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.

1.21 WASTE MATERIALS DISPOSAL

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

1.22 SUBSTANTIAL COMPLETION

- A. The Contractor shall be fully responsible for contacting all applicable parties including Orange County Project Manager and Engineer's observation of work representative 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.

1.23 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 26 Section.
- 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 may be submitted in PDF electronic format.
- B. Submittals shall consist of a PDF Format sheets sized at 8-1/2" x 11" sheets and organized in an "ELECTRICAL SUBMITTALS" (Power and Lighting) zip file.
 - 1. Each Specification section shall be in individual PDF "binder".
- C. 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 individual binder sheets tabbed with the appropriate specification reference

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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. U.L. listed fire and smoke stopping assemblies for each applicable penetration
 - k) See specific sections of Specifications for further requirements.
6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
 - a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
 - b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
 - c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract and this section of the

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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. Long Lead Items
 6. 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. |
| 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

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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:

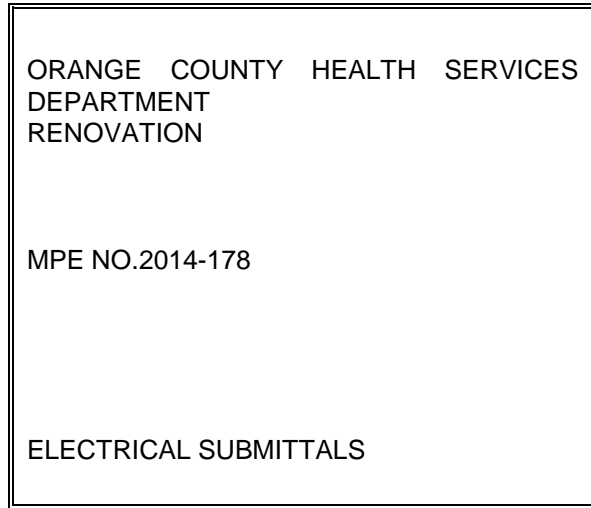
Matern Professional Engineering, Inc.
130 Candace Drive
Maitland, Florida 32751
Telephone No.: (407) 740-5020
Fax No.: (407) 740-0365

GENERAL CONTRACTOR:

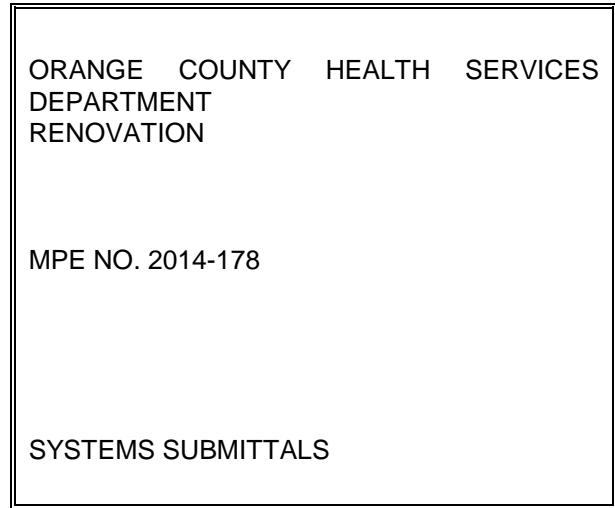
SUBCONTRACTOR:

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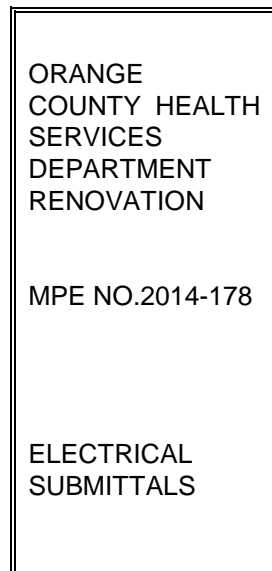
BINDER EXAMPLES FOR SUBMITTALS
Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder



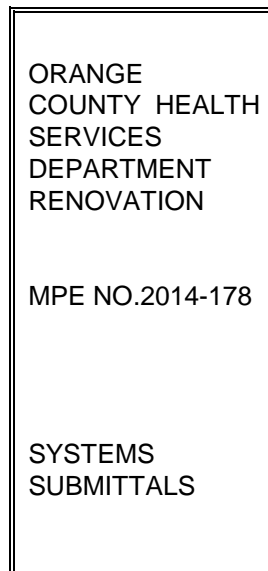
(Size To 8-1/2" x 11")



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



(Size To 11")



(Size To 11")

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SECTION 26 05 09 - REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Reference Standards and Regulatory Requirements applicable to Divisions 26, 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
BICSI	BICSI, Inc.
CRSI	Concrete Reinforcing Steel Institute
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
FFPC	Florida Fire Prevention Code
FLA	State of Florida

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FMC	Florida Building Code (Mechanical)
FPC	Florida Building Code (Plumbing)
FS	Florida Statutes
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers, Inc
IES	Illumination Engineering Society of North America
LPCR	Local Power Company Requirements
LPI	Lightning Protection Institute
NEC	National Electrical Code
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.

1.4 REGULATORY REQUIREMENTS

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

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

- a) Americans with Disabilities Act of 1990, as amended
- b) ADA Standards for Accessible Design, 2010
- c) American National Standards Institute
- d) American Society of Heating, Refrigerating and Air Conditioning Engineers
- e) American Society of Mechanical Engineers
- f) American Society for Testing and Materials
- g) Concrete Reinforcing Steel Institute
- h) Department of Community Affairs
- i) Electronics Industries Association/Telecommunications Industry Association

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- j) Florida Building Code, 2010
- k) Florida Fire Prevention Code, 5th edition
- 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
- v) NFPA 101 Life Safety Code
- w) Occupational Safety and Health Act
- x) Sheet Metal and Air Conditioning Contractors
- y) Underwriters Laboratories, Inc.
- z) 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 01 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

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

1.4 ABBREVIATIONS

- A. The following abbreviations or initials are used.
- | | |
|----------|--|
| A/C | Air Conditioning |
| AFD | Adjustable Frequency Drive |
| A.C. | Alternating Current |
| ADD # | Addendum # |
| A/E | Architect/Engineer (or Engineer when Architect not applicable) |
| AFF | Above Finished Floor |
| AFG | Above Finished Grade |
| AHU | Air Handler Unit |
| AIC | Amps Interrupting Capacity |
| AL | Aluminum |
| ALT | Alternate |
| AMP | Ampere |
| ANSI | American National Standards Institute |
| AWG | American Wire Gauge |
| @ | At |
| B.C. | Bare Copper |
| 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 |

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Comp.	Compressor
Conn.	Connection
Cond.	Condenser
Cont.	Continuous
C.R.I.	Color Rendering Index
C.T.	Current Transformer
CU.	Copper
C.U.	Compressor Condenser Unit
C.W.	Cold Water
D.B.	Direct Burial
D.C.	Direct Current
Disc.	Disconnect
DN.	Down
DPST	Double Pole Single Throw
DWG	Drawing
E.C.	Electrical Contractor (or General Contractor)
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
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
SPST	Single Pole Single Throw

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SF	Square Foot
SW.	Switch
SWBD	Switchboard
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 Dustight, 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 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.

3.8 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.

3.9 COLOR CODING

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

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- 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.

3.10 TAPS/SPLICES/CONNECTORS/TERMINATIONS

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

END OF SECTION

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

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

- A. Submit catalog cut sheets/product data on:
 - 1. Mechanical connectors.
 - 2. Ground bus bars and associated components.
 - 3. Testing equipment and procedures
- B. Product data shall prove compliance with specifications, National Electrical Code, manufacturers' specifications, and written installation data.

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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 WIRE

- A. Material: Stranded copper.
- B. Size: Size to meet NFPA 70 requirements as a minimum, increase size if called for on drawings, in these specifications, or as required for voltage drop.
- C. Insulated THWN (or bare as noted elsewhere).

2.2 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.

3.2 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.

3.3 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.

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- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the grounding bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.
- E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
- F. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.
- G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.
- H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.4 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:

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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.
 6. 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.
- 3.5 EXTERIOR GRADE (OR FREE STANDING ABOVE GROUND) MOUNTED EQUIPMENT
- A. General:
1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc) mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.
 2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC 250 based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.
- B. Electrical equipment connection rack mounted equipment.
1. Bond all metal parts as noted above.
- C. Grounding electrodes (ground electrodes system) shall be:
1. Located at each rack location.

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

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 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

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all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.

- I. Grounding provisions shall include double locknuts on all heavywall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.
- K. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.
- L. Bond together reinforcing steel and metal accessories in pool and fountain structures and bond to electrical system per NEC.
- M. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten full length rebars which contact the connected rebar (by Division 26 Contractor). Provide size and length of rod to meet NEC requirements.

3.8 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).

3.9 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.

3.10 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-

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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.

3.11 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.

3.12 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. Flexible Metal Conduit (FMC) NEC 348
 - 3. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
 - 4. Electrical Metallic Tubing (EMT) NEC 358
 - 5. Rigid Polyvinyl Chloride Conduit (Type PVC) NEC 352
 - 6. Fittings and Conduit Bodies

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

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

1.5 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70. (See Drawings and this and other sections of these Specifications for additional requirements).
- B. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.
- C. A raceway shall be provided for all electrical power and lighting, and electrical systems unless specifically specified otherwise.

1.6 SUBMITTALS

- A. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.
- B. Submit catalog cut sheet on all types of conduit bodies and fittings.
- C. Product data shall be submitted for acceptance on:
 - 1. Conduits.

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2. Conduit straps, hangers and fittings.
 3. PVC solvent(s) and bending box.
 4. Fitting entering and leaving the ground or pavement
 - D. Submit UL listed fire and smoke stopping assemblies for each applicable application.
 - E. Product data shall prove compliance with Specifications, National Electrical Code, National Board of Fire Underwriters, manufacturers' specifications and written installation data.
- 1.7 PROJECT RECORD DOCUMENTS
- A. Submit record documents to accurately record actual routing of conduits larger than 1.25".
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, properly store and protect products at the site.
 - B. Accept conduit on site. Inspect for damage.
 - C. Protect conduit from sun, rain, corrosion and entrance of debris by storing above grade. Provide appropriate covering.
 - D. Protect PVC conduit from sunlight.
- 1.9 PROJECT CONDITIONS
- A. Verify that field measurements are as shown on Drawings.
 - B. Verify routing and termination locations of conduit prior to rough-in.
 - C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 GENERAL

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

2.2 MINIMUM TRADE SIZE

- A. Rigid Conduit: 3/4".
- B. Non-metallic Conduit: 3/4" C.
- C. EMT: 3/4".
- D. Homeruns and Branches Underground: 3/4" C.
- E. Branches Aboveground: 1/2" C.
- F. All Types: 1/2" C.

2.3 RIGID METAL CONDUIT

- A. Comply with:
 1. ANSI C80.1.
 2. UL 6.
 3. NEC 344.
- B. Conduit material:
 1. Zinc coated or hot dipped galvanized steel.
- C. Fittings:
 1. Threaded.
 2. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape

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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 METAL CONDUIT PVC COATED

- 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, 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.

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

2.6 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Comply with:
1. NEC 350.
 2. ANSI/UL 360.
- B. Conduit material:
1. Flexible hot-dipped galvanized steel core, interlocked.
 2. Continuous copper ground built into core up to 1-1/4" size.
 3. Extruded polyvinyl gray jacket.
- C. Fittings:

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

2.7 ELECTRICAL METALLIC TUBING

- A. Comply with:
1. UL 797.
 2. ANSI C80.3.
 3. NEC 358.
 4. ANSI/UL 797.
- B. Conduit material: Galvanized steel tubing.
- C. Fittings:
1. ANSI/NEMA FB 1.
 2. Set screw.
 3. Zinc plated malleable iron or steel.
 4. Concrete tight.

2.8 RIGID POLYVINYL CHLORIDE CONDUIT

- A. Comply with:
1. NEMA TC 2.
 2. UL 651.
 3. NEC 352.
- B. Conduit material:
1. Shall be high impact PVC, tensile strength 55 PSI, flexural strength 11000 PSI.
- C. Fittings:
1. 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.

2.9 EXPANSION FITTINGS

- A. Expansion fittings shall be:
1. UL Listed, hot dipped galvanized inside and outside providing a 4" expansion chamber when used with rigid conduit, intermediate metal conduit and electrical metallic conduit, or:
 2. Be polyvinyl chloride and shall meet the requirements of and as specified elsewhere for non-metallic conduit and shall provide a 6" expansion chamber.
 3. Hot dipped galvanized expansion fitting shall be provided with an external braided grounding and bonding jumper with accepted clamps, UL listed for the application.
 4. Expansion fitting, UL listed for the application and in compliance with the 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

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- A. Underground Installations:
 - 1. Use rigid non-metallic conduit (PVC) only unless local Authority Having Jurisdiction or applicable codes/utility requirements, etc. require rigid steel conduit.
 - 2. Use galvanized rigid conduit, or PVC encased in steel-reinforced concrete.
 - 3. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.
 - 4. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with NEC 300.5 except the minimum cover for any conduit shall be 2'. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.
 - 5. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.
 - 6. PVC runs over 150' in length shall utilize rigid steel 90 degree elbows at each riser and at each change in direction. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC 250.80 and NEC 300.5.
 - 7. All underground service lateral raceways shall be protected as required by NEC 300.5, including requirements for installation of warning tape.
- B. In Slab Above or on Grade:
 - 1. Use coated rigid steel conduit, coated intermediate metal conduit (if accepted) or rigid non-metallic conduit.
 - 2. Coating of metallic conduit to be black asphaltic or PVC.
- C. Penetration of Slab:
 - 1. Exposed Location:
 - a) Where penetrating a floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 - 2. Concealed Location:
 - a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 48" above finished floor.
 - b) Where penetrating a floor in location other than that above use a black mastic coated or PVC coated galvanized rigid steel conduit.
- D. Outdoor Location:
 - 1. Above Grade:
 - a) Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 - b) In general all exterior conduit runs shall be rigid conduit (with PVC coating if within 10 miles of ocean or gulf) and threaded connectors as specified elsewhere.
 - c) Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.
 - d) Exterior conduits not on roof and not subject to damage (i.e. 6' above grade/floor or higher) may be rigid non-metallic PVC conduit as specified elsewhere. (Schedule 40 for low voltage Class II wiring, Schedule 80 for power wiring.)
 - e) Exterior conduits from grade level to 6' above grade may be rigid non-metallic Schedule 40 PVC for low voltage Class II wiring provided rigid metal conduit is used at transition from below grade to 12" above grade (due to weed eater damage, etc.).
 - 2. Metal Canopies:
 - a) Conduit runs except for canopy lighting raceways are not to be run on (top or bottom)

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of metal canopies roof systems. All new conduit shown on or at these areas shall be run underground.

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

E. Interior Dry Locations:

1. Concealed: Use rigid metal conduit, intermediate metal conduit, electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" AFF except where prohibited by the NEC (Places of Assembly, etc.).
2. Exposed: Use rigid metal conduit, intermediate metal conduit, electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.
3. Concealed or Exposed Flexible Conduit:
 - a) Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not longer than 6' in length with a ground conductor installed in the conduit or an equipment ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Exposed flexible steel conduit or seal tight flexible steel conduit shall not exceed 2' in length, unless written authorization by A/E for specific conditions is granted.

F. Interior Wet and Damp Locations:

1. Use rigid galvanized steel or intermediate metal conduit.

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

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

3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

- A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.
 1. Accepted pipe vise.
 2. Roller/bade type cutter or band saw.
 3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.
- B. Hangers shall be installed 8' apart.
- C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.

3.3 ADDITIONAL REQUIREMENTS FOR EMT

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

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

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

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

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

- A. Rigid non-metallic PVC conduit is not allowed anywhere inside building(s) except underground, in slab, in poured in place concrete, and in block wall up to first outlet box (if not over 40" AFF) if allowed by codes. Rigid non-metallic PVC conduit may be used exterior to building as stated elsewhere in these specifications.
- B. Join rigid non-metallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- C. Threads will not be permitted on rigid non-metallic PVC conduit and fittings, except for rigid steel to rigid non-metallic PVC couplings.
- D. Installation of rigid non-metallic PVC conduit shall be in accordance with manufacturer's recommendations.
- E. Rigid non-metallic PVC conduit shall not be used to support fixture or equipment.
- F. Field bends shall be made with accepted hotbox. Heating with flame and hand held dryers are prohibited.

3.6 SUPPORTS

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

3.7 EXPANSION FITTINGS

- A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- B. Expansion fittings shall be installed in the following cases: In each conduit run wherever it

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crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than 100' long and interval between expansion fittings in such runs shall not be greater than 100'.

3.8 GROUNDING

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

3.9 FIRE AND SMOKE STOPPING

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

3.10 GENERAL

- A. Install conduit in accordance with NECA Standard Practice of Good Workmanship in Electrical Contracting. Contractor shall layout all work prior to rough-in.
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange conduit to maintain headroom and present neat appearance.
- D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.
- E. Route conduit in and under slab from point-to-point.
- F. Do not cross conduits in slab.
- G. Maintain adequate clearance between conduit and piping.
- H. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

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

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- boot. Coordinate location with roofing installation specified under other Sections of these specifications.
- CC. 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.
 - DD. 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.
 - EE. 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. 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.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
- D. Install boxes to preserve fire resistance rating of partitions and other elements.
- E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- F. Use flush mounting outlet boxes in finished areas.
- G. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation. Provide minimum 24" separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Support all outlet boxes from structure with minimum of one 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two all-thread rod hangers, minimum.
- L. Do not fasten boxes to ceiling support wires.
- M. Support boxes independently of conduit.
- N. Use gang box where more than one device is mounted together. Do not use sectional box.
- O. Use gang box with plaster ring for single device outlets.

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- P. Use cast outlet box in exterior locations and wet locations.
- Q. Comply with applicable portions of the NECA National Electrical Installation Standards.
- R. Install outlets in the locations shown on the Drawings; however prior to rough-in, the Owner shall have the right to make slight changes in locations to reflect room furniture layouts.
- S. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.
- T. The Contractor shall relocate electrical boxes as required so that once installed, electrical devices will be symmetrically located with respect to the room layout.
- U. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.
- V. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.
- W. As a minimum, provide pull boxes in all raceways over 150' long. The pull box shall be located near the midpoint of the raceway length.
- X. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
- Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
- Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
- AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
- BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.
- CC. Outlet boxes mounted in metal stud walls are to be supported to studs with two screws inside of outlet box to a horizontal stud brace between vertical studs, or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall is finished.
- DD. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.
- EE. Mount Height.
 - 1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural Drawings and Shop Drawings for installing:

Switches	4'-0" AFF to top
Receptacles	1'-4" AFF to bottom
Lighting Panels	6'-6" AFF to centerline of highest breaker/fuse

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Phone outlets	1'-4" AFF to bottom
Fire Alarm Pull Stations	4'-0" AFF to top
Fire Alarm Strobe Lights	80" AFF to bottom
Thermostats	4'-0" AFF to top

2. Bottoms of outlets above countertops or base cabinets shall be minimum 2" above countertop or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural Drawings, prior to rough-in, regardless of height shown on Division 26 Drawings.
3. Height of wall-mounted fixtures shall be as shown on the Drawings or as required by Architectural Drawings and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

FF. Special Purpose Outlets.

1. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.

GG. Outlets in Fire/Smoke and Smoke Partitions/Walls.

1. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other accepted materials. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for products furnished under all Sections of these specifications.
- B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.
- C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closure in unused box opening.

END OF SECTION

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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.

PART 3- EXECUTION

3.1 GENERAL

- A. Install per NEC.
- B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
- F. Install boxes to preserve fire resistance rating of partitions and other elements.
- G. Align adjacent wall-mounted boxes with each other.
- H. Use flush mounting boxes in finished areas.
- I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation. Provide minimum 24" separation in acoustic rated walls.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Pull and junction boxes larger than 25 square inches shall be supported with two 3/8" all-thread rod hangers minimum.
- M. Pull and junction boxes used for Systems Divisions 27, 28 larger than 25 square inches shall be hinged cover type.
- N. Do not fasten boxes to ceiling support wires.
- O. Support boxes independently of conduit.
- P. Large Pull Boxes:
 - 1. Boxes larger than 100 cubic inches in volume or 12" in any dimension.:
 - a) Interior dry locations per NEC with screw covers.
 - b) Other locations use hinged enclosure under provisions of Section 26 27 16 Cabinets and Enclosures.
- Q. Outdoor Locations: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

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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 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.
- B. Letter Size:
 - 1. 1/8" letters for identifying individual equipment and loads.
 - 2. 1/4" letters for identifying grouped equipment and loads.
- C. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the Drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards, switchboards, motor control centers, disconnects and enclosed breakers shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire." In addition, provide phenolic label in panel to describe where the panel is fed from and location. For example, "Fed From MDP-1:3:5 Electrical Room #E101 Level 1." Nameplates for equipment listed below shall describe particular equipment name and associated panel/circuit, if applicable. The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and pushbutton station nameplates for that machine.
- D. The following items shall be equipped with nameplates:
 - 1. All motors, motor starters, motor-control centers, pushbutton stations, control panels, time

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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.

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>
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
TV	Zinger Pink S01150
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.

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- B. Identify conduit not installed in public areas with corresponding panel/circuit numbers or corresponding system type as described above. Spacing 20 ft. on center adjacent to color identification bands.

2.5 UNDERGROUND WARNING TAPE

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

PART 3 – EXECUTION

3.1 PREPARATION

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

3.2 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel pop rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Nameplates installed inside on dead front cover shall be self-adhesive tape. Do not drill or install screws in dead front.
- E. Identify new and existing conduit, junction boxes, and outlet boxes using field painting.
- F. Identify new underground conduit using underground warning tape. Install a minimum of one tape per trench at 6" below finished grade. For trenches exceeding 24" in width, provide one tape per 24" of trench width spaced evenly over trench width.
- G. Install wire markers at all new connections and terminations, and at existing connections and terminations modified or altered.

END OF SECTION

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SECTION 26 08 03 - DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1. Communications Systems
 - a) Each system included in Systems sections.
2. Electrical Entrance Equipment
 - a) Circuit breakers
 - b) Fuses and fuseholders
 - c) Meters (where applicable)
3. Miscellaneous Electrical Equipment
 - a) Electrical systems controls and equipment
 - b) Electrical power equipment
 - c) Relays
 - d) Special transformers
 - e) Starting devices
 - f) Surge suppression equipment
4. Lighting Fixtures (include relamping and replacing lenses)
 - a) Exit and safety fixtures
 - b) Fixtures, indoor and outdoor
5. Lightning Protection System
6. Distribution Equipment
 - a) Lighting and appliance panelboards
7. Wiring Devices
 - a) Low-voltage controls
 - b) Switches: regular, time

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

1.3 TIME

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

1.4 ATTENDING PARTIES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

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

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- B. Demonstrate by "start-stop operation" how to work the controls, how to reset protective devices, how to replace fuses, and what to do in case of emergency.
- C. Performance Verification and Demonstration to Owner
 - 1. Submit Check Out Memo form for each item, equipment and system. Copy to be included in each Operation and Maintenance Manual.

END OF SECTION

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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 _____

Equipment Manufacturer _____

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

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

CHECKED BY:

MANUFACTURER'S REPRESENTATIVE (print)

ADDRESS

TELEPHONE, FAX, E-MAIL

MANUFACTURER'S REPRESENTATIVE (signature, title)

DATE CHECKED

WITNESSED BY:

CONTRACTOR'S REPRESENTATIVE (signature, title)

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

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SECTION 26 08 13 - TESTS AND PERFORMANCE VERIFICATION OF ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section pertains to the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.
- B. Operate system for a three day period. Do performance verification work as required to show that the system is operating correctly in accordance with design. Supply instruments required to read data. Adjust system to operate at the required performance levels.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 TESTS

- A. System:
 - 1. General: After installation of all conductors and before final acceptance, make required tests to determine proper functioning of all circuits. Furnish all necessary instruments required to make tests and correct any deficiencies found. Prior to energizing, circuits shall be "rung-out" to verify opens, intentional and non-intentional grounds, continuity and detect short circuits by accepted constant megger.
 - 2. Procedure:
 - a) All wires in conduit that are shorted or unintentionally grounded shall be replaced.
 - b) Insulation resistance of all feeder conductors and all conductors AWG #1 and larger shall be tested. This is to include all new conductors and/or all existing conductors that are connected and/or extended. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps, and connections are made, except connection to source and point of final termination at distribution or utilization equipment.
 - c) Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using AVO Biddle (or accepted equal) megger at not less than 1000 volts dc. Resistance shall be measured from conductor to conduit (ground). Testing methodology shall conform to short-time or spot-reading procedural recommendations of AVO Biddle Instruments for specific megger being used. Acceptable insulation resistance of conductors rated at 600 volts shall not be less than 1 megohm.
 - d) Conductors that do not satisfy test requirements of paragraph c) above, shall be removed, replaced, and testing repeated on new cable at no additional cost to the Owner. All tests shall be performed by licensed electrician trained in the use of test instruments. Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed and complete Conductor Insulation Resistance Test form (see Section 26 01 00 Operation and Maintenance Manuals) and submit five copies to Engineer for acceptance. Test shall be witnessed by Owner's Representative and Engineer (if so desired). Final acceptance data is to be submitted in O & M Manual.
 - e) Test reports shall identify each feeder conductor tested, date, time and result of

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test, weather conditions and range, test voltage, and serial number of the megger instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced, and additional test shall be performed.

- f) Observe all safety instructions set by testing equipment manufacturer. Application of voltage testing involves risk of electric shock and sparking.
3. Take readings of voltage and amperage at building main disconnect switch and at main for each panel, at primary and secondary side of each transformer, and at the end of the longest branch circuit at each panel. The above readings shall be taken 1) "no load" conditions and 2) "full load" conditions with all equipment using electricity. Tabulate readings, complete Voltage and Amperage Readings (Tabulated Data) form (see Section 26 01 00 Operation and Maintenance Manuals) and submit five copies to the Engineer for acceptance. Final accepted data is to be submitted in O & M Manual.
- B. Motors:
1. Test run each motor via motor's control unit in both manual mode and automatic mode. Verify proper operation, voltage and rotation.
 2. Test run each motor furnished under this Division of the Specifications and all existing motors specifically noted on the Drawings and/or Specifications to be tested:
 - a) With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate +/- 10% from the nameplate ratings, the condition shall be corrected. Notify the Engineer immediately should deviations occur.
 - b) Record results of existing motors tested and submit values to A/E in writing.
 - c) Test the insulation resistances of all motor windings to ground with a megger before applying line voltage to the motors. If these values are less than 1 megohm, the Contractor furnishing the motor shall be responsible for correcting the error.
 - d) Tabulate readings, complete Motor Test Information form (see Section 26 01 00 Operation and Maintenance Manuals) and submit five copies to the Engineer for acceptance. Final accepted data is to be submitted in O & M Manual.
- C. Grounds:
1. Test each raceway for raceway continuity as called for in Section 26 05 26 Grounding and Bonding.
 2. Test each grounding system used in the project as called for in Section 26 05 26 Grounding and Bonding.
 3. Submit Ground Test Information form (see Section 26 01 00 Operation and Maintenance Manuals) for every grounding system in the project, including but not limited to, each ground rod installation, each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment), and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
 4. Grounding resistance shall be as called for in Section 26 05 26 Grounding and Bonding.
 5. Testing shall be 3-point method in accordance with IEEE recommended practice.
 6. Transformer grounding.
- D. Communications:
1. See specific sections of these Specifications for further requirements.

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E. Service Ground Fault Protection System:

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

F. Ground Fault System:

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

END OF SECTION

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SECTION 26 09 23 - OCCUPANCY SENSORS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensors, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system as described herein.
- B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.
- C. The Occupancy Sensor System shall sense the presence of human activity within the desired space and fully control the "On" / "Off" function of the lights.
- D. Sensing technologies shall be completely passive meaning that they will not emit any radiation that is known to interfere with certain types of hearing aides, or electronic devices such as electronic white board readers. Acceptable programmable shall be Passive Infrared (PIR), and/or PIR/Microphonic Passive Dual Technology (PDT). Ultrasonic or Microwave based sensing technologies shall not be accepted.
- E. Time Delay settings shall be factory set at 10 minutes, and shall not be field adjusted unless specifically instructed by Engineer. This delay selection is based on lamp life vs. energy savings and sensor performance. Automatic adjustments to this delay period by the sensor shall not be permitted.
- F. In high humidity or cold environments, the sensors must be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
- G. Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay and Photocell field adjustments shall be provided as needed.
- H. The installer shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.3 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.

1.4 DESIGN REQUIREMENTS

- A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

1.5 EQUIPMENT QUALIFICATION

- A. All components shall be UL listed and offer a five year warranty.

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1.6 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings showing actual field conditions for this project's installation.

B. Product Data:

1. Submit data sheets on sensors, control units and all junction boxes and mounting accessories, including all wiring diagrams (standard).

C. Submit manufacturer's installation instructions.

1.7 PROJECT RECORD DOCUMENTS

A. Submit record documents to accurately record actual location of each sensor and control unit.

B. Revise diagrams included in Drawings to reflect actual control device connections.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit instructions for operation, use, and adjustment of system.

B. Submit recommended preventive maintenance procedures and materials.

C. Submit parts list.

1.9 APPROVED MANUFACTURER AND SUBSTITUTIONS

A. Approved manufacturer shall be Sensor Switch, Inc. (800) 727-7483 www.sensorswitch.com.

B. Substitutions must be submitted no less than 14 days prior to bid date. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with substitution request. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to the exception. If substitution is approved, the Contractor shall bear the responsibility of a fully functional system to the Owner's and Engineer's satisfaction.

C. Product must be manufactured in the USA and be warranted for five years.

1.10 WARRANTY

A. Contractor shall warrant all equipment furnished in accordance with this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications.

B. The supplier's obligation shall include repair or replacement and testing of all parts of equipment found to be damaged, defective or non-conforming and returned to the supplier. This shall be at no cost to the Owner.

C. Warranty on sensor and control units will be for a period of five years.

D. The warranty shall commence upon the Owner's acceptance of the project.

E. Warranty on labor shall be for a minimum period of one year.

1.11 INSTRUCTION TO OWNER

A. The Contractor shall provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

PART 2 - PRODUCTS

2.1 WALL SWITCH SENSORS – SMALL AREAS

A. Sensor shall recess into single gang switch box and fit a standard Decora opening.

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- B. Sensor must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
- C. Sensor shall use PIR sensing incorporating a nominal 1/2" focal length lens viewing 9" above and below horizontal view pattern measured at 10'.
- D. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, and no switch as specified.
- E. In areas with inboard/outboard switching, sensor shall provide two dedicated relays and override switches. Each relay shall have independent programmable time delays.
- F. In areas with obstructions to the occupant's workspace, sensor shall utilize programmable dual technology PIR/Microphonic sensing.
- G. All models shall have "Reduced Turn On." This is a field programmable function for problematic areas with unforeseen reflective surfaces. False turn on shall be eliminated with this feature.
- H. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified herein or shown on Drawings.
 - 1. WSD (PIR)
 - 2. WSD-2P (PIR inboard/outboard)
 - 3. WSD-PDT (PIR/Microphonic)
 - 4. WSD-PDT-2P (PIR/Microphonic inboard/outboard)
 - 5. WSD-SA (PIR Semi-Automatic)
 - 6. WSD-PDT-SA (PIR/Microphonic Semi-Automatic)

2.2 WALL SWITCH SENSORS – LARGE AREAS

- A. Sensor shall surface mount to single gang switch box.
- B. Sensor shall use PIR sensing incorporating a nominal 1" focal length lens viewing 9" above and below horizontal view pattern measured at 20'.
- C. Sensor shall have optional feature for photocell/daylight override.
- D. In areas with inboard/outboard switching or two circuits, sensor shall provide two dedicated relays and override switches.
- E. In areas with obstructions to the occupant's workspace, sensor shall utilize dual technology PIR/Microphonic sensing.
- F. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified.
 - 1. LWS (PIR)
 - 2. LWS-2P (PIR inboard/outboard or two circuits)
 - 3. LWS-PDT (PIR/Microphonic)
 - 4. LWS-PDT-2P (PIR/Microphonic inboard/outboard or two circuits)

2.3 LOW VOLTAGE SENSORS

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- A. Sensors shall operate on a Class 2, 3-conductor system. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 milliamps so that up to 14 sensors may be connected to a single power pack.
- B. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
- C. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.
- D. Specific sensors shall have optional feature for photocell/daylight override, and/or Low Temperature/High Humidity environments.
- E. Sensors shall be the following Sensor Switch model numbers.
 - 1. CM-9 (PIR Ceiling)
 - 2. CM-PDT (PIR/Microphonic Ceiling)
 - 3. CM-10 (PIR Ceiling-Extended Range)
 - 4. CM-PDT-10 (PIR/Microphonic Ceiling-Extended Range)
 - 5. WV-PDT (PIR/Microphonic Wall Mount)
 - 6. HW-13 (PIR Hallway)
 - 7. HM-10 (PIR High Bay Aisle Way)
 - 8. CM-6 (PIR High Bay)

2.4 POWER PACKS

- A. Power packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power for up to 14 remote sensors.
- B. Power pack shall securely mount to junction location through a threaded 1/2" chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
- C. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- D. Power pack shall incorporate a Class 1 relay and an ac electronic switching device. The ac electronic switching device shall make and break the load, while the relay shall carry the current in the "On" condition. This system shall provide full 20 amp switching of all load types, and be rated for 400,000 cycles.
- E. Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.
- F. Power packs shall be the following Sensor Switch model numbers.
 - 1. PP-20 (Single Pole)
 - 2. PP-20-2P (Two Pole)
 - 3. SP-20 (Slave Pack)

2.5 LINE VOLTAGE SENSORS

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- A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
- B. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.
- C. Multiple sensors controlling the same load shall be wired in parallel.
- D. Wall mounted sensors must be installed at 7' to 8' above the floor. Single and two circuit units shall be available.
- E. High bay sensors controlling HID Bi-Level must incorporate a Start to High timer on initial power up to provide full light output for up to 20 minutes to prevent shortened lamp life.
- F. Specific sensors shall have optional feature for Low Temperature/High Humidity environments.
- G. Sensors shall be the following Sensor Switch model numbers.
 - 1. CMR-9 & CMR-9-2P (PIR Ceiling Mount- single and two pole)
 - 2. CMR-PDT & CMR-PDT-2P (PIR/Microphonic Ceiling Mount- single and two pole)
 - 3. CMR-10 & CMR-10-2P (PIR Ceiling Mount Extended Range - single and two pole)
 - 4. CMR-PDT-10 & CMR-PDT-10-2P (PIR/Microphonic Ceiling Mount Extended Range - single and two pole)
 - 5. WVR-16 & WVR-16-2P (PIR Wall Mount single and two pole)
 - 6. WVR-PDT & WVR-PDT-2P (PIR/Microphonic Wall Mount single and two pole)
 - 7. HMR-10 (PIR High Bay Aisle Way)
 - 8. CMR-6 & CMR-6-SH (High Bay Ceiling)

2.6 WIRING

- A. Between sensors and controls, units shall be a minimum three conductors, 18 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable accepted for use in plenums.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and equipment in accordance with manufacturer's instructions.
- B. It shall be the Contractor's responsibility with the supplier's assistance to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.
- C. Rooms shall have ninety to one hundred percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within in the room(s).
- D. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms which are to be provided with sensors.
- E. The Contractor shall provide additional sensors if required to properly and completely cover the respective room.
- F. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components

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

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

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

2.5 SERVICE ENTRANCE EQUIPMENT

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

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- 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 27 26 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
 - 1. Wall switches.
 - 2. Wall dimmers.
 - 3. Receptacles.
 - 4. Device plates and decorative box covers.

1.3 REFERENCES

- A. NEMA WD 1 General Requirements for Wiring Devices
- B. NEMA WD 6 Wiring Devices Dimensional Specifications

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

- A. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 - 1. Submit product data on all types of wiring devices including plates and engraving.
- B. Submit Manufacturer's Instructions:
 - 1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

1.6 QUALIFICATIONS

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

1.7 EXTRA MATERIALS

- A. Provide a minimum of two screwdrivers of each type of tamper proof screw used on project.
- B. Turn over to Owner and submit Spare Parts/Maintenance Stock Certification. (See Section 26 01 00 Operation and Maintenance Manual).

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices shall be Specification Grade as minimum.

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- B. General purpose wiring devices shall meet NEMA standard WD-1, Wiring Devices, General Purpose. Special purpose devices shall conform to the requirements of NEMA standard WD-5, Wiring Devices, Special Purpose.
- C. All wiring devices shall bear UL labels.
- D. All devices of one type (i.e. all snap switches, all duplex receptacles, etc.) shall be by the same manufacturer. Hazardous Location and Special Purpose Devices may not be available from the same manufacturer; this shall constitute the only exception to this requirement of single-source.
- E. Corrosion resistant devices shall be as specified for normal usage, and fabricated of yellow color melamine plastic. Where "Weatherproof" type is indicated for exterior or wet locations, provide matching self-closing cover with gasketed seals at plate/wall junctions and for cover.
- F. Provide factory packaged wiring devices having high impact strength molded plastic bodies.
- G. Except where specifically required in these Specifications, use of interchangeable type or combination switch-receptacle-pilot devices is not acceptable and shall be removed.

2.2 WALL SWITCHES

- A. Manufacturers:
 - 1. See Drawings.
- B. General:
 - 1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in Specifications and/or on Drawings.
 - 2. Switches shall be toggle or key-operated types, as indicated on the Drawings. All key-operated switches shall be keyed alike.
 - 3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "On". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.
 - 4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front relampable.
 - 5. Snap switches installed in hazardous locations shall be UL listed for the type of location (class and division).
 - 6. Voltage and ampere rating of switches shall be marked on switch, and shall conform to voltage of system to which applied.
- C. Description: NEMA WD 1, heavy-duty, ac only general-use snap switch.
- D. Voltage Rating: 120-277 volts, ac.
- E. Current Rating: 20 amperes minimum.
- F. Ratings: Match branch circuit and load characteristics.

2.3 WALL DIMMERS

- A. Manufacturers:
 - 1. See Drawings.
- B. Description: NEMA WD 1, semiconductor dimmer for incandescent lamps, type as indicated on Drawings.

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- C. Device Body: Plastic with rotary knob or linear slide as called for on Drawings.
- D. Voltage: 120 volts or as required to match application.
- E. Power Rating: Match load shown on Drawings; 600 Watts minimum.
- F. Accessory Wall Switch: Match dimmer appearance.
 - 1. Same manufacturer and style as dimmer switch.

2.4 RECEPTACLES

- A. General:
 - 1. All receptacles shall be of standard NEMA configuration, as indicated on the Drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration. Color to match plates unless specifically noted otherwise in specifications and/or on drawings.
 - 2. Duplex receptacles shall have integral UL listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of Industrial Fluorescent light fixtures on the same switching circuit. Receptacle face to be impact resistant nylon.
 - 3. Weatherproof duplex receptacles shall be provided in all exterior locations, and shall be ground fault circuit interrupting (GFCI) types, with weatherproof cover plates allowing use of receptacle with cover in closed position.
 - 4. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.
 - 5. Duplex receptacles shall have back and side wired screw pressure terminals.
- B. Description: NEMA WD 1; heavy-duty general use receptacle.
- C. Configuration: NEMA WD 6; heavy-duty, general use type as specified and indicated.
- D. Convenience Receptacle: Type 5-20.
- E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- F. Manufacturers:
 - 1. See Drawings.

2.5 COVER PLATES

- A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.
- B. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel having a nominal thickness of .04" and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.
- C. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed..
- D. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the Drawings. Metallic plates and nylon plates in ivory, beige, gray, and white shall be engraved with black fill. Red, brown, and black nylon plates shall be engraved with white fill.

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- E. Unless specifically noted otherwise in Specifications or on Drawings, all outlets for telephone and other communications and data systems shall be provided with standard size one-piece cover plates having a minimum 3/4" diameter bushed hole in the center unless specifically noted otherwise in Specifications and/or on Drawings. Where telephone conductors are installed, plates shall contain telephone type, polarized plug-in receptacles.
- F. All device plates (including systems device plates and trims) located in secure areas such as cells, dayrooms, holding rooms, recreation areas, etc., shall have security wall plates (minimum 10 gauge) with minimum 12 gauge galvanized steel backplate. Plates shall have TORX counter pin reject type tamperproof screws.
- G. All device plates (including systems device plates and trims) and blank plates located in all secure areas shall be mounted with tamper proof screws, unless otherwise noted.

2.6 COLOR

- A. Wiring devices connected to normal power and located in unfinished spaces shall be grey color. Devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the following list of standard colors: ivory, beige, gray, white, brown, black.
- B. Cover plates for devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the above list of standard colors or #302 stainless steel.
- C. All devices and coverplates in paneled walls shall have finish to match paneling.
- D. Devices connected to [the life safety or critical branch of the emergency distribution system] emergency power shall be red color, except where established building standards and/or isolated ground devices require otherwise. Coordinate before purchase.
- E. Contractor shall modify any given catalog numbers as required to procure devices and plates of the proper color.

2.7 FLUORESCENT DIMMERS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify conditions under provisions of Division 01 General Requirements and any other applicable supplemental requirements/conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify floor boxes are adjusted properly.
- E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

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

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- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on bottom.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- H. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.
- I. Where two or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang box and combination multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.
- J. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.
- K. In finished areas provide same type of plate for all surface mounted devices as for recessed mounted devices.
- L. In any room where new and existing construction is present, all receptacles, switches, and coverplates which are existing to remain shall be changed as required to match new work.
- M. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.
- N. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.
- O. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.
- P. All devices shall be installed so that only one wire is connected to each terminal.
- Q. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.
- R. Receptacles shown to be floor mounted shall be installed in floor boxes (with coverplates) which are approved for this use.
- S. Connect wiring devices by wrapping conductor around screw terminal.
- T. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- U. Install protective rings and split nozzle on active flush cover service fittings.
- V. Install local room area wall switches at door locations on the lock side of the door approximately 4" from the jamb. Where locations shown on the Drawings are in question, provide written request for information to A/E prior to rough-in.

3.4 NEUTRAL CONDUCTOR CONNECTIONS

- A. Each receptacle's "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.

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3.5 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under other Sections of these Specifications to obtain mounting heights specified and indicated on Drawings.

3.6 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION

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SECTION 26 28 19 - ENCLOSED DISCONNECT SWITCHES

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

- A. Provide all labor, materials, and equipment necessary to properly install switches as shown on the Drawings and as required by codes.
- B. Coordinate with Division 23 Contractor and Specifications as to who is to provide disconnect switches for mechanical equipment. Provide all disconnect switches not being provided by Division 23 Contractor.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver switches in factory wrapped packaging to the site. Handle switches carefully to prevent damage. Store in a clean, dry space protected from dirt, water, and physical damage. Do not install damaged switches.

1.4 QUALITY ASSURANCE

- A. The manufacturer of switches shall be the same as that of the panelboards.

1.5 SUBMITTALS

- A. Submit catalog cut sheet on each type of disconnect switch to be used on this project. Submit catalog cut sheet on enclosure locks to be used on this project.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

- A. Switches shall be heavy duty types with visible, quick-make, quick-break blades.
- B. Units for 2-speed motors shall be 6-pole in a single enclosure. Use of two 3-pole units will not be acceptable.
- C. Provide ground bus, and where required a solid neutral bus.
- D. Switches shall be fusible or nonfusible as denoted on the Drawings or as required by the equipment served from the switch. Fusible switches shall have rejection type fuse holders.
- E. Terminal lugs shall be rated for 75 degrees Centigrade.
- F. Enclosures, unless otherwise noted, shall be NEMA 1 for indoor locations and NEMA 4X stainless steel for outdoor locations as a minimum. All switches mounted outdoors including those noted to be NEMA 3R on drawings shall be heavy duty type 4X, watertight, corrosion resistant
- G. The enclosure shall be interlocked with the switch handle such that the enclosure door or cover cannot be opened with the switch in the "ON" position. The switch handle shall be capable of being padlocked in the "OFF" position but not in the "ON" position.
- H. Finish for NEMA I units shall be standard baked gray enamel finish over a rust inhibiting phosphate primer.
- I. Each disconnect switch shall be provided with a Homac #ELB-2 or similar enclosure lock. Homac #ELB-2 is available from Graybar Electric.
- J. Disconnect switches installed between any variable speed drive type of unit (VFD, AFD, USD,

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etc.) and its respective motor(s), shall have auxiliary break before break (open) interlock control contact.

- K. Disconnect switches installed to disconnect HVAC equipment are to be fusible type with fuses as recommended by HVAC manufacturer.

2.2 RATING

- A. The size, number of poles, and fusing for each switch shall be as denoted on the Drawings. As a minimum, no less than one pole for each ungrounded conductor shall be provided. Switches shall be rated 250 VAC or 600 VAC as required by the circuit to which it is connected.
- B. Switches serving motors with more than one set of windings shall have the number of poles necessary to disconnect all conductors to all windings in a single switch. Switches serving motor loads shall be horsepower rated of sufficient size to handle the load.

2.3 SERVICE ENTRANCE EQUIPMENT

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

2.4 KITCHEN EQUIPMENT

- A. All switches in kitchen areas, wet areas, etc. to be NEMA 4 stainless steel.

2.5 ENCLOSED CIRCUIT BREAKERS

- A. Molded Case Circuit Breakers: NEMA AB1, plug-on 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. Breakers shall be HID rated. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- B. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all switches in accordance with the manufacturer's written instructions, NECA National Electrical Installation Standards, the applicable requirements of the NEC, and recognized industry practice.
- B. All switches shall be firmly anchored to walls and supporting structures (where used) using appropriate installation. Switches shall be installed with the turning axis of their handles approximately 5'-0" above finished floor unless otherwise indicated. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.
- C. Switches shall be mounted in accessible locations chosen where the passageway to the switch is not likely to become obstructed. Where a switch serves as the disconnecting means for a load, the switch shall be located as close as practical to the load with the switch handle within sight of the load.
- D. Provide and install lugs on disconnect switch as required to accept conductors called for on Drawings.
- E. Disconnect switches shall not be mounted on equipment unless specifically noted or required, and meet all applicable codes, etc. If switches are noted or required to be mounted on equipment, they shall have vibrator clips on fuses and be connected to conduit system with liquid tight flexible conduit.

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- F. Provide and install enclosure lock on each disconnect switch. Enclosure lock bolt shall be tightened firmly but not tight enough to break bolt.
- G. Coordinate all requirements for controls between variable speed drive unit and its respective motor with drive specification, manufacturer, provider and installer. Provide auxiliary contacts, relays, etc. as required.

END OF SECTION

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SECTION 26 41 13 - LIGHTNING PROTECTION SYSTEM

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. Air terminals and interconnecting conductors.
 - 2. Grounding and bonding for lightning protection.

1.3 REFERENCES

- A. ANSI/NFPA 780 Standard for the Installation of Lightning Protection Systems
- B. ANSI/UL 96 Lightning Protection Components
- C. UL 96A Installation Requirements for Lightning Protection Systems
- D. LPI - Lightning Protection Institute
- E. OSHA Standard 29 CFR
- F. Section 26 05 26 Grounding and Bonding
- G. Section 26 08 13 Tests and Performance Verification

1.4 REGULATORY REQUIREMENTS

- a) ANSI/NFPA 780 UL 96A Master Label for:
 - 1. New installation, and reconditioned installationDESCRIPTION
- A. A Lightning Protection System shall be provided and installed on the structure(s) even though not shown on Drawings, by experienced installers in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Underwriters Laboratories. All equipment to that result shall be included whether or not specifically called for herein with the additional requirement that the system shall meet all the requirements of LPI.
- B. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.
- C. Provide complete lightning protection system for all pavilions and/or structures, including but not limited to all shelters and play ground pavilions.
- D. Materials shall comply in weight, size and composition with the requirements of Underwriters' Laboratories and the National Fire Protection Code relating to this type of installation, and shall be UL labeled.
- E. All materials, where available by any one manufacturer, shall be cast.
 - 1. System shall comply with the following:

1.6 SUBMITTALS

- A. Submit shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details. Drawings shall include full layout of cabling and points, and connections.
- B. Submit product data showing dimensions and materials of each component, and include

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indication of listing in accordance with ANSI/UL 96.

- C. Submit manufacturer's installation instructions.
- D. Submittal shall include ground wells as called for in Section 26 05 26 Grounding and Bonding.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit project record documents.
- B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in lightning protection equipment with minimum five years documented experience and member of the Lightning Protection Institute.
- B. Installer: Authorized installer of manufacturer with minimum five years documented experience and member of the Lightning Protection Institute.

1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference one week prior to commencing work of this Section.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with roofing and exterior and interior finish installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Thompson Lightning Protection, Inc. - Premium Line
- B. Independent Protection Company, Inc. - Premium Line
- C. Heary Bros. Lightning Protection - Premium Lines
- D. Harger Lightning Protection, Inc. - Premium Line

2.2 MATERIALS

- A. Components: In accordance with ANSI/UL 96 and LPI.
- B. Air Terminals:
 - 1. Air Terminals shall be solid (aluminum or copper) as required to match roof conductors, shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface.
 - 2. Terminals shall be of such length as to comply with NFPA 780.
 - 3. Air Terminal for Chimney: Lead-coated copper.
- C. Conductors:
 - 1. Roof conductors shall consist of (aluminum or copper) complying with the weight and construction requirements of the code. Roof conductor material shall match and/or be compatible with roof flashing material.
 - 2. Down conductors shall be copper and shall be provided where shown installed in PVC conduit and hidden within the structure.
 - 3. If routing of down conductor raceway is in location where PVC is not allowed per code, install in metal conduit to meet code and bond both ends.
- D. Fastener:

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1. Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor.
- E. Connectors and Splicers:
 1. Above-Grade and Accessible: They shall be bronze or aluminum as required to be compatible with conductor being connected.
 2. Below-Grade or Concealed: Exothermic connections
- F. Ground Rods:
 1. Ground rods shall comply with all requirements of Section 26 05 26 Grounding and Bonding and Section 26 08 13 Tests and Performance Verification.
 2. Install in ground wells in accessible area (not in sidewalks, unless specifically accepted by Engineer).
- G. Ground Plate: Copper.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that field measurements are as shown on shop drawings.
- C. Beginning of installation means installer accepts existing conditions.

3.2 PROTECTION OF SURROUNDING ELEMENTS

- A. Protect elements surrounding work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with UL 96A, ANSI/NFPA 780, and LPI.
- C. Install ground rods in accordance with Section 26 05 26 Grounding and Bonding. Where conflict exists between the requirements of Section 26 05 26 Grounding and Bonding and this Section, the most stringent shall govern.
- D. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed within structure, and shall be run in 1" conduit complying with NEC. See Paragraph 'F' below and NFPA 780 4.15.1.
- E. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- F. Conductors concealed in steel reinforced concrete shall be installed, bonded, etc. per NFPA 780 4.15.3. Specific attention is brought to the requirements of NFPA 780 4.9.13 requiring down conductors to be connected to reinforced steel at its upper and lower extremities.
- G. Lightning protection system shall be bonded to metal bodies as required by NFPA 780 4.21.
 1. The Contractor shall provide proper connection of the lightning protection system to all grounded media in and around the protected structure (see NFPA 780 4.20, Potential Equalization).
 2. The Contractor shall provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14, including electric service, telephone and antenna system grounds, underground metallic piping systems, underground metal conduits.

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3. All fences, gates, handrails, metal flagpoles, metal bleacher seats, metal playground equipment shall be grounded and bonded to the grid.
 4. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.
- H. Provide proper connections of lightning protection system to all grounded media in and around the protected structure per NFPA 780 4.20 Potential Equalization.
- I. Provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14 including electric service, telephone and antenna system grounds as well as underground metallic piping systems, underground metal conduits, etc.
- J. All exposed conductors located 6' or less above finished floor or finished grade is to be suitably protected/shielded as well as other exposed locations where conductor is subject to mechanical damage.
- K. Coordinate and receive acceptance of all penetrations of roofing system and mounting to roofing system with Architect and Roofing Contractor prior to submittal of shop drawings.
- L. Coordinate and receive acceptance of all connections to structural steel, rebar, etc. with Structural Engineer prior to submittal of shop drawings.
- M. Submittal of shop drawing by Contractor is evidence that the Contractor has received acceptance of penetrations, connections, etc. by all parties and that Contractor assumes responsibility for such penetrations, connections, etc.
- N. Ground Terminals:
1. Ground connections shall be made in accordance with requirements of all applicable codes and Section Grounding and Bonding (including but not limited to requirements for testing, ground rods, materials, wells, etc.).
 2. Ground rods shall be placed outside, a minimum of 2' from building foundations. Top of rod shall be at least 1' deep into earth (i.e. with minimum earth cover of 1'). Install in ground well. Install gravel/rock in base of all ground well, from well bottom to minimum of 6" below well bottom.
 3. Each and every ground rod location shall consist of:
 - a) Two or more 30' ground rods (5/8" copper) at no less than 60' spacing shall be driven vertically to a depth resulting in 1' earth cover.
 - b) Bond the two or more ground rods together with a cable size that meets the applicable requirements of NFPA 780 for Class I or II locations as applicable.
 - c) Provide additional rod electrodes as required to achieve specified ground resistance.
 - d) Complete installation shall exceed the minimum requirements of NFPA 780.
 - e) Provide grounding well enclosure at each ground rod location in accordance with Section 26 05 26 Grounding and Bonding.
 4. Install in accordance with OSHA Standard 29 CFR Regulations 1910.23(c)(3), 1910.212, 1926.501(b), and the intent of 1926.701(b) Guarded Requirements.
- 3.4 FIELD QUALITY CONTROL
- A. Test grounds per Section 26 05 26 Grounding and Bonding and 26 08 13 Tests and Performance Verification.
 - B. Obtain the service of Underwriters Laboratories to provide inspection and certification of the lightning protection system under provisions of UL 96A.

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- C. Obtain UL master label and attached to building at location directed by Owner.
- D. Obtain UL Letter of Findings and submit to Architect/Engineer.
- E. Submit test results on each ground location including final length of each ground rod and final distance between each installed ground rod at each ground rod location.

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 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.

1.6 SUBMITTALS

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

1.7 OPERATION AND MAINTENANCE DATA

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

1.8 QUALITY ASSURANCE

- A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.
- B. The surge protective device manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor. Factory representatives are to accept installation prior to Substantial Completion.

1.9 COORDINATION/PROJECT CONDITIONS

- A. Verify proper grounding is in place.
- B. Verify proper clearances, space, etc. is available for surge protective devices.

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- 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 ten years.
- B. Any surge protective device which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.

1.11 DEFINITIONS/ABBREVIATIONS

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

PART 2 - PRODUCTS

2.1 GENERAL

- A. Surge protective devices shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (N-G) mode protection.
- B. Surge protective devices shall be of a hybrid design, and include circuitry with tight, wave-tracking clamping characteristics.
- C. Surge protective devices shall be designed to withstand a maximum continuous operating voltage of not less than 115 percent of nominal RMS line voltage.
- D. Surge protective devices shall contain internal safety fusing to disconnect the surge protective device from the electrical source if the surge protective device fails, in order to prevent catastrophic failure modes.
- E. Surge protective devices shall be fail safe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.
- F. Surge protective devices shall be UL 1449 listed under UL Category Code VZCA and shall be accepted for the location in which they are installed.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES

- A. General: Provide service entrance surge protective devices on each main electrical service panel at each building and/or structure. Surge protective devices shall meet or exceed the following (in addition to requirements under 'General' above):
 - 1. Surge protective devices shall be tested per UL 1449 requirements to determine voltage protection rating (VPR).
 - 2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 10 kA, Cat. C3 test criteria.
 - 3. Enclosure:
 - a) UL listed
 - b) Fire retardant
 - c) NEMA 1 or as required for each location.
 - d) Surface mounted as required and/or shown/called for on Drawings for each location.

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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. 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

7. Minimum Short Circuit Current Rating:
 - a) 200,000 amps.
8. 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.
 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.
9. Status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.
10. 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.
11. Minimum Surge Capacity:
 - a) 240,000 amps. per phase.
12. Voltage Protection Ratings (VPR) and Maximum Continuous Operating Voltage. Comply with the following maximum voltages for UL 1449 testing requirements:

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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

13. Short Circuit Current Rating:

- a) 100,000 amps.

14. 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.
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.

C. SECOND LEVEL SURGE PROTECTIVE DEVICES

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

1. Surge protective devices shall be tested as per UL 1449 requirements to determine voltage protection ratings (VPR – 3 kA).
2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 3 kA, Cat. B3 test criteria.
3. Enclosure:
 - a) UL listed.
 - b) Fire retardant.
 - c) NEMA 1 or as required for each location.
 - d) Surface mounted or as required and/or shown/called for on drawings for each location.

2.3 EXTERIOR CIRCUITS

- A. Provide surge arrester in pole handhole.
- B. Surge arrester shall be UL listed as a Type 1 surge arrester.

2.4 SERVICE SURGE ARRESTER

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

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- B. This suppressor shall be connected on the line side of service to each building and where required to meet UL 96A.
- C. 50 kA per phase rating.
- D. Minimum short circuit current rating: 200,000 amps
- E. Enclosure:
 - 1. NEMA 4X polycarbonate
- F. Manufacturers:
 - 1. Advanced Protection Technologies SPDEE Series for applied voltage
 - 2. Atlantic Scientific Zone Defender Curve Series for applied voltage

2.5 POINT OF USE LOCATION (120 VOLT)

- A. UL 1449 listed.
- B. 20 Amp, 120V rated. All components must be 20 Amp rated.
- C. Surge protection devices shall be tested per IEEE C62.41 for Categories A and B.
- D. Normal mode (L - N), and common mode (L+N-G) protection.
- E. Internal fusing.
- F. Hybrid design.
- G. Indicators for normal operation and failure indication.
- H. Enclosure:
 - 1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.
- I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3 kA, 8 x 20 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

2.6 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:

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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 (panel, service, ATS, etc.) that the electrical service encounters as it enters the facility.
- B. Provide, install and connect surge protective devices at each branch panel as noted on drawings.
- C. Provide, install and connect surge protective devices in pole near hand hole of all exterior lighting poles 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.
- E. Provide surge protective devices at panel feeding exterior site lighting circuits for each circuit for each panel feeding site lighting.

3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Surge protective devices for other than 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

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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 26 51 13 - INTERIOR LIGHTING FIXTURES, LAMPS AND BALLASTS

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. Interior luminaires and accessories
 - 2. Exit signs
 - 3. Ballasts
 - 4. Lamps
 - 5. Luminaire accessories
 - 6. Fluorescent dimming ballasts
- B. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the Drawings.
- C. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.
- D. Lamps shall be included in the system guarantee for a period of thirty days after final acceptance of the building.

1.3 REFERENCES

- A. ANSI C78.379 Classification of the Beam Patterns of Reflector Lamps
- B. ANSI C82.1 Lamp Ballast – Line Frequency Fluorescent Lamp Ballast
- C. ANSI C82.4 Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type)
- D. ANSI/NFPA 70 National Electrical Code
- E. ANSI/NFPA 101 Life Safety Code
- F. NEMA WD 6 Wiring Devices - Dimensional Requirements

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of
 - 1. ANSI/NFPA 70
 - 2. NFPA 101
 - 3. ADA
 - 4. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 1. Shop drawings shall be submitted for all fixtures that require modifications, either as specified or as required to fit architectural field conditions of this project. (i.e., luminous

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ceiling, wall/slot fixtures, special fixtures).

2. Shop drawings shall be complete showing all dimensions and installation instructions required for conditions on this project.
- B. Submit Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:
1. Dimensions
 2. UL Label
 3. Fusing
 4. Luminaire Disconnect
 5. Metal gauge
 6. Lens/louvre thickness
 7. Finish
 8. Voltage
 9. Lamps
- 1.6 OPERATION AND MAINTENANCE DATA
- A. Submit Maintenance Data and include replacement parts list.
- 1.7 MANUFACTURER'S QUALIFICATIONS
- A. Company specializing in manufacturing products specified in this Section with minimum five years experience.
- 1.8 PRODUCT STORAGE AND HANDLING
- A. Physically protect fixtures against damage as recommended by manufacturer.
- 1.9 MAINTENANCE MATERIALS
- A. Provide to Owner:
1. Ten of each size/type of fuses.
 2. Six of each type of lamps.
 3. One carton or twenty-four (whichever is greater) in manufacturer's carton of 4' T8 lamps.
- 1.10 WARRANTY
- A. All ballasts furnished under this Division shall be covered by a warranty against defects. Warranty shall include payment for normal labor costs of replacement of inoperative in-warranty ballasts.

PART 2 - PRODUCTS

2.1 LUMINAIRES/FIXTURES

- A. Furnish products as specified in schedule on Drawings.
- B. Install ballasts, lamps, and specified accessories at factory.
- C. All light fixtures shall adhere to UL Test Standard 1598 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.

2.2 LAMPS

- A. Manufacturers

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1. Sylvania, G.E., Phillips.
- B. Incandescent:
 1. Lamps to be rated and stamped for 130 volts.
 2. Provide type specified for luminaire/fixture on drawings.
 3. Reflector lamp beam patterns: ANSI C78.379.
- C. Fluorescent:
 1. Fluorescent lamps to be Octron type T8 bulb with medium bi-pin base.
 2. Correlated color temperature shall be 4100K with color rendering index of 80.
- D. Compact Fluorescent:
 1. General:
 - a) Provide complete with starter, ballast, etc.
 - b) Suitable for low starting temperatures 32 degree F. and below.
 2. Twin Tube Type:
 - a) T4 bulb.
 - b) 5, 7, 9, or 13 watt lamps as called for on drawings.
 - c) 4100K temperature.
 - d) Color rendering index: 80.
 3. Double Twin (quad) Tube Type:
 - a) T4 bulb.
 - b) 9, 13, 18 or 26 watt lamps as called of on Drawings.
 - c) 4100K temperature.
 - d) Color rendering index: 75.
 4. Adapters:
 - a) Provide where called for on drawings to convert medium socket base to compact fluorescent tube. THD shall be 20 percent maximum, power factor shall be 90 percent maximum.

2.3 BALLASTS

- A. Manufacturers:
 1. Magnetek, Advance, or accepted substitution.
- B. Fluorescent Ballast:
 1. Provide ballast suitable for lamps specified.
 2. Voltage: Match luminaire voltage and voltage of system to which applied.
 3. Ballast to be protected with in-line fuse/fuseholder.
 4. Provide disconnecting means for ballast that simultaneously disconnects all supply conductors to the ballast, including the grounded conductor.
 5. Ballasts installed outdoors or in cool temperatures to be 0 degree ballasts.
- C. Electronic Ballasts:

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1. Fluorescent lamp ballasts shall be high frequency electronic type, operating lamps at a frequency of 20 kHz or higher with no detectable flicker.
2. Ballasts shall not be affected by lamp failure and shall yield normal lamp life.
3. Lamp current crest factor shall not exceed 1.6.
4. Ballasts shall operate at an input frequency of 60 Hz and an input voltage of 108 to 132 (120V models) or 249 to 305 (277V models).
5. Ballasts shall have power factor above 95 percent.
6. Ballasts that operate as a parallel circuit shall allow remaining lamp(s) to maintain full output if companion lamp(s) fail.
7. Ballasts shall carry five-year warranty, including labor allowance.
8. Ballast manufacturers shall have been producing electronic ballasts in the US for more than 10 years with a low failure rate.
9. Ballasts shall be accepted and listed by Underwriters Laboratories.
10. Ballasts shall comply with all applicable state and federal efficiency standards.
11. Ballasts shall comply with FCC and NEMA limits governing electromagnetic and radio frequency interference and shall not interfere with operation of other normal electrical equipment.
12. Ballasts shall meet all applicable ANSI and IEEE standards regarding harmonic distortion and surge protection.
13. Total harmonic distortion (THD) to be less than 20 percent and shall have a passive power factor corrective front end.
14. Ballasts to be in 1, 2, 3 or 4 lamp configuration as required to facilitate switching/circuitry shown on Drawings or as called for on Drawings. If not specifically called for or noted on Drawings provide minimum of one ballast per 2-lamp fixture, two ballasts per 3-lamp or 4-lamp fixture.

2.4 EXIT SIGNS (See Section 26 52 13 Emergency Lighting Equipment for self contained emergency power exit signs)

- A. Description: Exit sign fixture suitable for use as emergency lighting unit.
- B. Exit signs to have long life LED lamps for normal and emergency operation.
- C. Exit sign shall have universal mount, universal arrows, down light, stencil face. Arrows shall be as shown on Drawings.
- D. Transformer shall be dual rated for 120 or 277 volt.
- E. Furnish all lamps required.
- F. Install suspended exit signs using pendants supported from swivel hangers.
- G. Mount all exit signs at 7'-6" AFF or as required to meet ADA requirements. Provide all mounting accessories/hardware as required for proper mounting including pendant/swivel hangers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate and supporting grids for luminaires.
- B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

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- A. Install in accordance with manufacturer's instructions and NEC.
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Support luminaires larger than 2' x 4' size independent of ceiling framing.
- D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- F. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
- G. Install recessed luminaires to permit removal from below.
- H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Recessed luminaires not rated for contact with insulation (Type IC) shall not be installed within 3" of any insulation or as required by the NEC. All recessed luminaires installed within three inches of insulation shall be identified for contact with insulation and bear the UL Type IC label.
- J. Install wall mounted luminaires and exit signs at height as indicated on Drawings, or as required by ADA, local codes and state codes. Where conflict exists between what is shown on Drawings and what is required by codes, install fixture as required by codes.
- K. Install accessories furnished with each luminaire.
- L. Connect emergency lighting fixtures per Section 26 52 13 Emergency Lighting Equipment.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond products and metal accessories to branch circuit equipment grounding conductor.
- O. Install specified lamps in each luminaire and exit sign.
- P. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the Drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type.
- Q. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Clips identified and listed for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards.
- R. All interior and exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer's labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. Manufacturer's name or logo shall not appear on the exterior of any light fixtures unless accepted in writing by the Engineer.
- S. Miscellaneous (provide and install complete):
 - 1. Dimming ballasts for all fluorescent lights connected to dimming circuits as required to match dimmer unit/system.
 - 2. Low voltage transformers for all low voltage light fixtures.
 - 3. Tents as required for fixtures in fire rated ceilings as per applicable codes.

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4. Thermal protection for all fixtures with tents or fixtures surrounded by insulation as per applicable codes.
 5. Zero degree ballast for outdoor lighting fixtures.
 6. Heat removal or air supply slot covers for all fixtures requiring them as determined by Mechanical Engineer.
- T. Ceiling surface mounted fluorescent fixtures installed in exposed ceiling areas are to be suspended from ceiling structure with minimum 3/8" all-thread rods and 1-1/2" x 1-1/2" Kindorf channels, full length of fixture/row. Mount outlet box at structure with flexible connection to fixture.
- U. Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.
- V. Electrical Contractor shall remotely locate all transformers called for in these Specifications in a well ventilated and easily accessible space to comply with all codes. Revise circuitry as shown on plans as required to facilitate transformer/fixture location.
- W. Voltage for all fixtures shall match the voltage of the lighting circuit fixture is connected to. Coordinate with electrical drawings.
- X. All light fixtures shall have label near lamp socket, out of view of public stating maximum wattage of lamp allowed in fixture. Maximum wattage to be stated is wattage as shown on schedule of lighting equipment herein. Circuits are based on these wattages, circuitry, etc. Any failure to comply with this requirement shall be responsibility of Contractor. Location of labels must meet acceptance of Lighting Designer, Architect and Engineer.
- Y. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect.

3.3 EXIT SIGNS

- A. Install illuminated exit signs as shown on Drawings, as herein specified or as required by applicable codes.
- B. Connect exit sign to local lighting circuit ahead of all switches.
- C. Install suspended exit signs using pendant supported from swivel hangers.
- D. Mount all exit signs at 7'-6" AFF or as required to meet ADA requirements. Provide all mounting and accessories/hardware as required for proper mounting including pendant/swivel hangers.

3.4 ADJUSTING

- A. Aim and adjust luminaires as directed.
- B. Adjust exit sign directional arrows as indicated.
- C. Relamp luminaires that have failed lamps at Substantial Completion.

3.5 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.6 DEMONSTRATION

- A. Provide demonstration of luminaire operation.

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3.7 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.8 CLEAN-UP

- A. Luminaires:
 - 1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as Windex and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean Alzak aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove finger prints and smudges.
 - 2. It is the Contractor's responsibility to remove any UL labels or manufacturers labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION

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SECTION 26 56 00 - EXTERIOR LUMINAIRES

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. Exterior luminaires and accessories.
 - 2. Poles.
- B. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the Drawings.
- C. Light fixtures shall be neatly and firmly mounted.
- D. Lamps shall be included in the system guarantee for a period of thirty days after final acceptance of the project.
- E. Provide and install concrete base as noted on Drawings. Construct concrete base per applicable section and/or division of the specifications.

1.3 REFERENCES

- A. ANSI C78.379 Classification of Beam Patterns
- B. ANSI C82.1 For Lamp Ballast – Line Frequency Fluorescent Lamp Ballast
- C. ANSI C82.4 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
- D. ANSI O5.1 Wood Poles, Specifications and Dimensions
- E. IES RP-8 Roadway Lighting
- F. IES RP-20 Lighting for Parking Facilities

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of the following:
 - 1. ANSI/NFPA 70 National Electrical Code
 - 2. ASCE 7-10 Minimum Design Loads for Building and Other Structures
 - 3. FBC Florida Building Code
 - 4. IES Illuminating Engineering Society
 - 5. NESC National Electrical Safety Code

1.5 SUBMITTALS

- A. Submit point to point photometric analysis of the entire job site to the property line. Utilize photometric data obtained from submitted fixtures only. Verify that all submitted fixture types and light levels are compliant with all local codes, ordinances, and the authority having jurisdiction. Submittal will not be reviewed by the A/E without this narrative data.
- B. Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:
 - 1. Dimensions

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2. UL label
 3. Fusing
 4. Luminaire disconnect
 5. Metal gauge
 6. Lens thickness
 7. Finish
 8. Voltage
 9. Lamps
 10. Lightning arrestor, surge arrestor/, and/or surge protection device
- C. Submit drawings on concrete base complete with rebars, etc.
- 1.6 PROJECT RECORD DOCUMENTS
- A. Submit record documents to accurately record actual locations of each luminaire.
- 1.7 OPERATION AND MAINTENANCE DATA
- A. Submit Maintenance Data and include instructions for maintaining luminaires.
- 1.8 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.
- 1.9 REGULATORY REQUIREMENTS
- A. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store and protect products at site.
 - B. Accept products on site. Inspect for damage.
 - C. Protect poles from finish damage by handling carefully.
 - D. Store and handle solid wood poles in accordance with ANSI O5.1.
- 1.11 COORDINATION
- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding, brackets, concrete bases, anchor bolts and all necessary fittings and accessories for a complete installation.
- B. Furnish products as specified on Drawings.
- C. All exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. No manufacturers name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the Engineer.

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- D. All light fixtures shall adhere to UL Test Standard 1598 and NEC 410-115(C). All manufacturers shall provide the required thermal protection as required.
- E. Pole luminaires, poles, and concrete bases shall comply with applicable requirements of IES, NESC, ASCE, FBC, and including but not limited to their requirements for illumination, uniformity, construction, wind loading, pole setback, breakaway, installation, glare criteria.
- F. All site lighting fixtures/luminaries that may spill light onto adjacent properties shall have glare control shield installed on all fixtures/luminaries as required to meet the glare control requirements of applicable codes and standards. Add required glare control shield to order/model number of all site lighting fixtures.

2.2 BALLASTS

- A. Fluorescent Ballast:
 - 1. Description: ANSI C82.1 electronic ballast rated for 0 degrees F.
 - 2. Provide ballast suitable for lamps specified.
 - 3. Voltage: Match luminaire voltage and voltage of system to which applied.
 - 4. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.
 - 5. Ballast to be protected with in-line fuse/fuseholder.
 - 6. Provide disconnecting means for ballast that simultaneously disconnects all supply conductors to the ballast, including the ground conductor.
- B. High Intensity Discharge (HID) Ballast:
 - 1. Description: ANSI C82.4 lamp ballast to match lamp.
 - 2. Provide ballast suitable for lamp specified.
 - 3. Voltage: Match luminaire voltage and voltage of system to which applied.
 - 4. Ballast to be protected with in-line fuse/fuseholder.

2.3 LAMPS

- A. Provide lamp type specified for luminaire.
- B. All lamps shall match those specified in Section 26 51 13 Interior Lighting Fixtures, Lights and Ballasts.

2.4 LIGHTNING ARRESTER

- A. Provide lightning arrester for each pole light.
- B. Lightning arrester to be UL listed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine excavation and concrete foundation for lighting poles.
- B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

- A. Install all fixtures in accordance with manufacturers written instructions, NEC, IES, ASCE, FBC, and NESC.
- B. Install lighting poles at locations indicated.

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- C. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.
- D. Install lamps in each luminaire.
- E. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrodes at each pole. See Section 26 05 26 Grounding and Bonding.
- F. Where ceiling mounted fixtures are called for in the Light Fixture Schedule and on the drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Clips identified for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted.
- G. All exterior post/pole mounted light fixtures shall have hand hole near base. Hand hole shall provide easy access to light fixture fusing and lightning protection ground lug. Lightning protection ground lug shall be provided inside post/pole, electrically in contact with pole, for connection to ground rod. Provide and install ground wire from ground lug to ground rod, concealing ground wire through post/pole base. Anchor bolts to be galvanized.
- H. Pole installation shall comply with windloading criteria stated in ASCE 7-10 and Florida Building Code and the formulas and tables presented in ASCE 7-10.
- I. Provide soil compacting and/or treatment to assure windloading can be achieved for direct buried poles.
- J. Ducseal shall be installed to seal all conduits entering exterior light fixtures from underground.
- K. Lightning arrester and in-line fusing to be located at handhole location of pole for easy access.
- L. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect

3.3 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.4 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution as directed.
- B. Re-lamp luminaires which have failed lamps at Date of Substantial Completion.

3.5 GLARE CONTROL

- A. Provide, install and adjust glare control shields to prevent light glare on adjacent properties.

3.6 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.
- E. Luminaires:
 - 1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as Windex and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection

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may not require cleaning. Clean Alzak aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.

2. It is the Contractor's responsibility to remove any UL labels or manufacturer's labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION

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SECTION 27 01 00 - OPERATION AND MAINTENANCE MANUALS FOR COMMUNICATIONS
SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the requirements for Operation and Maintenance Manuals (O & M Manuals) specifically applicable to Division 27 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

1.2 OPERATION AND MAINTENANCE MANUALS

- A. O& M Manuals shall consist of a minimum of one hard cover view type 3-ring binder sized to hold 8 1/2" x 11" sheets for COMMUNICATIONS OPERATION AND MAINTENANCE. Refer to Division 1, general requirements for additional requirements.
1. Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3". Provide additional binders if 3" size is not sufficient to properly hold submittals.
 2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for O & M's at the end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e. COMMUNICATIONS OPERATION AND MAINTENANCE.
- B. O & M Data:
1. Manufacturer's operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e. surge suppression – intercom).
 2. Include troubleshooting instructions, list of special tools required, theory of operation, manufacturer's care and cleaning, preventative maintenance instructions, wiring diagrams, and point-to-point schematics.
- C. O & M Manuals to include:
1. Completed forms and information per Division 1, General Requirements, and this section of the specifications.
 - a) Table of Contents
 - b) Project Addresses
 - c) Reinforced Separation Sheets tabbed with the appropriate specification reference number and typed index for each Section in the Systems Schedule
 - d) Check Out Memo
 - e) Ground Test Information
 - f) Progress and Record Drawing Certification
 - g) Spare Parts Certification Memo
 2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 3. Product Data: Product data and/or Catalog sheets shall be a copy of the final and accepted submittal submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 4. Warranty/Guarantee: Provide copy of warranty/guarantee in respective location in O & M

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binder, (Power and Lighting) (Systems). Original warranty/guarantee is to be incorporated into separate project warranty book with warranty/guarantees provided for other sections and divisions of the specifications and submitted for Architectural/Owner acceptance.

5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section
6. Wiring diagrams, schematic, etc. inserted in proper order, for:
 - a) UPS systems.
 - b) Each and every part of the Systems sections of these Specifications
7. For Sections 27
 - a) Product data and/or catalog sheets on all equipment applicable to this project.
 - b) Equipment supplier list for each section's equipment.
 - c) Floor boxes; in addition to above provide:
 1. Installation/removal instructions.
 2. Parts list.
 - d) UPS system; in addition to above provide:
 1. Wiring diagrams.
 2. Parts list.
 3. Installation/removal instructions.
 4. Operation and maintenance requirements.
 5. Copy of maintenance contract.
 6. Preventive maintenance instructions.
 7. Check-Out Memo Form
 - e) Grounding; in addition to above provide:
 1. Test results on each ground rod.
 2. Ground Test Information Form
8. Sections 27
 - a) Installer's name, address, phone, etc. for each system.
 - b) Authorized representatives name, address, phone, etc. for each system.
 - c) Equipment supplier's name, address, phone, etc. for each system.
 - d) Surge Suppression.
 1. Product data and/or catalog sheets on equipment applicable to this project.
 2. Parts list.
 3. Recommended testing and replacement procedures.
 - e) Sound/Paging, Television Systems.
 1. Product data and/or catalog sheets on equipment applicable to this project.
 2. Parts list.
 3. Installation/removal instructions.
 4. Wiring diagrams of panels.
 5. Point-to-point wiring diagrams of system.
 6. Operation and maintenance requirements.
 7. Shop drawing as submitted and accepted in submittal process.
 8. Check-Out Memo Form
 - f) Premise Distribution Systems.
 1. Product data and/or catalog sheets on equipment applicable to this project.
 2. Parts list.
 3. Wiring diagrams of panels.
 4. Shop drawing as submitted and accepted in submittal process.

1.3 PROCESSING SUBMITTALS

- A. Submit a minimum of three (3) sets of O & M Manuals, two (2) sets for Owner, one (1) set for

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Engineer.

- B. The Contractor shall review the manuals before submitting to the A/E. No request for payment will be considered until the brochure has been reviewed and submitted for acceptance.
- C. Provide additional copies if additional copies are required in other Divisions and/or sections of these specifications.

1.4 DELAYS

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

1.5 RESUBMITTALS

- A. The A/E shall be reimbursed cost to review re-submittals subsequent to the second submittal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

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PROJECT ADDRESSES

OWNER:

ARCHITECT:

CONSULTING ENGINEER:

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

GENERAL CONTRACTOR:

SUBCONTRACTOR:

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CHECK OUT MEMO FORM

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

Project Name:

Type of equipment checked:

Equipment Number:

Name of manufacturer of equipment:

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

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

Checked By: (Print or Type Name of Manufacturer's Representative)

(Address and Phone No. of Representative)

(Signature and Title of Representative)

(Date Checked)

Witnessed By: Signature and Title of Contractor Rep.)

*Exceptions Noted At Time Of Check-Out (use additional page if necessary)

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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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PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT:

DIVISION NUMBER AND NAME:

This is to certify that the attached marked-up design prints were marked as the items were installed at the site during construction, and that these prints represent as accurate "As-Builts" record of the work as actually installed. One copy will be turned over to the Owner at the instruction in Operation Conference. The duplicate copy is for the Engineer's files.

Name Of General Contractor

BY: Authorized Signature And Title

Date

Name Of Subcontractor

BY: Authorized Signature And Title

Date

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SPARE PARTS CERTIFICATION MEMO

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

Project Name:

Type of Spare Parts:

Specification Reference:

Quantity of Spare Parts:

Signature below by the contractor signifies that the spare parts required by the drawings and/or specifications have been turned over to the Owner.

(Name of General Contractor)

(Signature, Title, Date)

(Name of Subcontractor)

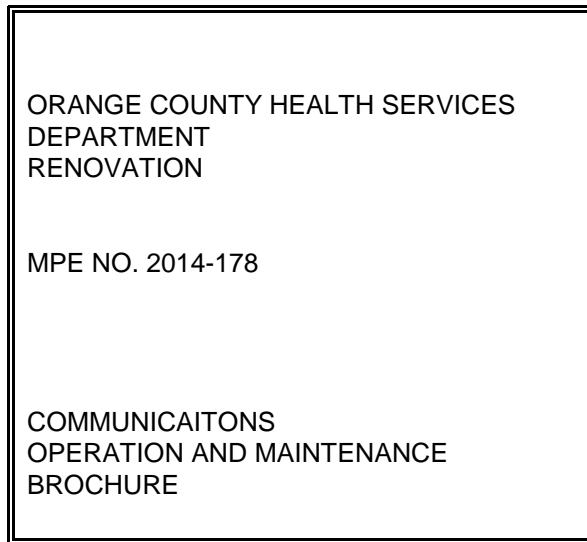
(Signature, Title, Date)

(Name of Owner)

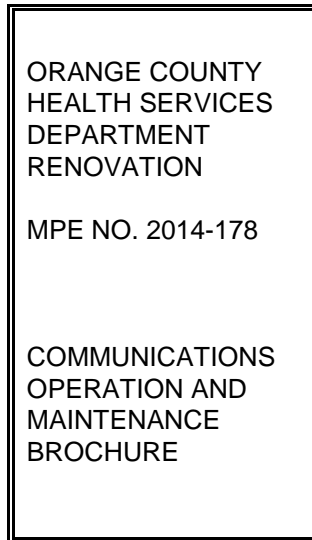
(Signature, Title, Date)

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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 11")

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SECTION 27 01 05 - INVESTIGATION OF EXISTING COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

- A. Test the essential features of the following existing electrical systems:
 - 1. Alarm and bells
 - 2. Fire detection devices, smoke detection devices
 - 3. Intercommunication equipment
 - 4. Television System
 - 5. Clock System
 - 6. Emergency lighting fixtures
 - 7. Batteries
 - 8. Generator (if applicable)
 - 9. Battery chargers
 - 10. Controls and alarms
 - 11. Outlets: convenience
 - 12. Switches: regular, time
 - 13. Building grounding systems
- B. Each system shall be tested once only, and after completion of testing, results given to the Owner, Engineer and/or Owner's representative. Point out any non-operational function noticed during testing.
- C. Document the existing conditions and operation of the existing electrical systems prior to any work.
- D. Contractor is responsible for all non-working systems and their components unless non-working status is verified prior to work on system.

1.3 TIME

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

1.4 ATTENDING PARTIES

- A. The testing shall be held in the presence of the Owner, or his representative and contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PERFORMANCE VERIFICATION

- A. Test the operation of each of the following existing devices and associated systems:
 - 1. Fire Alarm System
 - a) Test each pull station and record location of each tested device, and note either

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operational or non operational.

- b) Test each heat detector and record location of each tested device and note either operational or non operational.
- c) Test each duct mounted smoke detector with canned smoke and verify alarm activation, remote pilot light activation and damper operation. Record location of each tested device and note either operational or non operational.
- d) Test each smoke detector with canned smoke and record location of each tested device and note either operational or non operational.
- e) Test tamper switches by closing the valve until signal is activated and verify trouble signal indication at the fire alarm control panel and annunciators. Record location of each tested device and note either operational or non operational.
- f) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.
- g) Test Fire Alarm System sufficiently to determine existing operating condition of system. Pull the pull stations, check automatic detectors. Test minimum of one manual device per zone, and one automatic device per zone.
- h) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.

2. Intercom System

- a) Test each call in button and/or handset and speaker, verify voice path operation. Record location of each tested device and note either operational or non operational.
- b) Check each call in switch and light on the master unit. Note either operational or non operational.
- c) Check all call, emerg. call, etc.
- d) Test intercom system sufficiently to determine existing operating condition of system. Check minimum of one call-in station/handset per switchbank and per building.
- e) Check for call-in annunciation and communication.
- f) Check all call, emerg. call, etc.

3. Television System

- a) Test (each) (at least one per building) T.V. outlet with color receiver to verify general reception and operation of existing system distribution.
- b) Check main equipment cabinet for general operation of all components.

4. Lighting and Exit Lighting Fixtures - in areas of remodel and/or renovation.

- a) Test all lighting fixtures and exit lights for proper operation, list bad ballasts, lamps or broken lenses. Record location of fixtures tested.
- b) Test light switches, relay controls, and photo cell controls for proper operation and record location of tested device and note operational or non operational.

5. 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.

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6. Ground System

- a) Test ground system at each permanent building and at each modular unit/building.
 - b) Submit "GROUND TEST INFORMATION" Form (see form at the end of this Section) for each and every grounding system in the project, including but not limited to: each ground rod installation; each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment); and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
 - c) Testing shall be three (3) point method in accordance with IEEE recommended practice.
 - d) Where grounding resistance is greater than value required by this Specification, Contractor is to bring this to the Engineer's and Owner's attention in wiring along with attached 'GROUND TEST INFORMATION' Form.
- B. The electrical contractor shall investigate all existing systems as called out in this performance verification prior to the beginning of any work which could affect these systems.
- C. Each system shall be retested after completion of remodel and/or renovation to ensure proper operation is maintained. Demonstrate operation per Section Demonstration of Completed Electrical Systems.

3.2 MEMO OF INVESTIGATION (TESTING)

- A. Submit Existing Facilities Investigation Memo and advise Owner/Engineer of all deficiencies in system(s) prior to work. All systems will be assumed to be fully operational if memo is not received by Engineer prior to work on system.
- B. Submit five (5) copies of memo of tested devices and equipment, memo signed by the Contractor, Subcontractor and Owner and submit each test result to the owner's representative.

END OF SECTION

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EXISTING FACILITIES INVESTIGATION MEMO

NAME OF PROJECT:

The existing systems on the above project have been investigated and checked to determine the existing condition of all existing electrical systems within the area(s) affected by the scope of work of this project. The investigation consisted of testing all electrical systems/devices as required by Section Investigation of Existing Electrical Systems of these Specifications.

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

NAME OF PRIME CONTRACTOR:

AUTHORIZED SIGNATURE AND TITLE:

DATE:

NAME OF OWNER'S AUTHORIZED REPRESENTATIVE:

AUTHORIZED SIGNATURE AND TITLE:

DATE:

Note To Contractor: Upon completion of investigation and one week prior to the commencement of work, submit five copies of the completed EXISTING FACILITIES INVESTIGATION MEMO to the Owner's Authorized Representative, signed and dated by the Contractor. Have the Owner's Authorized Representative sign and date receipt of MEMO. Retain copy(ies) and submit copy of MEMO in each Operation and Maintenance Manual. Contractor shall submit quantities of MEMOS as required to present required information.

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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 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

- A. This section includes Basic Electrical Requirements specifically applicable to Division 26 27 28 Sections, in addition to Division 01 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

- A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.
- B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.
- C. The Division 26 27 28 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.
- D. Only trained and 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 27 28 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.

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 it's originating point.
- F. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.
- G. Remove existing 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. Notify Owner [72 hours] [24 hours] in advance of any shut-down of existing systems. Perform work during [non-general office] [non-school] operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.
- K. Bid shall include all removal and relocation of all piping, fixtures or other items required for completion of alterations and new construction.
- L. See Section Minor Electrical Demolition for Remodeling for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

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

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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 Divisions 26 27 28 methods and materials unless specifically noted otherwise.
- F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.
- G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.
- H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.
- I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.
- J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.
- K. Where tamperproof screws are specified or required, Phillips head or Allen head devices shall

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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 all electrical

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1.11 SUPERVISION OF THE WORK

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

1.12 COORDINATION

- A. Provide all required coordination and supervision where work connects to or is affected by work of other trades, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
 - 1. Door Hardware
 - 2. Roll-up doors
 - 3. Fire shutters
 - 4. Roll-up grilles
 - 5. Elevators
 - 6. Escalators
 - 7. Sliding doors
 - 8. Mechanical Division of the Specifications
 - 9. Interior design drawings
 - 10. Pool/spa equipment
 - 11. Fountains
 - 12. Landscape Architect drawings
 - 13. Lifts
 - 14. Laundry Equipment
 - 15. Kitchen Equipment
 - 16. Conveyors
 - 17. Flight Information Display Systems
 - 18. Baggage Information Display Systems
 - 19. Millwork design drawings and shop drawings
- B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Divisions 26 27 28 Contract Documents

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or not.

- C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.
- D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.
- E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
- G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design.
- H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.
- I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes due to these coordination efforts shall be made at no additional cost to the Owner.

1.13 PROVISION FOR OPENINGS

- A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.
- B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.
- C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.14 CONCRETE PADS

- A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4

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6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Provide 3000 psi concrete.

- B. Contractor to provide/install concrete pad for exterior pad mount transformers as required by power company.
- C. Contractor to provide/install concrete pad for exterior generators as recommended by generator manufacturer and structural engineer (8" minimum).

1.15 SURFACE MOUNTED EQUIPMENT

- A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

1.16 CUTTING AND PATCHING

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

1.17 TRENCHING

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

1.18 INSTALLATION

- A. Erect equipment to minimize interferences and delays in execution of the work.
- B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.
- C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.
- D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.
- E. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.

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- F. The Contractor shall keep the construction site clean of waste materials and rubbish at all times. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.
- G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and a layout made prior to the setting or embedment thereof, so as to cause no delay to the project schedule.

1.19 PROGRESS AND RECORD DRAWINGS

- A. Keep two sets of blueline prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.
- B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:
 - 1. All raceways 1-1/2" and above, exactly as installed.
 - 2. All site raceways exactly as installed.
 - 3. Any combining of circuits (which is only allowed by specific written permission) or change in homerun outlet box shall be made on as-builts.
 - 4. Any circuit number changes on plan shall be indicated on as-builts.
 - 5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..
- C. Marked up prints as noted above are to be submitted to A/E for review.. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.
- D. The changes and alterations shall be transferred to 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.

1.20 "OBSERVATION OF WORK" REPORT

- A. Reference the General Conditions.
- B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item to the A/E. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected, and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise

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manner or failure to return the signed reports shall be cause for disallowing request for payments.

- C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.21 SYSTEMS WARRANTY

- A. Reference the General Conditions.
- B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of each System. Warranty shall not include lamps in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.
- C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.
- D. Where extended warranty or guarantee are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.
- E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

1.22 WASTE MATERIALS DISPOSAL

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

1.23 SUBSTANTIAL COMPLETION

- A. The Contractor shall be fully responsible for contacting all applicable parties [(A/E or Project Manager)] to schedule required observations of the work by Engineer. [A minimum of 72 hours notice shall be given for all required observations of the work by Engineer, and minimum of 120 hours for substantial completion observation. Time and date shall be agreed on by all applicable parties in writing.]
- B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

1.24 PROHIBITION OF ASBESTOS AND PCB

- A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.
- B. Prior to the final review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 27 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.

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PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 27 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.
- B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

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

1.4 SUBMITTALS

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

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width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting, (and if required) "SYSTEMS SUBMITTALS."

B. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.
3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).
5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
 - a) Fabrication and erection dimensions.
 - b) Arrangements and sectional views.
 - c) Necessary details, including complete information for making connections with other work.
 - d) Kinds of materials and finishes.
 - e) Descriptive names of equipment.
 - f) Modifications and options to standard equipment required by the work.
 - g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).
 - h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
 - i) Conduit/raceway rough-in drawings.
 - j) Items requiring shop drawings include (but not limited to):
 1. Lightning protection system
 2. Special built light fixtures
 3. Each section of fire alarm, television, etc..
 4. UPS systems
 5. Emergency generator systems
 6. Special and/or modified equipment
 7. Main switchboard(s)
 8. UL listed fire and smoke stopping assemblies for each applicable penetration

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- k) See specific sections of Specifications for further requirements.
- 6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
 - a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
 - b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
 - c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.
- B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:
 - 1. Project Addresses
 - 2. Index
 - 3. Separation Sheets
 - 4. Basic Materials
 - 5. Panelboards
 - 6. Light Fixtures
 - 7. Long Lead Items
 - 8. Systems Product Data
- C. Remainder of submittals are to be submitted no later 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.

Action

Description

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- | | |
|---------------------------|--|
| 1. No Exception Noted | No exceptions taken. Resubmittal not required. |
| 2. Rejected | Not in compliance with Contract Documents. Resubmit. |
| 3. Submit Specific Item | Resubmit item as specified. |
| 4. Make Corrections Noted | Make corrections noted, resubmittal not required. |
| 5. Revise and Resubmit | Make corrections noted, resubmittal is required |
| 6. Review not Required | Not required for review. No action taken. Copy retained for reference. |
- H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet, and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.
- I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict, unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

1.6 DELAYS

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

1.7 RE-SUBMITTALS

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

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

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PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

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

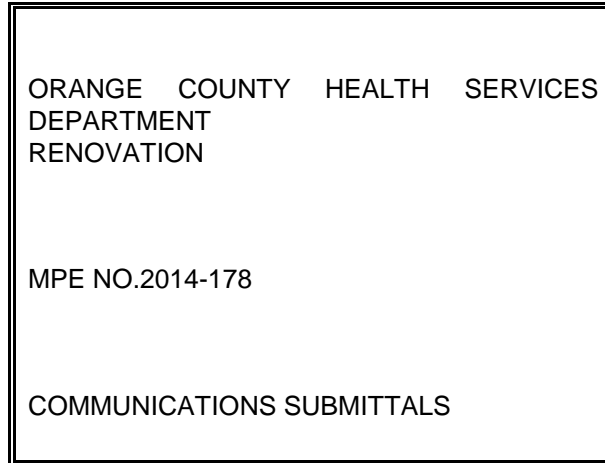
GENERAL CONTRACTOR:

SUBCONTRACTOR:

BINDER EXAMPLES FOR SUBMITTALS

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



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



(Size To 11")

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SECTION 27 05 08 - SUBSTITUTIONS 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. This Section specifies general, administrative and procedural requirements for substitutions for Division 26 27 28 Sections above and beyond the requirements of Division 01 General Requirements Section 01 25 00 and any Supplemental requirements/conditions.

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 Division 26 27 28 Sections.
 - 2. Is a different design which accomplishes the same result as that design specified in Division 26 27 28 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) Effects 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

- 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.
 - 4. Compliance Statement. Each request shall include the following compliance statement typed on letterhead of submitting company:

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- 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 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 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.

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PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 27 05 10 - SYMBOLS AND ABBREVIATIONS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 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
UL Underwriters' Laboratories
UTP Unshielded Twisted Pair
VFD Variable Frequency Drive
VHF Very High Frequency
VHO Very High Output
V Volt
VA Volt Amperes
Vol. Volume
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 27 05 15 - TELEPHONE RACEWAY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This conduit system including terminal backboards, and outlets as shown by the drawings and described herein, shall be furnished and installed by the Electrical Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Telephone Terminal Boards shall be 8'-0" high and of the width shown unless otherwise noted. Terminal Boards shall be 3/4" A/C grade exterior plywood painted fire retardant light gray. Fire retardant paint shall have a flame spread rating of Class A.
- B. Raceway and outlet boxes shall conform to the requirements outlined in the Raceway Section of this specification.
- C. Bushings shall be provided on all telephone conduits.
- D. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than 1" shall have a tensile strength not less than 200 lbs.
- E. Grounding conductors shall be #6 bare copper unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All conduits shall be installed in a manner conforming to the requirements outlined in the Raceway Section of this specification.
- B. Conduits at Terminal Board locations shall be neatly racked on a Kindorf Type rack secured to wall above and below terminal boards.
- C. Each terminal board shall be provided with a #6 bare copper conductor installed in 3/4" conduit to the building service ground. Service ground attachment shall be made with an accepted lug. Provide 6'-0" excess ground conductor length at terminal board for connection to telephone equipment by Telephone Company.
- D. All conduit and boxes shall be installed as shown on the drawings. Any exceptions to the conduit routing shall be brought to the attention of the engineer before installation.
- E. Install blank plates on all outlets to match plates specified for wiring devices.

END OF SECTION

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SECTION 27 05 16 - COMPUTER/DATA RACEWAY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This conduit system including terminal cabinets, backboards, and outlets as shown by the drawings and described herein, shall be furnished and installed by the Electrical Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

- A. This system shall have the same terminal board as the telephone system.
- B. Raceway and outlet boxes shall conform to the requirements outlined in the Raceway Section of this specification. Conduits shall be 3/4" C. minimum unless otherwise noted.
- C. Bushings shall be provided on all computer conduits.
- D. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than 1" shall have a tensile strength not less than 200 lbs.
- E. Grounding conductors shall be #6 bare copper unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All conduits shall be installed in a manner conforming to the requirements outlined in the Raceway Section of this specification.
- B. Conduits at Terminal Board locations shall be neatly racked on a Kindorf Type rack secured to wall above and below terminal boards.
- C. All conduit and boxes shall be installed as shown on the drawings. Any exceptions to the conduit routing shall be brought to the attention of the engineer before installation.
- D. Install blank plates on all outlets to match plates specified for wiring devices.

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. Diameter: 3/4 inch.
- D. Length: 30 feet (minimum). Increase lengths as required to meet and achieve specified resistance.
- E. Length: 10 feet (minimum).

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

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drawings, in these specifications, or as required for voltage drop.

- C. Insulated THWN (or bare as noted elsewhere).

2.4 GROUNDING WELL COMPONENTS

- A. Grass Non-Traffic Areas:

1. Well: 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.

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- E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

3.2 GROUNDING ELECTRODES

- A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by braising or clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on drawings.
- B. Each rod shall be die stamped with identification of manufacturer and rod length.
- C. Install rod electrodes at locations indicated and/or as called for in these specifications.
- D. Ground Resistance:
 - 1. Main Electrical Service (to each building) and Generator Locations:
 - a) Grounding resistance measured at 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 [25] [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 [25][5] ohms for the Franklin system [and 10 ohms for the ESE (Early Streamer Emission) 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 (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.

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- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the Grounding Bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.
- E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
- F. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.
- G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.
- H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.5 MAIN ELECTRICAL SERVICE

- A. Existing 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.

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- 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.
 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 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

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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 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. 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 (2) ground connections: each to two (2) or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 - 6. Where transformer is mounted exterior to building one (1) of the two (2) ground electrodes required shall be ground rod electrode as called for in 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,

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provide, install and connect two or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. 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 (2) ground connections: each to two (2) or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 6. Where generator is mounted exterior to building one (1) of the two (2) ground electrodes required shall be ground rod electrode as called for in 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 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 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. 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 (2) ground connections: each to two (2) or more 30 ft. ground rod electrodes at no less than 30 ft. spacing, driven vertical to a minimum depth of 30 ft. plus 1 below grade.
 6. Where generator is mounted exterior to building one (1) of the two (2) ground electrodes required shall be ground rod electrode as called for in 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 CONDUCTOR'.

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

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or leaving all buildings, and counterpoise system ground where provided.

C. See Section 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 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 ft. spacing, driven vertical to a minimum depth of 1 ft 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 78.

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 (2) or more 30 ft. ground rods at no less than 30 ft. spacing driven vertically to a minimum depth of 30 ft. 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.

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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:
 - 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 ft. ground rods at no less than 30 ft. spacing shall be driven vertically to a minimum depth of 30 ft. 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 (2) 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 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.

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- 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 ft. 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 Articles 500, 501, 502, 503, 511 and 514 of the National Electrical Code.

3.14 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.

3.15 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 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.

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- F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
- I. Grounding provisions shall include double locknuts on all heavywall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.
- K. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an accepted ground point.
- L. Bond together reinforcing steel and metal accessories in pool and fountain structures and bond to electrical system per NEC.
- M. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten (10) 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 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).

3.17 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 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

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less. Provide two (2) counterpoise conductors above outside edge of ductbank (or conduit groupings) over 12 inches 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 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.

3.18 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 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 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.

3.20 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.

3.21 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 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, local and other Federal codes where applicable.

2.2 MINIMUM TRADE SIZE

- A. Rigid conduit - 3/4".
- B. Non-metallic conduit - 3/4"c.
- C. 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. Die Cast (Use as Option for SCPS)
 - 4. Malleable iron, zinc plated.
 - 5. Threaded rigid and IMC conduit to flexible conduit coupling.
 - 6. Direct flexible conduit bearing set screw type not acceptable.
- 2.8 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)
- A. Comply with:
 - 1. NEC 350
 - 2. ANSI/UL 360
 - B. Conduit material:
 - 1. Flexible hot-dipped galvanized steel core, interlocked.
 - 2. Continuous copper ground built into core up to 1-1/4" size.
 - 3. Extruded polyvinyl gray jacket.
 - C. Fittings:
 - 1. Threaded for IMC/rigid conduit connections.
 - 2. Accepted for hazardous locations where so installed.
 - 3. Provide sealing washer in wet/damp locations.
 - 4. Compression type.
 - 5. ANSI/NEMA FB 1.
 - 6. ANSI/UL 5148.
 - 7. Die Cast (Option for SCPS)
 - 8. Zinc plated malleable iron or steel.
- 2.9 ELECTRICAL METALLIC TUBING (EMT)
- A. Comply with:
 - 1. UL 797
 - 2. ANSI C80.3
 - 3. NEC 358
 - 4. ANSI/UL797
 - B. Conduit material: Galvanized steel tubing.
 - C. Fittings:

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1. ANSI/NEMA FB 1
2. Set screw
3. Die Cast (Option for SCPS)
4. Zinc plated malleable iron or steel.
5. Concrete tight.
6. T&B Series 5031/5030.

2.10 RIGID NONMETALLIC CONDUIT (PVC) (RNC)

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

2.11 EXPANSION FITTINGS

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

PART 3 - EXECUTION

3.1 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.

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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.
 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:

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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 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

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- 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 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

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expansion fittings in such runs shall not be greater than 100 feet.

3.9 GROUNDING

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

3.10 FIRE AND SMOKE STOPPING

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

3.11 VERTICAL RACEWAYS

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

3.12 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.

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- H. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- I. Cut conduit square using saw or pipecutter; de-burr cut ends.
- J. Bring conduit to shoulder of fittings; fasten securely.
- K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- L. Install no more than equivalent of 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 &

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- 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 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 NEC.
- 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. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan.

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- G. Outlet boxes to be one-piece.
- H. 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 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.

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- 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 (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

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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.

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
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 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.

HH. Ceiling Paddle Fans.

1. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan. An outlet box identified for this purpose can only be used to support ceiling paddle fans that weigh up to 35 lbs, unless the box is listed for the weight of the fan. Provide box as required for weight of fan. Provide additional support for fan and outlet box to building structure per detail on drawings. Where no detail on drawing is provided provide support structure as required by authority having jurisdiction and applicable codes and standards.

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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

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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

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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 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.

2.2 CENTER HUNG TYPE CABLE TRAY

A. CONSTRUCTION

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 4 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 top of the spine.
2. Tray shall be constructed of one (1) 1.52 x 2.752 rectangular extruded aluminum tube to which 3/4" x 1/2" box beam (type D) rungs are attached on 6 inch centers.
3. The tray must not have continuous side rails.
4. Summary: Trays shall be 4 inches high x 12 inches wide with rungs 6 inches on center with center spine below rungs providing approximately 4" x 12" clear area for cables.

B. FITTINGS

1. Splice Connectors - aluminum. Sections of Mono-Tray and all other fittings shall be joined by using one (1), two bolt, 4 inch long, rectangular splice connector which telescope about the spine of the tray. Splice connectors shall allow for thermal

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expansion/contraction of the tray system. The splice connectors shall be provided with a vertical hole to accept a 1/2 inch threaded rod (furnished by others) which is used to support the tray in an overhead application. In addition, steel splice connectors shall be installed with the seam up and shall have holes to accommodate mounting configurations associated with horizontal and vertical pivot connectors.

2. Quick Tee and Quick Cross Connectors. Horizontal and Vertical quick connect items shall be used for all 90 degree elbows. Quick Tees and Crosses shall have factory installed splice connector(s) welded to the component assembly.
3. Horizontal and Vertical Pivot Connectors - Angle tray connections to be field installed with Horizontal and Vertical pivot connectors. Fittings and shall telescope about the spine in a similar manner as the above splice connectors with top or side mounted pivot plates.
4. Rungs must pass through sections of spine and be staked in place, not screwed or welded. Each tray length shall consist of one tubular rectangular shaped spine member. All fittings and accessories to be constructed of aluminum and to be manufactured for use with cable tray system.

C. 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.

D. BASIS OF DESIGN:

1. Mono-Systems, Inc
2. Cooper B-Line
3. Approved substitution

2.3 MANUFACTURERS

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

2.4 LADDER-TYPE CABLE TRAY

- A. Description: NEMA VE 1, Class 20C ladder type tray.
- B. Material: Steel or Aluminum.
- C. Finish: ASTM A 123, hot dipped galvanized after fabrication or ASTM A 525, mill-galvanized before fabrication.
- D. Inside Width: 12inches or As indicated.
- E. Inside Depth: 3 inches or As indicated.
- F. Straight Section Rung Spacing: 6 inches on center.

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- G. Inside Radius of Fittings: 12 inches or As indicated.
- H. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
- I. Covers: Flanged cover.

2.5 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 [top of the spine] [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 [top of the spine] [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 [] inch 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 a height of [] inches 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

- 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

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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.

2.6 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. Install fiberglass cable tray in accordance with NEMA FG 1.
- D. 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.
- 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] [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.
- G. Install warning signs at in centers along cable tray, located to be visible.

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: gray baked enamel.
- C. Fronts:
 - 1. Electrical or mechanical room locations: screw cover with flush handle or as noted below.
 - 2. Other locations: mono-flat with concealed trim clamps, concealed hinges, and flush lock lockable handle.
 - 3. Flush or surface type as shown or called for 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. Sq. "D" Class 6650 Series.

2.4 TERMINAL BLOCKS

- A. Terminal Blocks: ANSI/NEMA ICS 4.
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.5 LOCAL GROUND BUS/BAR

- A. Size to handle #6 through #14 AWG copper ground wire.
- B. Length as required for circuits.
- C. Manufacturer:

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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 08 00 - DEMONSTRATION OF COMPLETED COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for demonstration of completed electrical systems:

1.3 DESCRIPTION

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

- 1. Communications Systems
 - a) Each and every system included in Sections Systems.

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

1.4 TIME

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

1.5 ATTENDING PARTIES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

- A. Demonstrate the function and location (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.
- B. Demonstrate by "start-stop operation" how to work the controls, how to reset protective devices, how to replace fuses, and what to do in case of emergency.
- C. Performance Verification and Demonstration to Owner
 - 1. Submit one copy of Check Out Memo Form for each O & M Manual. (Form at end of this section.) Form shall be signed by the contractor, subcontractor and Owner's authorized representative for "each" type of equipment and system. Complete an individual form for each item, equipment and system.

END OF SECTION

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CHECK OUT MEMO FORM

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

Project Name _____

Type of Equipment Checked _____

Equipment Number _____

Equipment Manufacturer _____

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

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

CHECKED BY:

MANUFACTURER'S REPRESENTATIVE (PRINT)

ADDRESS

TELEPHONE/FAX/EMAIL

MANUFACTURER'S REPRESENTATIVE (SIGNATURE, TITLE)

DATE CHECKED

WITNESSED BY:

CONTRACTOR'S REPRESENTATIVE (SIGNATURE, TITLE)

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

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SECTION 27 08 13 - TESTS AND PERFORMANCE VERIFICATION OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section pertains to the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.
- B. Operate system for a 3-day period. Do performance verification work as required to show that the System is operating correctly in accordance with design. Supply instruments required to read data. Adjust System to operate at the required performance levels.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 TESTS

- A. System:
1. General: After installation of all conductors, and before final acceptance, make required tests to determine proper functioning of all circuits. Furnish all necessary instruments required to make tests, and correct any deficiencies found. Prior to energizing, circuits shall be "rung-out" to verify opens, intentional and non-intentional grounds, continuity and detect short circuits by accepted constant "megger".
 2. Procedure:
 - a) All wires in conduit that are shorted or unintentionally grounded shall be replaced.
 - b) Insulation resistance of all feeder conductors and all conductors AWG #1 and larger shall be tested. This is to include all new conductors and/or all existing conductors that are connected and/or extended. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps, and connections are made except connection to source and point of final termination at distribution or utilization equipment.
 - c) Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using AVO Biddle (or accepted equal) Megger at not less than 1000 volts dc. Resistance shall be measured from conductor to conduit (ground). Testing methodology shall conform to short-time or spot-reading procedural recommendations of AVO Biddle Instruments for specific megger being used. Acceptable insulation resistance of conductors rated at 600 volts shall not be less than one (1) megohm.
 - d) Conductors that do not satisfy test requirements (c.) above shall be removed, replaced, and testing repeated on new cable, at no additional costs to the Owner. All tests shall be performed by licensed electrician trained in the use of test instruments. Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed and complete "CONDUCTOR INSULATION RESISTANCE TEST" Form (found at the end of Section Operation and Maintenance Manuals) and submit five (5) copies to Engineer for acceptance. Test shall be witnessed by Owners representative and engineer (if so desired). Final acceptance data is to be submitted in O&M Manual.

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- e) Test reports shall identify each feeder conductor tested, date, time, and result of test, weather conditions, and range, test voltage, and serial number of the megger instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced, and additional test shall be performed.
 - f) Observe all safety instructions set by testing equipment manufacturer. Application of voltage testing involves risk of electric shock and sparking.
3. Take readings of voltage and amperage at building main disconnect switch and at main for each panel, at primary and secondary side of each transformer and at the end of the longest branch circuit at each panel. The above readings shall be taken (1) "no load" conditions and (2) "full load" conditions with all equipment using electricity. Tabulate readings, complete "TABULATED DATA VOLTAGE AND AMPERAGE READINGS" form (found at the end of Section Operation and Maintenance Manuals) and submit five (5) copies to the engineer for acceptance. Final accepted data is to be submitted in O & M manual.
- B. Motors:
1. Test run each motor via motor's control unit in both manual mode and automatic mode. Verify proper operation, voltage and rotation.
 2. Test run each motor furnished under this division of the specifications and all existing motors specifically noted on the drawings and/or specifications to be tested:
 - a) With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate +/- 10% from the nameplate ratings, the condition shall be corrected. Notify the engineer immediately should deviations occur.
 - b) Record results of existing motors tested and submit values to A/E in writing.
 - c) Test the insulation resistances of all motor windings to ground with a "megger" before applying line voltage to the motors. If these values are less than one megohm the contractor furnishing the motor shall be responsible for correcting the error.
 - d) Determine power factor of motor(s) at full load.
 - e) Tabulate readings, complete "Motor Test Information" form (found at the end of Section Operation and Maintenance Manuals) and submit five (5) copies to the engineer for acceptance. Final accepted data is to be submitted in O & M manual.
- C. Grounds:
1. Test each raceway for raceway continuity as called for in Section Grounding and Bonding.
 2. Test each grounding system used in the project as called for in Section Grounding and Bonding.
 3. Submit "GROUND TEST INFORMATION" form (see form at the end of Section Operation and Maintenance Manuals. for each and every grounding system in the project including but not limited to: each ground rod installation; each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment); and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
 4. Grounding resistance shall be as called for in Section Grounding and Bonding.
 5. Testing shall be three (3) point method in accordance with IEEE recommended practice.
 6. Transformer grounding.
- D. Primary Cable:

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1. Primary cable dc proof test shall be performed in the field on new cable from fuse cutout to transformer after complete installation. Test shall be made after all terminations have been completed, but with all switches and other devices normally permanently "connected" to the cables disconnected. A dc voltage shall be applied from appropriate test equipment to the conductor of the cable to be tested, and the low potential or grounded terminal connected to the cable shield. The voltage is applied for 5 minutes and leakage current after 15, 30, 45 and 60 seconds and at one-minute intervals shall be recorded on a form similar to form enclosed herein. Test voltage shall be applied in accordance with IPCEA Standards. Any breakdown of cable or terminals shall be replaced or repaired as directed. Replaced cable or repaired splices shall be retested. The tests shall be witnessed and "D-C HIGH VOLTAGE CABLE TEST REPORT" form (found at the end of Section Operation and Maintenance Manuals). Submit five (5) copies to the Engineer for acceptance. Final accepted data is to be submitted in O&M Manual.

E. Pad Mounted Liquid Filled Transformers:

1. Tests: Transformers shall be tested, and results shall be submitted to the engineer. The test shall include ratio, polarity, no-loss, load loss, resistance measurements, impedance, temperature, impulse strength on liquid-filled transformers, sound level and exciting current and low frequency dielectric strength. A certified copy of the temperature, impedance and sound level tests performed previously on a transformer, which is a duplicate electrically, will be accepted in lieu of temperature, impedance and sound level tests. Minimum impedance shall be 5.00%. All test results shall show comparative data to prove tests equal or greater than ANSI and NEMA Standards.

F. Communications, etc.:

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

G. Generator

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

H. UPS System

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

I. IPS System

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

J. Switchboard

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

K. Service Ground Fault Protection System

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

L. Ground Fault System

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

3.2 DATA PROCESSING

A. Testing Data.

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

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3. Where specific performance verification information is called for in the specifications, use copies of the sheets provided for recording readings.
4. Data shall be submitted and accepted before check-out memos are signed or a request for final inspection is made.

B. Equipment Check-out.

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

END OF SECTION

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SECTION 27 10 00 - PREMISE DISTRIBUTION SYSTEM (EMPTY RACEWAY)

PART 1 - GENERAL

1.1 GENERAL

- A. Applicable provisions of applicable sections of Division 26, "General Conditions," "Supplementary General Conditions," "General Requirements," and Division 1, 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 install a Premise Distribution Empty Raceway System. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.
- 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. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways required for a complete and fully functional system as intended by these specifications. The Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall provide and install, within the wall, a properly sized conduit extended above ceiling and turned into room it serves for each device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from the device to an accessible area. Routing of raceway from device to device shall not be acceptable. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install sleeves and firestopping where penetrations are made through rated walls and floors.

1.3 DESCRIPTION OF SYSTEM

- A. The Contractor shall provide a complete empty raceway system for the Premise Distribution System (PDS) to include all equipment, materials, and labor as required to provide, install and test complete a system as described herein. The system to include but not be limited to:
 - 1. Telephone Service Entrance Pathway: Raceway from point of telephone utility connection to building service terminal backboard.
 - 2. Backbone Pathway: Conform to ANSI/EIA/TIA-569 using conduit, cable tray, backboards, etc. as indicated.
 - 3. Horizontal Pathway: Conform to ANSI/EIA/TIA-569-1990, using raceway, bridle rings, sleeves, backboards, and cabinets as indicated.
 - 4. Raceways, outlet boxes, cabinets, identification, etc.: Conform to applicable sections in these specifications. Provide/install complete with all required basic materials.
 - 5. Terminal backboards and/or cabinets.
 - 6. Fireproofing.
- B. Special Requirements for Cable Routing and Installation:

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1. Sealing of openings between floors, 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 raceway passage between locations as shown on the drawings shall be the responsibility of the Contractor. Any openings created by or for this Contractor and left unused shall also be sealed as part of this work.
 2. 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, shall be included as necessary.
- C. All future backbone cable shall be installed in appropriate raceway system.

1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

- A. Reference Section Reference Standards and Regulatory Requirements.
- B. All referenced Standards, Codes, and Regulatory Requirements shall be either the latest version adopted by the Authority Having Jurisdiction or, where not formally adopted, the latest published version.
- C. 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/TIA/EIA-568-A - Commercial Building Telecommunications Cabling Standard.
 3. ANSI/EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.
 4. ANSI/TIA/EIA-606 - Administration Standard for The Telecommunications Infrastructure of Commercial Buildings.
 5. ANSI/TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
 6. 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.
 7. ANSI/EIA/TIA-TSB-67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
 8. FCC: Federal Communication Commission Part 68 as modified by Wiring Docket 88-57.
 9. BICSI TDMM - Building Industry Consulting Service International, Inc. Telecommunications Distribution Methods Manual
 10. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems.
 11. LPC - Lightning Protection Code (NFPA-780).
 12. NEC - National Electrical Code (NFPA-70).
 13. NFPA 262 - National Fire Prevention Association, 1470 Atlantic Avenue, Boston, MA 02210.
 14. IEEE 802.3 - Institute of Electrical and Electronics Engineers LAN Standard for Ethernet.
 15. IEEE 802.5 - Institute of Electrical and Electronics Engineers LAN Standard for Token Ring.

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16. UL Listed - Underwriters Laboratories Listed.
 17. UL Certified - UL's LAN Cable Certification Program.
 18. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
 19. UL 1666 - Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts.
 20. UL 1449 3rd Edition, Standard For Safety for Surge Protective Devices
 21. UL 497, UL 497A, UL 497B.
 22. ANSI - American National Standards Institute.
 23. NEMA - National Electrical Manufacturer's Association.
- D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.
- E. The equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
1. Americans with Disabilities Act (ADA): Where applicable, the Premise Distribution System shall comply with:
 - a) ADA, Public Law 101-336, 1990.
 - b) ADA Accessibility Guidelines (ADAAG).
 2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
 3. Local and State Building Codes.
 - a) Standard Building Code
 - b) Florida Administrative Code
 - c) Department of Community Affairs Florida Board of Building Codes and Standards - Florida Accessibility Code For Building Construction
 4. Authority Having Jurisdiction:
 - a) General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.

1.5 RELATED SECTIONS

- A. All applicable sections of Division 0, Division 1, and Division 26.

1.6 QUALITY ASSURANCE

- 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:
1. 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

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installation and testing of optical and metallic premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.

2. Contractor shall specialize in installing raceway systems for Premise Distribution Systems with minimum five (5) years documented experience.
 3. The Contractor shall be a direct sales division of, or the authorized and designated distributor for the equipment manufacturer whose product he intends to install.
 4. The Installer shall be currently licensed as a Certified Limited Energy System Specialty Contractor (ES 069).
 5. Installing Contractor shall maintain a permanent, local staff of specialists, including a Superintendent, for planning, installation, and service.
 6. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing Premise Distribution Systems for at least five (5) consecutive years going back from date of bid.
 7. Perform work governed by local telephone utility (service entrance only) in accordance with telephone utility's rules and regulations.
- D. To establish the type and operating characteristics of the Premise Distribution System, 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 Common Work Results on Substitutions):
1. Contractor qualifications (as listed above).
 2. Complete lists, descriptions and drawings of materials to be used.
 3. A complete narrative outlining the differences between the specified product and the contractor's proposed substitution product.
 4. A complete riser diagram of Premise Distribution System.
 5. Where the Contractor proposes to substitute the specified cable (either copper or fiber optic) he shall provide to the engineer a complete copy of the UL Test report for that product. Proposed cable substitutions that are not accompanied by the appropriate UL test report will be rejected.

1.7 SUBMITTALS

- A. Submit in accordance with Sections Common Work Results and Submittals.
- B. In addition to requirements of above, 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.

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- e) The Contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.
- f) Qualifications: Submit qualifications of system installer including but not limited to:
- g) Contractor's license.
- h) Proof of certification by the manufacturer(s).
- i) Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- j) Submit labeling scheme and sample of label.
- k) Contractor shall submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.
- l) Submit a detailed step by step testing procedure for a component by component system functional checkout and test.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit in accordance with Sections Common Work Results and Operation and Maintenance Manuals.
- B. In addition to the requirements above, the contractor shall submit:
 - 1. Record actual locations and sizes of pathways, terminal boards, etc.
 - 2. Record "to and from" locations for all raceways at each terminal board or cabinet.
 - 3. Provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, 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.
 - 4. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit in accordance with Sections Common Work Results and Operation and Maintenance Manuals.
- B. In addition to the requirements above, the contractor's O & M Manuals shall include:
 - 1. A complete as-installed equipment list, listed by room, 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. System performance measurements shall be documented as noted elsewhere in this specification.
 - 3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, etc..
 - 4. Drawings required herein are in addition to those required under "PROJECT RECORD DOCUMENTS".

1.10 WARRANTY

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- A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.
- B. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
- C. Respond to trouble call within twenty-four (24) hours after receipt of such a call.
- D. The contractor shall guarantee all raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

1.11 DEFINITIONS

- A. 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.
- B. 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.
- C. Intrabuilding pathways consist of conduit, sleeves or slots, and trays, and provide the means for placing backbone cables from:
 - 1. CER to CC
 - 2. CC or CP to CC or CP

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.
- B. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.
- C. 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 RACEWAYS

- A. General:
 - 1. All pathways (conduit, raceways, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 16 of these specifications.
 - 2. All pathways (conduit, raceways, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of ANSI/EIA/TIA-569.
 - 3. Conduit. (Comply with Section Conduit except as noted below).
 - 4. Metal flexible conduit shall not be used for PDS system.
 - 5. 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.
 - 6. Pull Cords: Install pull cords in all raceway runs that are installed without cable.

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7. Size:
 - a) See Part 3 for size requirements.
 - b) Minimum size shall be 1".
8. Boxes:
 - a) All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
 - b) Boxes shall be sized as required by EIA/TIA and NEC for cables, conduit and/or device installed.

2.3 TERMINATION BACKBOARDS

- A. Material: 3/4" A/C grade, Class A Flame Spread 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.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General
 1. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The Contractor shall provide and install all raceways required for a complete and fully functional system as intended by these specifications. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall provide and install, within the wall, a properly sized conduit extended above ceiling and turned into room it serves for each device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from the device to an accessible area. Routing of raceway from device to device shall not be acceptable. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install sleeves and firestopping where penetrations are made through rated walls and floors.
 2. Locate, install, and test the Premise Distribution System in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electric Code, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.
 3. Install 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.
 4. Install all electrical basic materials per applicable sections of these specifications.
 5. Properly ground system per applicable sections of these specifications.

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6. Support raceways, backboards, and cabinets under the provisions of Section Hangers and Supports, and/or as required by manufacturer's instructions.
 7. Install raceways to conform to applicable sections of these specifications.
 8. The PDS system 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.
- B. 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 (i.e., outlet boxes, indoor service poles, floor boxes, etc.).
 3. Wall Plates: Provide and install a blank stainless steel cover plate on each outlet box.
- C. Pathway
1. General
 - a) Provide and install raceway for all drops down walls, to non-exposed location, penetrations of fire rating assemblies/walls/etc., where exposed to damage, exterior locations, underground locations, interconnection of CC's, CP's, and CER's, or any combination thereof, for all backbone cables, and all areas required by applicable codes and standards or as otherwise noted/required in these specifications.
 - b) Where acceptable to authority having jurisdiction and all applicable codes/standards, cables above accessible ceilings may be run without raceways provided complete installation complies with all applicable codes/standards. Proper firestopping and support hardware must be utilized.
 - c) All raceways shall meet the applicable requirements of all Sections 16100 through 16199.
 - d) All raceways at terminal boards shall terminate at point within 6 inches of termination board with appropriate bushing, (ground if metal).
 - e) Raceway 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.
 - f) 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.
 - g) Install raceways so no more than two 90° bends are in any raceway section without pullbox. Install additional pullboxes as required to maintain maximum of two 90° bends between pullboxes and/or termination points.
 - h) Label all raceway 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.
 - i) Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.

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- j) Special Raceway Systems: Special raceway systems may be specified for some portions of the PDS system. Refer to the drawings and other sections of these specifications to determine where or if such systems are used.
 - k) Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.
- D. Fire Stop
- 1. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.
 - 2. Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.
 - 3. Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.
- E. Horizontal Cable Pathway
- 1. Sleeves
 - a) Install rigid steel conduit sleeves with bushings on both ends at penetration of all walls above ceilings. Stub-out each side of wall a minimum of 12 inches.
 - b) Install firestopping at sleeves and all rated firewall/smoke wall penetrations. Stub-out wall as required for routing. Firestopping assembly must comply with UL for wall routing and material used.
 - c) Size sleeves as required by the NEC for cable installed, but in no case shall sleeve be less than 2 inch diameter, nor smaller than that required by "4)" below.
 - d) Sleeve size shall not be smaller than that required by EIA/TIA-569, Table 4.1-1, "Conduit Sizing."
- F. CC/CER Termination Locations
- 1. Provide bushings on each end of wireway.
- G. CP Termination Locations
- 1. Install wireway from CP to ceiling space as called for CC/CER locations, but terminate wireway at CP.
 - 2. Locations requiring two (2) wall mounted equipment cabinets shall have, as a minimum, two (2) 2" conduits installed between the two assemblies for routing of patch cables. In all cases the Contractor shall size these conduits according to the NEC fill requirements and shall provide patch cables of sufficient length for the routing path.
- H. Communication Outlet (CO) Pathway:
- 1. Each CO outlet shall have conduit stubbed up above ceiling. Terminate stub in cavity with an "ell" to facilitate cable entry into wall stub.
 - 2. Minimum size to be 1" c.
- I. Backbone Pathways (Intrabuilding or Interbuilding)
- 1. Install raceways as required above under "General."
 - 2. Minimum size: 2" C.
 - 3. 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.

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4. 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.
- J. Pullboxes, Splice (Junction) Boxes, Outlet Boxes
1. Install per applicable sections of these specifications and all applicable codes/standards.
 2. 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.
 3. A pull or splice box shall be placed in a conduit run where:
 - a) the length is over 100 feet,
 - b) there are more than two 90° bends, or
 - c) if there is a reverse bend in the run.
 4. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.
 5. Outlet boxes shall be installed at locations shown on drawings per applicable codes/standards.
 6. Provide bushed nipple at speakers receiving cable without raceway/conduit.
 7. Every pullbox and/or splicebox shall have a hinged cover. Install appropriate access panel to allow cover to open.
 8. Size:
 - a) Where a pullbox is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pullbox.
 - b) Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
 1. for straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway;
 2. for angle and U pulls:
 - (a) 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
 - (b) have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
 - (1) -six times the trade size diameter of the raceway; or
 - (2) -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.

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9. Where a splicebox is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."
 10. No box shall be smaller than that required by NEC 314-28 (a), (1) and (2).
- K. Telephone System Service Entrance Conduit/Raceway:
1. General:
 - a) Provide an underground telephone service entrance conduit system.
 2. Raceway:
 - a) Provide rigid Schedule 40 PVC conduit except all stub-ups, elbows and changes of direction shall be galvanized rigid steel.
 - b) All bends shall be formed with large sweeping radius.
 - c) Provide nylon pull cord in each raceway.
 - d) Provide insulating bushing at all ends.
 - e) Leave at least 12" of free pull cord and cap all ends.
 - f) Provide a pull box whether shown on drawings or not at least every two 90° bends and more as may be required by the telephone company cable installers. Pull boxes shall be dedicated to telephone cables.
 - g) Change of direction shall not exceed 90° per bend.
 - h) Provide suitable raceway mounting anchors or bracing to withstand cable pulling force.
 - i) Terminate and identify service conduit at the property line as directed by the telephone company cable installer.
 - j) For penetration of foundation walls below grade, provide a galvanized rigid conduit sleeve that extends at least 24" outside wall, or longer to reach undisturbed soil, to prevent service conduit shearing by building settlement.
 - k) Telephone service conduit shall be buried with at least 24" of cover.
 - l) When concrete encasement is not provided, bury a continuous orange plastic warning tape above the service conduit, "CAUTION-TELEPHONE LINE BURIED BELOW," or similar accepted wording. Tape shall be TerraTape by Reef Industries or accepted substitution. Tape shall be six inches wide, 6 mil plastic with minimum 600% elongation (extra-stretch).
 - m) Telephone service conduits shall be separated from power conduits by not less than:
 1. 3" of concrete or
 2. 24" of earth, well-tamped.
- L. Termination Backboards
1. Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.
 2. Install termination backboards plumb, and attach securely to building wall at each corner.
 3. Finish paint termination backboards with durable gray paint having flame spread rating of Class A prior to installation of any equipment on termination boards.
 4. Mark all backboards with the legend "PDS" under the provisions of Section Electrical Identification.

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M. 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.

N. Terminal Boards

1. General:
 - a) Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.
2. Grounding:
 - a) Ground each terminal board by extending 1 AWG #6 green insulated copper conductor in 3/4" non-metallic conduit from a junction box at terminal board to the nearest accessible acceptable building grounding electrode system as defined in NEC Article 800-40(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.
 - b) Locate junction box where directed by PDS installers.
 - c) Coil a minimum 6 ft. length of conductor pigtail and leave inside junction box.

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.

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

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SECTION 27 31 00 - COMPUTER/DATA RACEWAY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This conduit system including terminal cabinets, backboards, and outlets as shown by the drawings and described herein, shall be furnished and installed by the Electrical Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

- A. This system shall have the same terminal board as the telephone system.
- B. Raceway and outlet boxes shall conform to the requirements outlined in the Raceway Section of this specification. Conduits shall be 3/4" C. minimum unless otherwise noted.
- C. Bushings shall be provided on all computer conduits.
- D. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than 1" shall have a tensile strength not less than 200 lbs.
- E. Grounding conductors shall be #6 bare copper unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All conduits shall be installed in a manner conforming to the requirements outlined in the Raceway Section of this specification.
- B. Conduits at Terminal Board locations shall be neatly racked on a Kindorf Type rack secured to wall above and below terminal boards.
- C. All conduit and boxes shall be installed as shown on the drawings. Any exceptions to the conduit routing shall be brought to the attention of the engineer before installation.
- D. Install blank plates on all outlets to match plates specified for wiring devices.

END OF SECTION

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SECTION 26 01 00 - OPERATION AND MAINTENANCE MANUALS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 sections apply to this Section.
- B. The requirements in this section of the specifications are in addition to all requirements in sections referenced above.

1.2 SUMMARY

- A. This section includes the requirements for Operation and Maintenance Manuals (O & M Manuals) specifically applicable to Divisions 26 27 28 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 OPERATION AND MAINTENANCE MANUALS

- A. O& M Manuals shall consist of a minimum of one (or if required) two hard cover view type 3-ring binder(s) sized to hold 8 1/2" x 11" sheets; one (1) for ELECTRICAL OPERATION AND MAINTENANCE (Power and Lighting) (black); one (1) for SYSTEMS OPERATION AND MAINTENANCE (Sections 16700 thru 16799) (blue). Where SYSTEMS OPERATION AND MAINTENANCE (Sections 16700 thru 16799) is not applicable, only one (1) binder is required. Refer to Division 1, general requirements for additional requirements.
 1. Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3". Provide additional binders if 3" size is not sufficient to properly hold submittals.
 2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for O & M's at the end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e. ELECTRICAL OPERATION AND MAINTENANCE for Power and Lighting, (and if required) SYSTEMS OPERATION AND MAINTENANCE for Divisions 27 and 28.
- B. O & M Data:
 1. Manufacturer's operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e. surge suppression - 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:
 1. Completed forms and information per Division 1, General Requirements, and this section of the specifications.
 - a) Table of Contents
 - b) Project Addresses
 - c) Reinforced Separation Sheets tabbed with the appropriate specification reference number and typed index for each Section in the Systems Schedule
 - d) Check Out Memo
 - e) Conductor Insulation Resistance Test Memo

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- f) D-C High Voltage Cable Test Report
 - g) Ground Test Information
 - h) Motor Test Information
 - i) Voltage and Amperage Readings Tabulated Data.
 - j) Progress and Record Drawing Certification
 - k) Spare Parts Certification Memo
2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 3. Product Data: Product data and/or Catalog sheets shall be a copy of the final and accepted submittal submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 4. Warranty/Guarantee: Provide copy of warranty/guarantee in respective location in O & M binder, (Power and Lighting) (Systems). Original warranty/guarantee is to be incorporated into separate project warranty book with warranty/guarantees provided for other sections and divisions of the specifications and submitted for Architectural/Owner acceptance.
 5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section
 6. Wiring diagrams, schematic, etc. inserted in proper order, for:
 - a) Time clocks.
 - b) Photocells.
 - c) Control devices, motor controls.
 - d) UPS systems.
 - e) Emergency Generator systems.
 - f) Automatic transfer switches.
 - g) Transformers.
 - h) Panelboards.
 - i) Distribution panelboards.
 - j) Switchboards.
 - k) Each and every part of the Systems sections of these Specifications
 7. For Sections 26
 - a) Product data and/or catalog sheets on all equipment applicable to this project.
 - b) Equipment supplier list for each section's equipment.
 - c) Floor boxes; in addition to above provide:
 1. Installation/removal instructions.
 2. Parts list.
 - d) UPS system; in addition to above provide:
 1. Wiring diagrams.
 2. Parts list.
 3. Installation/removal instructions.
 4. Operation and maintenance requirements.
 5. Copy of maintenance contract.
 6. Preventive maintenance instructions.
 7. Check-Out Memo Form
 - e) Ground fault wiring devices; in addition to above provide:
 1. Wiring diagram.
 - f) Grounding; in addition to above provide:
 1. Test results on each ground rod.
 2. Ground Test Information Form

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8. Sections 26

- a) Product data and/or catalog sheets on equipment applicable to this project.
- b) Equipment supplier list for each sections equipment.
- c) Transformers; in addition to above provide:
 - 1. Recommended periodic testing procedures.
 - 2. Parts list.
 - 3. Any special manufacture suggested O & M information.
 - 4. Installation/removal instructions.
 - 5. Check-Out Memo Form
- d) Panels, distribution panelboards, switchboards; in addition to above provide:
 - 1. Internal wiring diagrams.
 - 2. Bus diagrams.
 - 3. Operation and maintenance requirements, instructions, and recommended testing.
 - 4. Parts list.
 - 5. Copy of directory.
 - 6. Voltage and Amperage Readings Tabulated Data Form
 - 7. Check-Out Memo Form
- e) Overcurrent protective devices; in addition to above provide the following for large circuit breakers:
 - 1. Parts list.
 - 2. Operation and maintenance requirements.
 - 3. Wiring diagrams.
 - 4. Testing data.
 - 5. Installation/removal instructions.
 - 6. Check-Out Memo Form
- f) Motor Control; in addition to above provide the following:
 - 1. Internal wiring diagrams.
 - 2. Wiring diagrams.
 - 3. Bus diagrams.
 - 4. Operation and maintenance requirements, instructions, and recommended testing.
 - 5. Parts list.
 - 6. Copy of directory.
 - 7. Testing data, motor test information sheets.
 - 8. Check-Out Memo Form

9. Sections 26

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

10. Sections 26

- a) Product data and/or catalog sheets on all equipment applicable to this project.
- b) Equipment supplier list for each sections equipment.
- c) Lightning Protection System: In addition to the above provide:
 - 1. Shop drawing.
 - 2. Product data on all components.
 - 3. Parts list.
 - 4. Operation and maintenance procedures.

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5. Copy of lightning protection system master label.
 6. Installer's name, address, etc.
 - d) Surge Suppression:
 1. Product data and/or catalog sheets on equipment applicable to this project.
 2. Parts list.
 3. Recommended testing and replacement procedures.
 - e) Emergency Generator, Emergency Control/System/Switchboard
 1. Internal wiring diagrams
 2. Wiring diagrams
 3. Bus diagrams
 4. Operation and maintenance requirements, instructions and recommended testing
 5. Parts list.
 6. Copy of directory.
 7. Testing data, motor test information sheets
 8. Check Out Memo Form
 9. Narrative of emergency system operation, controls, etc.
11. 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.
 7. Shop drawing as submitted and accepted in submittal process.
 8. Check-Out Memo Form
 - f) Telephone, Computer Systems.
 1. Product data and/or catalog sheets on equipment applicable to this project.
 2. Parts list.
 3. Wiring diagrams of panels.
 4. Shop drawing as submitted and accepted in submittal process.

1.4 PROCESSING SUBMITTALS

- A. Submit a minimum of three (3) sets of O & M Manuals, two (2) sets for Owner, one (1) set for Engineer.
- B. The Contractor shall review the manuals before submitting to the A/E. No request for payment will be considered until the brochure has been reviewed and submitted for acceptance.
- C. Provide additional copies if additional copies are required in other Divisions and/or sections of these specifications.

1.5 DELAYS

- A. Contractor is responsible for delays in job project accruing directly or indirectly from late

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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 ADDRESSES

OWNER:

ARCHITECT:

CONSULTING ENGINEER:

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

GENERAL CONTRACTOR:

SUBCONTRACTOR:

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CHECK OUT MEMO FORM

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

Project Name:

Type of equipment checked:

Equipment Number:

Name of manufacturer of equipment:

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

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

Checked By: (Print or Type Name of Manufacturer's Representative)

(Address and Phone No. of Representative)

(Signature and Title of Representative)

(Date Checked)

Witnessed By: Signature and Title of Contractor Rep.)

*Exceptions Noted At Time Of Check-Out (use additional page if necessary)

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CONDUCTOR INSULATION RESISTANCE TEST MEMO

PROJECT NAME: _____

CONDUCTOR FROM _____ TO

SIZE

INSULATION TYPE

INSULATION VOLTAGE RATING

DATE _____ TIME

WEATHER CONDITIONS

TEST VOLTAGE (DC)

RANGE

MEGGER INSTRUMENT/SERIAL NUMBER

TESTING METHODOLOGY

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

PHASE A TO GROUND _____

PHASE B TO GROUND _____

PHASE C TO GROUND _____

NEUTRAL TO GROUND _____

ISOLATED GROUND TO GROUND

CONTRACTOR'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

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D-C HIGH VOLTAGE CABLE TEST REPORT

Project Name: _____

Location: _____

Description: _____

Rated Voltage: _____

TEST DATA

Set Leakage @ Test Voltage _____ ma Variac _____

Pri. Voltage _____

Sphere Gap _____ Inches

Duct Temp. _____ Ambient Temp. _____ Weather _____

Cable Status _____ 1 hour prior to test

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

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

Final Test Voltage _____

Time Finish: _____

KV DC after 1 min.

Test Procedure _____ No. of Terminals _____

Joints _____

Witnessed by: _____ Performed by: _____

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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:

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

(b) Manufacturer

(c) Model Number

(d) Serial Number

(e) RPM

(f) Frame Size

(g) Code Letter

(h) Horsepower

(i) Nameplate Voltage and Phase

(j) Nameplate Amps

(k) Actual Voltage

(l) Actual Amps

(m) Starter Manufacturer

(n) Starter Size

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

(p) Manufacturer of dual-element fuse

(q) Amp rating of fuse

(r) Power Factor

CONTRACTOR'S REPRESENTATIVE:

DATE:

SIGNATURE OF CHECKER:

DATE:

OWNER'S AUTHORIZED REPRESENTATIVE:

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

Name Of General Contractor

BY: Authorized Signature And Title

Date

Name Of Subcontractor

BY: Authorized Signature And Title

Date

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SPARE PARTS CERTIFICATION MEMO

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

Project Name:

Type of Spare Parts:

Specification Reference:

Quantity of Spare Parts:

Signature below by the contractor signifies that the spare parts required by the drawings and/or specifications have been turned over to the Owner.

(Name of General Contractor)

(Signature, Title, Date)

(Name of Subcontractor)

(Signature, Title, Date)

(Name of Owner)

(Signature, Title, Date)

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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:

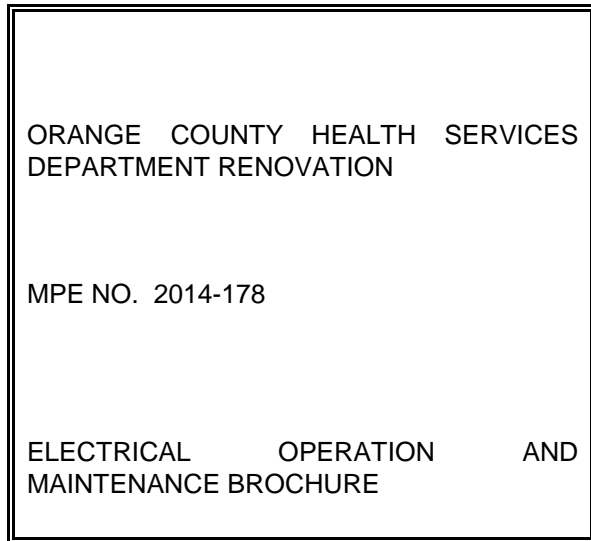
DATE
TIME

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

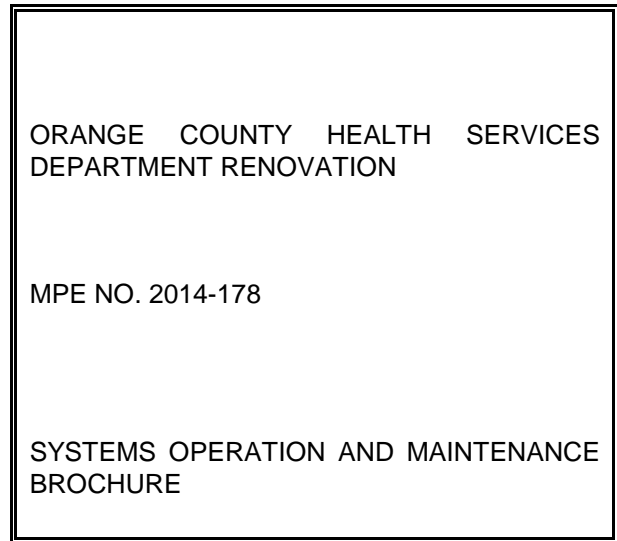
_____ ENGINEERS REPRESENTATIVE
_____ OWNER'S AUTHORIZED REPRESENTATIVE
_____ CONTRACTORS REPRESENTATIVE
_____ DATE

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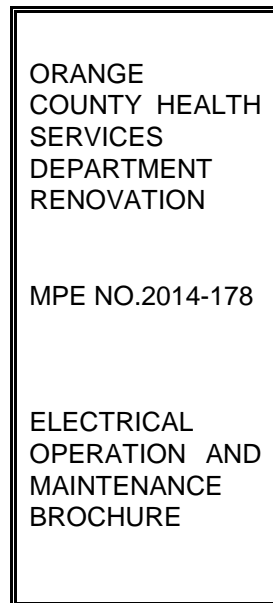
BINDER EXAMPLES FOR SUBMITTALS
Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder



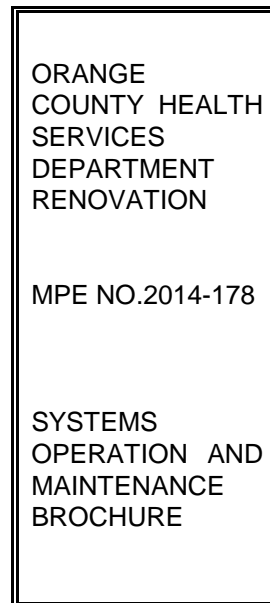
(Size To 8-1/2" x 11")



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



(Size To 11")



(Size To 11")

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SECTION 28 01 05 - INVESTIGATION OF EXISTING ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

- A. Test the essential features of the following existing electrical systems:
 - 1. Alarm and bells
 - 2. Fire detection devices, smoke detection devices
 - 3. Intercommunication equipment
 - 4. Television System
 - 5. Clock System
 - 6. Emergency lighting fixtures
 - 7. Batteries
 - 8. Generator (if applicable)
 - 9. Battery chargers
 - 10. Controls and alarms
 - 11. Outlets: convenience
 - 12. Switches: regular, time
 - 13. Building grounding systems
- B. Each system shall be tested once only, and after completion of testing, results given to the Owner, Engineer and/or Owner's representative. Point out any non-operational function noticed during testing.
- C. Document the existing conditions and operation of the existing electrical systems prior to any work.
- D. Contractor is responsible for all non-working systems and their components unless non-working status is verified prior to work on system.

1.3 TIME

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

1.4 ATTENDING PARTIES

- A. The testing shall be held in the presence of the Owner, or his representative and contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PERFORMANCE VERIFICATION

- A. Test the operation of each of the following existing devices and associated systems:
 - 1. Fire Alarm System
 - a) Test each pull station and record location of each tested device, and note either

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operational or non operational.

- b) Test each heat detector and record location of each tested device and note either operational or non operational.
- c) Test each duct mounted smoke detector with canned smoke and verify alarm activation, remote pilot light activation and damper operation. Record location of each tested device and note either operational or non operational.
- d) Test each smoke detector with canned smoke and record location of each tested device and note either operational or non operational.
- e) Test tamper switches by closing the valve until signal is activated and verify trouble signal indication at the fire alarm control panel and annunciators. Record location of each tested device and note either operational or non operational.
- f) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.
- g) Test Fire Alarm System sufficiently to determine existing operating condition of system. Pull the pull stations, check automatic detectors. Test minimum of one manual device per zone, and one automatic device per zone.
- h) Upon alarm activation verify that the fire alarm zone lights and audible/visual signals function properly. Verify that the local fire department or responding agency receives an automatic signal.

2. Intercom System

- a) Test each call in button and/or handset and speaker, verify voice path operation. Record location of each tested device and note either operational or non operational.
- b) Check each call in switch and light on the master unit. Note either operational or non operational.
- c) Check all call, emerg. call, etc.
- d) Test intercom system sufficiently to determine existing operating condition of system. Check minimum of one call-in station/handset per switchbank and per building.
- e) Check for call-in annunciation and communication.
- f) Check all call, emerg. call, etc.

3. Television System

- a) Test (each) (at least one per building) T.V. outlet with color receiver to verify general reception and operation of existing system distribution.
- b) Check main equipment cabinet for general operation of all components.

4. Lighting and Exit Lighting Fixtures - in areas of remodel and/or renovation.

- a) Test all lighting fixtures and exit lights for proper operation, list bad ballasts, lamps or broken lenses. Record location of fixtures tested.
- b) Test light switches, relay controls, and photo cell controls for proper operation and record location of tested device and note operational or non operational.

5. 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.

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6. Ground System

- a) Test ground system at each permanent building and at each modular unit/building.
 - b) Submit "GROUND TEST INFORMATION" Form (see form at the end of this Section) for each and every grounding system in the project, including but not limited to: each ground rod installation; each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment); and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
 - c) Testing shall be three (3) point method in accordance with IEEE recommended practice.
 - d) Where grounding resistance is greater than value required by this Specification, Contractor is to bring this to the Engineer's and Owner's attention in wiring along with attached 'GROUND TEST INFORMATION' Form.
- B. The electrical contractor shall investigate all existing systems as called out in this performance verification prior to the beginning of any work which could affect these systems.
- C. Each system shall be retested after completion of remodel and/or renovation to ensure proper operation is maintained. Demonstrate operation per Section 16095.

3.2 MEMO OF INVESTIGATION (TESTING)

- A. Submit Existing Facilities Investigation Memo and advise Owner/Engineer of all deficiencies in system(s) prior to work. All systems will be assumed to be fully operational if memo is not received by Engineer prior to work on system.
- B. Submit five (5) copies of memo of tested devices and equipment, memo signed by the Contractor, Subcontractor and Owner and submit each test result to the owner's representative.

END OF SECTION

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EXISTING FACILITIES INVESTIGATION MEMO

NAME OF PROJECT:

The existing systems on the above project have been investigated and checked to determine the existing condition of all existing electrical systems within the area(s) affected by the scope of work of this project. The investigation consisted of testing all electrical systems/devices as required by Section 16061 of these Specifications.

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

NAME OF PRIME CONTRACTOR:

AUTHORIZED SIGNATURE AND TITLE:

DATE:

NAME OF OWNER'S AUTHORIZED REPRESENTATIVE:

AUTHORIZED SIGNATURE AND TITLE:

DATE:

Note To Contractor: Upon completion of investigation and one week prior to the commencement of work, submit five copies of the completed EXISTING FACILITIES INVESTIGATION MEMO to the Owner's Authorized Representative, signed and dated by the Contractor. Have the Owner's Authorized Representative sign and date receipt of MEMO. Retain copy(ies) and submit copy of MEMO in each Operation and Maintenance Manual. Contractor shall submit quantities of MEMOS as required to present required information.

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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 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

- A. This section includes Basic Electrical Requirements specifically applicable to Division 26 27 28 Sections, in addition to Division 01 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

- A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.
- B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.
- C. The Division 26 27 28 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.
- D. Only trained and 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 27 28 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.

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 it's originating point.
- F. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.
- G. Remove existing 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. Notify Owner [72 hours] [24 hours] in advance of any shut-down of existing systems. Perform work during [non-general office] [non-school] operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.
- K. Bid shall include all removal and relocation of all piping, fixtures or other items required for completion of alterations and new construction.
- L. See Section Minor Electrical Demolition for Remodeling for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

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

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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 Divisions 26 27 28 methods and materials unless specifically noted otherwise.
- F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.
- G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.
- H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.
- I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.
- J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.
- K. Where tamperproof screws are specified or required, Phillips head or Allen head devices shall

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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 all electrical.

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1.11 SUPERVISION OF THE WORK

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

1.12 COORDINATION

- A. Provide all required coordination and supervision where work connects to or is affected by work of other trades, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
 - 1. Door Hardware
 - 2. Roll-up doors
 - 3. Fire shutters
 - 4. Roll-up grilles
 - 5. Elevators
 - 6. Escalators
 - 7. Sliding doors
 - 8. Mechanical Division of the Specifications
 - 9. Interior design drawings
 - 10. Pool/spa equipment
 - 11. Fountains
 - 12. Landscape Architect drawings
 - 13. Lifts
 - 14. Laundry Equipment
 - 15. Kitchen Equipment
 - 16. Conveyors
 - 17. Flight Information Display Systems
 - 18. Baggage Information Display Systems
 - 19. Millwork design drawings and shop drawings
- B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Divisions 26 27 28 Contract Documents

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or not.

- C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.
- D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.
- E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
- G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design.
- H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.
- I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes due to these coordination efforts shall be made at no additional cost to the Owner.

1.13 PROVISION FOR OPENINGS

- A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.
- B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.
- C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.14 CONCRETE PADS

- A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4

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6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Provide 3000 psi concrete.

- B. Contractor to provide/install concrete pad for exterior pad mount transformers as required by power company.
- C. Contractor to provide/install concrete pad for exterior generators as recommended by generator manufacturer and structural engineer (8" minimum).

1.15 SURFACE MOUNTED EQUIPMENT

- A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

1.16 CUTTING AND PATCHING

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

1.17 TRENCHING

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

1.18 INSTALLATION

- A. Erect equipment to minimize interferences and delays in execution of the work.
- B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.
- C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.
- D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.
- E. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.

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- F. The Contractor shall keep the construction site clean of waste materials and rubbish at all times. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.
- G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and a layout made prior to the setting or embedment thereof, so as to cause no delay to the project schedule.

1.19 PROGRESS AND RECORD DRAWINGS

- A. Keep two sets of blueline prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.
- B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:
 - 1. All raceways 1-1/2" and above, exactly as installed.
 - 2. All site raceways exactly as installed.
 - 3. Any combining of circuits (which is only allowed by specific written permission) or change in homerun outlet box shall be made on as-builts.
 - 4. Any circuit number changes on plan shall be indicated on as-builts.
 - 5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..
- C. Marked up prints as noted above are to be submitted to A/E for acceptance.. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.
- D. The changes and alterations shall be transferred to AutoCAD (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.

1.20 "OBSERVATION OF WORK" REPORT

- A. Reference the General Conditions.
- B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item to the A/E. The report shall indicate each item noted, and

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method of correction. Enter the date on which the item was corrected, and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.

- C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.21 SYSTEMS WARRANTY

- A. Reference the General Conditions.
- B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of each System. Warranty shall not include lamps in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.
- C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.
- D. Where extended warranty or guarantee are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.
- E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

1.22 WASTE MATERIALS DISPOSAL

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

1.23 SUBSTANTIAL COMPLETION

- A. The Contractor shall be fully responsible for contacting all applicable parties [(A/E or Project Manager)] to schedule required observations of the work by Engineer. [A minimum of 72 hours notice shall be given for all required observations of the work by Engineer, and minimum of 120 hours for substantial completion observation. Time and date shall be agreed on by all applicable parties in writing.]
- B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

1.24 PROHIBITION OF ASBESTOS AND PCB

- A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.
- B. Prior to the final review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 16 contain no asbestos or PCB's. Additionally, all manufacturers shall provide a statement with their submittal that indicates that

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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 28 05 07 - SUBMITTALS FOR ELECTRONIC SAFETY AND SECURITY

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.
- B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

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

1.4 SUBMITTALS

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

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width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting, (and if required) "SYSTEMS SUBMITTALS."

B. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.
3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).
5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
 - a) Fabrication and erection dimensions.
 - b) Arrangements and sectional views.
 - c) Necessary details, including complete information for making connections with other work.
 - d) Kinds of materials and finishes.
 - e) Descriptive names of equipment.
 - f) Modifications and options to standard equipment required by the work.
 - g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).
 - h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
 - i) Conduit/raceway rough-in drawings.
 - j) Items requiring shop drawings include (but not limited to):
 1. Lightning protection system
 2. Special built light fixtures
 3. Each section of fire alarm, television, etc..
 4. UPS systems
 5. Emergency generator systems
 6. Special and/or modified equipment
 7. Main switchboard(s)
 8. UL listed fire and smoke stopping assemblies for each applicable penetration

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- k) See specific sections of Specifications for further requirements.
- 6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
 - a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
 - b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
 - c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.
- B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:
 - 1. Project Addresses
 - 2. Index
 - 3. Separation Sheets
 - 4. Basic Materials
 - 5. Panelboards
 - 6. Light Fixtures
 - 7. Long Lead Items
 - 8. Systems Product Data
- C. Remainder of submittals are to be submitted no later 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.

Action

Description

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- | | |
|---------------------------|--|
| 1. No Exception Noted | No exceptions taken. Resubmittal not required. |
| 2. Rejected | Not in compliance with Contract Documents. Resubmit. |
| 3. Submit Specific Item | Resubmit item as specified. |
| 4. Make Corrections Noted | Make corrections noted, resubmittal not required. |
| 5. Revise and Resubmit | Make corrections noted, resubmittal is required |
| 6. Review not Required | Not required for review. No action taken. Copy retained for reference. |
- H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet, and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.
- I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict, unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

1.6 DELAYS

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

1.7 RE-SUBMITTALS

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

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

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PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

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

GENERAL CONTRACTOR:

SUBCONTRACTOR:

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

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MPE NO. 2014-178

ELECTRICAL SUBMITTALS

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

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MPE NO. 2014-178

SYSTEMS SUBMITTALS

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

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SERVICES
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RENOVATION

MPE NO.2014-178

ELECTRICAL
SUBMITTALS

(Size To 11")

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SERVICES
DEPARTMENT
RENOVATION

MPE NO.2014-178

SYSTEMS
SUBMITTALS

(Size To 11")

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SECTION 28 05 08 - SUBSTITUTIONS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies general, administrative and procedural requirements for substitutions for Division 26 27 28 Sections above and beyond the requirements of Division 1 General Requirements and any Supplemental requirements/conditions.

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 Division 26 27 28 Sections.
 - 2. Is a different design which accomplishes the same result as that design specified in Division 26 27 28 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) Effects 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

- 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.
 - 4. Compliance Statement. Each request shall include the following compliance statement typed on letterhead of submitting company:

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- 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 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 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.

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PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 28 05 10 - SYMBOLS AND ABBREVIATIONS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 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 01 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

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

1.4 ABBREVIATIONS

- A. The following abbreviations or initials are used.
 - A/C Air Conditioning
 - AFD Adjustable Frequency Drive
 - A.C. Alternating Current
 - ADD # Addendum #
 - A/E Architect/Engineer (or Engineer when Architect not applicable)
 - AFF Above Finished Floor
 - AFG Above Finished Grade
 - AHU Air Handler Unit
 - AIC Amps Interrupting Capacity
 - AL Aluminum
 - ALT Alternate
 - AMP Ampere
 - ANSI American National Standards Institute
 - AWG American Wire Gauge
 - @ At
 - B.C. Bare Copper
 - 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

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Comp. Compressor
Conn. Connection
Cond. Condenser
Cont. Continuous
C.R.I. Color Rendering Index
C.T. Current Transformer
CU. Copper
C.U. Compressor Condenser Unit
C.W. Cold Water
D.B. Direct Burial
D.C. Direct Current
Disc. Disconnect
DN. Down
DPST Double Pole Single Throw
DWG Drawing
E.C. Electrical Contractor (or General Contractor)
ELEV. Elevator
EMT Electrical Metallic Tubing
Equip. Equipment
EST Estimate
FAAP Fire Alarm Annunciator Panel
FACP Fire Alarm Control Panel
FARP Fire Alarm Remote Panel
FATC Fire Alarm Terminal Cabinet
FCCP Fire Alarm Command Center Panel
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

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K Kelvin
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

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S/N Solid Neutral
SPST Single Pole Single Throw
SF Square Foot
SW. Switch
SWBD Switchboard
Sys. System
THHN; THWN Nylon Jacketed Wire
TSP Twisted Shielded Pair
TTB Telephone Terminal Board
TTC Telephone Terminal Cabinet
TV Television
TVTC Television Terminal Cabinet
TVEC Television Equip. Cabinet
TYP Typical
Temp. Temperature
UL Underwriters' Laboratories
UTP Unshielded Twisted Pair
VFD Variable Frequency Drive
VHF Very High Frequency
VHO Very High Output
V Volt
VA Volt Amperes
Vol. Volume
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 28 05 29 - HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

- A. Furnish and install all supports, hangers and inserts required to mount fixtures, 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 28 05 33 - CONDUIT FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. 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, [local] and other Federal codes where applicable.

2.2 MINIMUM TRADE SIZE

- A. Rigid conduit - 3/4".
- B. Non-metallic conduit - 3/4"c.
- C. 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. Die Cast (Use as Option for SCPS)
 - 4. Malleable iron, zinc plated.
 - 5. Threaded rigid and IMC conduit to flexible conduit coupling.
 - 6. Direct flexible conduit bearing set screw type not acceptable.
- 2.8 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)
- A. Comply with:
 - 1. NEC 350
 - 2. ANSI/UL 360
 - B. Conduit material:
 - 1. Flexible hot-dipped galvanized steel core, interlocked.
 - 2. Continuous copper ground built into core up to 1-1/4" size.
 - 3. Extruded polyvinyl gray jacket.
 - C. Fittings:
 - 1. Threaded for IMC/rigid conduit connections.
 - 2. Accepted for hazardous locations where so installed.
 - 3. Provide sealing washer in wet/damp locations.
 - 4. Compression type.
 - 5. ANSI/NEMA FB 1.
 - 6. ANSI/UL 5148.
 - 7. Die Cast (Option for SCPS)
 - 8. Zinc plated malleable iron or steel.
- 2.9 ELECTRICAL METALLIC TUBING (EMT)
- A. Comply with:
 - 1. UL 797
 - 2. ANSI C80.3
 - 3. NEC 358
 - 4. ANSI/UL797
 - B. Conduit material: Galvanized steel tubing.
 - C. Fittings:

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1. ANSI/NEMA FB 1
2. Set screw
3. Die Cast (Option for SCPS)
4. Zinc plated malleable iron or steel.
5. Concrete tight.
6. T&B Series 5031/5030.

2.10 RIGID NONMETALLIC CONDUIT (PVC) (RNC)

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

2.11 EXPANSION FITTINGS

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

PART 3 - EXECUTION

3.1 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.

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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.
 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:

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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 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

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- 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 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

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expansion fittings in such runs shall not be greater than 100 feet.

3.9 GROUNDING

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

3.10 FIRE AND SMOKE STOPPING

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

3.11 VERTICAL RACEWAYS

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

3.12 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.

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- H. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- I. Cut conduit square using saw or pipecutter; de-burr cut ends.
- J. Bring conduit to shoulder of fittings; fasten securely.
- K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- L. Install no more than equivalent of 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 &

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- 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 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 28 05 34 - OUTLET BOXES FOR ELECTRONIC SAFETY AND SECURITY

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 NEC.
- 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 28 05 35, 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. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan.

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- G. Outlet boxes to be one-piece.
- H. 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 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.

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- 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 (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

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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.

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
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 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.

HH. Ceiling Paddle Fans.

1. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan. An outlet box identified for this purpose can only be used to support ceiling paddle fans that weigh up to 35 lbs, unless the box is listed for the weight of the fan. Provide box as required for weight of fan. Provide additional support for fan and outlet box to building structure per detail on drawings. Where no detail on drawing is provided provide support structure as required by authority having jurisdiction and applicable codes and standards.

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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

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SECTION 28 05 35 - PULL AND JUNCTION BOXES FOR ELECTRONIC SAFETY AND SECURITY

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 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

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SECTION 28 05 53 - IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

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. Nameplates for emergency power shall be laminated phenolic plastic. Red front and back, with white core, with lettering etched through outer covering, white engraved letters on red background.
- C. Letter Size:
 - 1. 1/8 inch letters for identifying individual equipment and loads.
 - 2. 1/4 inch letters for identifying grouped equipment and loads.
- D. 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

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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.

- E. 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 (Systems Sections 16700 through 16799), junction and pull boxes (larger than 4-11/16"), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number (if applicable).
- F. All Electrical System panels, transfer switches, motor control centers, disconnect switches, motor controllers, etc. shall be labeled as per branch, i.e.: "Panel ABC Emergency-Life Safety Branch" (similar for emergency legally required standby branch, or emergency optional standby branch).

2.2 WIRE MARKERS

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

2.3 CONDUIT/JUNCTION BOX COLOR CODE

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

COLOR CODE FOR JUNCTION BOXES KRYLON PAINT NUMBER

System Emergency 277/480 volt	Cherry Red K02101
System Emergency 120/208 volt	Zinger Pink S01150
Fire Alarm	Safety Orange K02410
Normal Power 277/480 volt	Leather Brown K02501
Normal Power 120/208 volt	Glossy Black K01601
Fiber Optics	Safety Purple K01929
Sound System	Safety Yellow K01813
Clock/Radio	Light Blue S01540
Intercom	True Blue K01910
Computer/Data	Bright Gold K01701
TV	Glossy White K01501
BAS	Cameo White K04129
FIDS/BIDS	Saddle Tan K03554
Security/CCTV	John Deere Green K01817
Telephone	Safety Green K02012
Grounding	Green Fluorescent K03106

- B. Conduits (not subject to public view) longer than 20 feet shall be painted with above color paint

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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 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 28 05 61 - CABINETS AND ENCLOSURES FOR ELECTRONIC SAFETY AND SECURITY

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 Division 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: gray baked enamel.
- C. Fronts:
 - 1. Electrical or mechanical room locations: screw cover with flush handle or as noted below.
 - 2. Other locations: mono-flat with concealed trim clamps, concealed hinges, and flush lock lockable handle.
 - 3. Flush or surface type as shown or called for 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. Sq. "D" Class 6650 Series.

2.4 TERMINAL BLOCKS

- A. Terminal Blocks: ANSI/NEMA ICS 4.
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.5 LOCAL GROUND BUS/BAR

- A. Size to handle #6 through #14 AWG copper ground wire.
- B. Length as required for circuits.
- C. Manufacturer:

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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 28 08 00 - DEMONSTRATION OF COMPLETED ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 and Division 26 27 28 Specification sections apply to this Section.
- B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

- A. This section includes the requirements for demonstration of completed electrical systems:

1.3 DESCRIPTION

- A. Demonstrate to Owner the essential features of the following electrical systems:
 - 1. Communications Systems
 - a) Each and every system included in Sections Systems.
 - 2. Electrical Entrance Equipment
 - a) Circuit breakers
 - b) Fuses and fuseholders
 - c) Meters (where applicable)
 - 3. Miscellaneous Electrical Equipment
 - a) Kitchen exhaust hood shut down
 - b) Electrical systems controls and equipment
 - c) Electrical power equipment
 - d) Motor control centers
 - e) Motor control devices
 - f) Relays
 - g) Special transformers
 - h) Starting devices
 - i) Surge suppression equipment
 - 4. Lighting Fixtures (include relamping and replacing lenses)
 - a) Exit and safety fixtures
 - b) Fixtures, indoor and outdoor
 - 5. Lightning Protection System
 - 6. Distribution Equipment
 - a) Lighting and appliance panelboards
 - b) Distribution panels
 - c) Switchboard
 - d) Voltage stabilizers
 - 7. Standby Electrical Equipment
 - a) Batteries
 - b) Battery chargers
 - c) Controls and alarms
 - d) Emergency generators, transfer switches
 - e) UPS systems
 - 8. Wiring Devices
 - a) Low-voltage controls
 - b) Switches: regular, time

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- B. Each system shall be demonstrated once only, after completion of testing.

1.4 TIME

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

1.5 ATTENDING PARTIES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

- A. Demonstrate the function and location (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.
- B. Demonstrate by "start-stop operation" how to work the controls, how to reset protective devices, how to replace fuses, and what to do in case of emergency.
- C. Performance Verification and Demonstration to Owner
 - 1. Submit one (1) copy of Check Out Memo Form for each O & M Manual. (Form at end of this section.) Form shall be signed by the contractor, subcontractor and Owner's authorized representative for "each" type of equipment and system. Complete an individual form for each item, equipment and system.

END OF SECTION

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CHECK OUT MEMO FORM

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

Project Name:

Type of equipment checked:

Equipment Number:

Name of manufacturer of equipment:

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

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

Checked By: (Print or Type Name of Manufacturer's Representative)

(Address and Phone No. of Representative)

(Signature and Title of Representative)

(Date Checked)

Witnessed By: Signature and Title of Contractor Rep.)

*Exceptions Noted At Time Of Check-Out (use additional page if necessary):

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SECTION 28 31 00 - ADDRESSABLE FIRE ALARM/DETECTION SYSTEM (EXTENSION OF EXISTING)

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test an extension of the existing automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.
- B. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least seven days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the Authority Having Jurisdiction.
- C. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The Contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.
- D. The Contractor shall provide and install the fire alarm system (including all equipment, wiring, etc.) in accordance with the manufacturer's recommendations.
 - 1. Installation of devices shall be in accordance with the manufacturer's requirements as well as the requirements of the Contract Documents. Recommendations by the manufacturer for the proper installation of the fire alarm system and its equipment shall not preclude the requirement for the Contractor to comply with the requirements of the Contract Documents.
 - 2. Termination of fire alarm circuits shall be in accordance with the manufacturer's recommendations, applicable requirements of the National Electrical Code (NFPA 70), ADA, other applicable codes and the Contract Documents.
 - 3. The fire alarm installer shall be responsible for ensuring that prior to bidding the project, the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the fire alarm system manufacturer's recommendations for proper installation of the system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.
- E. The Owner shall be responsible for any retrofits, installation and design required by the local AHJ to comply with the requirements of the Florida Fire Prevention Code, 5th edition, NFPA 1, Section

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11.10. This code requirement can only be determined after the construction of the building and may or may not be required by the local AHJ in the area of this project.

1.3 DESCRIPTION

- A. The Contractor shall furnish and install an addressable fire alarm system extension to match the existing system. All devices shall be addressable. Control shall be microprocessor based and field-programmable. All electronics shall be solid state.
- B. Provide all materials, work, labor, etc. as required to modify (including any programming, battery capacity, etc.) the existing to comply with the operation, etc. noted in these contract documents.
- C. The system extension shall include but not be limited to:
 - 1. Modification of the Main fire alarm control panel (FACP) including all required power supplies
 - 2. Fire alarm annunciator panel (FAAP)
 - 3. Manual pull stations
 - 4. Smoke detectors
 - 5. Heat detectors
 - 6. Combination audible/visual devices (indoor and outdoor weatherproof as indicated on the drawings)
 - 7. Visual devices (indoor and outdoor weatherproof as indicated on the drawings)
 - 8. Remote power supplies (Remote power supplies shall be in a UL listed assembly and be provided by the same manufacturer as the fire alarm control panel (FACP)).
 - 9. UL listed dialer
 - 10. Modem for remote service capabilities.
 - 11. Areas of rescue assistance equipment (Areas of rescue assistance equipment shall be provided and installed by the fire alarm system installer).
 - 12. Surge suppression
 - 13. Programming
 - 14. Grounding
 - 15. Firestopping
 - 16. Wire and cable labeling
 - 17. Electrical power required to comply with all functions and operations called for in this section of the specifications
 - 18. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system
- D. The Contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:
 - 1. Elevator recall, control, and/or shutdown
 - 2. Monitoring of Sprinkler System and/or Fire Protection System Flow and Tamper switches
 - 3. Monitoring of Sprinkler System and/or Fire Protection System Valve Supervisory switches
 - 4. Monitoring of Post Indicator Valve (PIV) switches

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5. Gas/Fuel valve shutoff
 6. Escalator shutdown
 7. HVAC system control and/or shutdown
 8. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown
 9. Smoke Control system control and/or shutdown
 10. Control of fire, smoke, and/or combination fire/smoke dampers
 11. Fire suppression and or extinguishing systems
 12. Monitoring of kitchen hood fire suppression systems
 13. Control of fire and/or smoke doors, dampers, shutters, etc.
 14. Computer room power panels and air conditioning control and/or shutdown
 15. Control of door hold open devices
 16. Control of time out room door lock devices
 17. Connection to telephone tie lines, UL Listed dialer, etc. required for monitoring of the fire alarm system
- E. The system shall operate as a non-coded, continuous ringing system, which will sound all audible devices and activate all visual devices until it is manually silenced. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.
- F. The system shall be wired as a Class A system for all circuits.
- G. The system is to be a complete addressable system.
- H. All portions of fire alarm system shall be installed in conduit. Conduit and boxes to be installed by electrical contractor.
- I. The fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.
- J. Contractor to advise owner of requirements for monitoring the fire alarm system by owner's monitoring company and provide all electrical required for remote monitoring.
- K. Provide and install wiring, equipment, etc. for connection to devices furnished under other divisions of the work.
- L. Provide and install wiring, equipment, etc. as required to deactivate power in the elevator rooms by heat detectors via shunt trip breakers and arm sprinkler pre-action system.
- M. Provide and install wiring, equipment, etc. as required to deactivate power to computer power panels and air conditioning equipment by automatic or manual devices as shown on plans.
- N. Although they may not be indicated on the Fire Alarm system diagram and/or drawings, all required control and interlock wiring between the Fire Alarm system and building equipment shall be provided hereunder, Controls are required to/for/from:
1. Fire/smoke air and duct detectors
 2. Fire, smoke and/or combination fire/smoke dampers.
 3. Supply/Return fans, Exhaust fans, and/or Fan Terminal Boxes (FTB)
 4. Automatic fire extinguishing systems

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5. Smoke evacuation equipment
- O. Provide wiring for Post Indicator Valve Alarms, in each instance in which these are provided under work of Other Trades, connected to Fire Alarm System.
- P. Provide and install all relays (electric-electric, electric-pneumatic, and/or pneumatic-electric) as required for a complete and operational fire alarm system, complying with all applicable codes and all requirements, and coordinated with all divisions of these specifications.
- Q. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.
- R. Surge Suppression
 1. The contractor shall have equipment installed on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes, which can cause damage to the microprocessor components of the system. Central office telephone lines shall have equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.
 2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
 3. Provide surge suppression equipment at the following locations:
 - a) On each conductor pair and cable sheath entering or leaving a building.
 - b) On each conductor associated with fire protection (sprinkler) system fire alarm connections.
 - c) On any and all telephone lines.
 - d) In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge protection equipment herein specified is required to be installed in addition to internal equipment protection.

1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

- A. 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. ANSI S3.41 American National Standard Audible Emergency Evacuation Signal
 2. National Fire Protection Association Standards:
 - a) NFPA 70 National Electrical Code (including but not limited to Article 760, Fire Alarm Systems)
 - b) NFPA 72 National Fire Alarm Code
 - c) NFPA 101 Code For Safety to Life from Fire in Buildings and Structures
 - d) NFPA 90A Installation of Air Conditioning and Ventilating Systems
 3. Underwriters Laboratories Inc. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
 - a) UL 864 (Category UOJZ) APOU Control Units and Accessories for Fire Alarm Systems. All Control Equipment shall be listed under UL category UOJZ.

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- b) UL 268 Smoke Detectors for Fire Alarm Systems
 - c) UL 268A Smoke Detectors for Duct Application
 - d) UL 217 Smoke Detectors Single Station and Multiple Station Smoke Alarms
 - e) UL 521 Heat Detectors for Fire Protective Signaling Systems
 - f) UL 228 Door Closers With or Without Integral Smoke Detectors
 - g) UL 464 Audible Signal Appliances
 - h) UL 1638 Visual Signaling Appliances
 - i) UL 1481 Power Supplies for Fire-Protective Signaling Systems
 - j) UL 1480 Speakers
 - k) UL 1424 Cables for Power-Limited Fire-Alarm Circuits
 - l) UL 1971 Signaling Devices for the Hearing Impaired
 - m) UL 1449 3rd Edition Surge Protective Devices
 - n) UL 497, UL 497A, UL 497B.
4. All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed by the Underwriters' Laboratories product directory called Fire Protection Equipment and/or the Electrical Construction Materials List.
5. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
6. The system controls shall be UL listed for Power Limited Applications per NEC. All circuits must be marked in accordance with NEC.
7. All equipment supplied as part of the Fire Alarm System shall be provided by a single manufacturer and shall comprise a complete UL Listed Fire Alarm System.
8. IEEE: The fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in Table 1, Location Category A High Exposure of ANSI/IEEE Standard C62.41-1991.
- C. The equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
- 1. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Standards for Accessible Design, 2010.
 - 2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
 - 3. Local and State Building Codes.
 - a) Florida Building Code, 2010.
 - b) Florida Administrative Code. All applicable chapters including but not limited to:
 - 1. Chapter 69A Rules, including but not limited to:
 - (a) Ch 69A-3 Fire Prevention - General Provisions.
 - (b) Ch 69A-46 Fire Protection System Contractors and Systems.
 - (c) Ch 69A-48 Fire Safety Standards for the Fire Alarm Systems.

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- c) Florida Department of Insurance:
 - 1. Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.
 - 2. Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal.
- d) Orange County – Orange County Fire Marshall Code
- e) Authority Having Jurisdiction:
 - 1. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local Authority Having Jurisdiction.
 - 2. Fire Department:
 - 3. Building Official
 - 4. State of Florida: Division of State Fire Marshal.

D. Surge Suppression

- 1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters Laboratories, shall bear the UL seal and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.
- 2. Comply with all standards and guides as listed under "References" above.

1.5 RELATED SECTIONS

- A. Applicable sections of these specifications with regard to, but not limited to:
 - 1. Doors
 - 2. Ductwork accessories: smoke dampers
 - 3. Building control systems
- B. Section Public Address/Bell Signaling System
- C. Section Local Area Sound System
- D. Section Intrusion Detection System

1.6 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years experience and with service facilities within 50 miles of Project.
- B. Installer:
 - 1. Company specializing in installing the products specified in this section with minimum ten (10) years experience.
 - 2. The Installer shall be currently licensed as a Florida Certified Alarm System Contractor I (EF).
 - 3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
 - 4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.

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5. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least ten (10) consecutive years going back from date of bid.

C. Surge Suppression

1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
3. Verify proper clearances, space, etc. is available for surge suppressor.

D. Coordination/Project Conditions

1. Verify proper grounding is in place.
2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide a coupling conductor within the fire alarm underground raceway system to run along side fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.

E. The work specified herein is an extension of the existing system and as such all equipment shall match existing. In the event that the existing equipment is no longer available other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the engineer (See Section Substitutions):

1. Certified letter from the manufacturer specifically stating the following:
 - a) Part numbers and descriptions of each item that is no longer manufactured.
 - b) Manufacturer name (if not the same as the original manufacturer), part numbers and descriptions of items that are certified by the manufacturer to be compatible with the existing system.
 - c) A detailed listing of specific differences, including both advantages and disadvantages, between the original item and the proposed substitution.
2. Contractor qualifications (as listed above).
3. Complete lists, descriptions and drawings of materials to be used.
4. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
5. A complete riser diagram of Fire Alarm System.

1.7 SUBMITTALS

A. Submit in accordance with Section Common Work Results and Section Submittals.

B. In addition to requirements above, 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.

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- b) Roughing-in diagrams.
 - c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
 - d) Operation and maintenance manuals.
 - e) Typical wiring diagrams and risers.
 - f) The contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.
- 3. Submit floor plans to locate all devices. Wiring diagrams shall include wire and raceway sizes, fire alarm control panels, communication panels, riser wiring and associated raceway sizes, wiring details, connections and terminal identification. All devices shall be identified by the same applied identification symbol as shown on the contract documents.
 - 4. Submit all load calculations and cable/wire sizing for each branch of the individual fire alarm field circuits. Wire sizing calculations to prove maximum three percent (3%) voltage drop at all AC voltages and maximum eight percent (8%) voltage drop at all DC voltages.
 - 5. Battery sizing calculations.
 - 6. Submit a detailed step by step testing procedure for a component by component system functional checkout and test.
 - 7. Point to point wiring diagrams and block diagrams of system to be installed. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with submittals.
 - 8. Riser diagrams and floor plans showing conduit runs and number of wires. All devices shall be identified by the same applied identification symbol as shown on the drawings.
 - 9. Surge Suppression
 - a) Surge protective data for 120 volt power source, power circuit, outside signaling circuit, and exterior incoming circuits from other buildings (if any), and outgoing circuits to other buildings (if any).
 - b) Submit Product Data for each type of suppressor:
 - 1. Dimensions.
 - 2. Means of mounting.
 - 3. Compliance with U.L Standards referenced.
 - 4. Compliance with IEEE Standards referenced.
 - 5. Design type (Hybrid, MOV).
 - 6. Size of wire leads.
 - 7. warranty.
 - 8. Performance data showing compliance with performance as specified herein.
 - 9. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
 - 10. Manufacturer's certified test data on each suppressor type.
 - 11. Test data from an independent test laboratory.

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10. Name, qualifications, etc. of company providing and installing system.
11. Qualifications of installer. Submit proof installer meets specified requirements.
12. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire to be used in installation of fire alarm and communications system.
13. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details and specification sheets for all fire alarm system components and rough-in boxes.
14. Submit Florida Registered Firm certificate number.
15. Submit Florida Fire Alarm Contractor's license number.
16. Submit Fire Alarm Technician(s) Manufacturer's certification.
17. Detailed drawing of the Fire Alarm Control Panels layout indicating the exact arrangement of all zones, including expansion zones.
18. Coordination Drawing: Coordination CAD drawing of building Fire Command room and equipment layout as shown on drawings, with all panel and rack footprints, using actual manufacturer's dimensions, indicating proper clearances.
19. Network:
 - a) Complete description data indicating UL listing for all network components.
 - b) Complete sequence of operation of all functions of the network.
 - c) A list of every network node address.
 - d) A list of every address of every device connected to a network node that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.
 - e) Complete network wiring diagrams for all components and interfaces to equipment supplied by others.
20. All drawings required herein shall be on AutoCAD 2007 or higher.
21. Where required by Authority Having Jurisdiction submit signed and sealed documents as required by Authority Having Jurisdiction. Where Authority Having Jurisdiction requires shop drawings to be signed and sealed by a Registered Engineer, Contractor is required to submit same and include in his bid all costs associated with having a Registered Engineer other than the design Engineer of Record perform signing and sealing.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit in accordance with Section Common Work Results and Section Operation and Maintenance Manuals.
- B. In addition to the requirements above, the contractor shall submit:
 1. Updated and revised contract documents to record actual locations (as-installed) of all equipment, devices, initiating devices, signaling appliances, and end-of-line devices.
 2. Record actual type, size, and routing of cables installed.
 3. Record all cable identifications.
 4. Drawings required herein are in addition to those required under Operation and Maintenance Data.
 5. All drawings required herein to be on AutoCAD 2007 or higher.

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1.9 OPERATION AND MAINTENANCE DATA

- A. Submit in accordance with Section Common Work Results and Section Operation and Maintenance Manuals.
- B. In addition to the requirements above, the contractor's O & M Manuals shall include:
 - 1. A complete as-installed equipment list, listed by room, 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 wire numbers, terminal block numbers and layouts, and other designations and codings (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.
 - 3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
 - 4. Repair parts list for each and every major equipment item furnished.
 - 5. Service manuals for each and every major equipment item furnished.
 - 6. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.
 - 7. 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.
 - 8. Surge Suppression
 - a) 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.
 - 9. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing detectors, speaker locations and orientation, rack locations, and all other related device locations.
 - 10. 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 2007 or higher.

1.10 WARRANTY

- A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.
 - 1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
 - 2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.
- B. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or

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electrical defects for one (1) year from date of final acceptance of the system.

C. Surge Suppression

1. All surge suppression devices shall be warranted free from defects in materials and workmanship for a period of five (5) years.
2. Any suppressor, which shows evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.
3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.11 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

- A. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes, and in particular the ADA Requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant system. Said additional devices shall be shown on shop drawings submitted by Contractor.
- B. In addition to the above-mentioned devices, Contractor shall include in his bid price the cost of installing ten additional audible/visual notification devices (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior to substantial completion date. At least two weeks prior to substantial completion system shall be fully operational. After system is operational, Owner's safety representative and the system installer shall review the placement of and coverage provided by visual and audible signals throughout the facility for compliance with all codes, and in particular the ADA Requirements and NFPA 72. System installer shall provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion.
- C. After the project has had its first annual safety inspection, the system installer shall install within one week's notice any additional audible/visual signals that have been determined to be required during said inspection from the balance of the twenty additional devices noted above. There shall be no cost for these added devices provided the total does not exceed the balance remaining of the twenty devices noted above. The final balance of the twenty additional devices included in bid price shall be turned over to the Owner as spare material after any fire alarm issues identified during the first annual safety inspection are resolved.

1.12 MAINTENANCE SERVICE

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

1.13 EXTRA MATERIALS

- A. Provide six (6) keys of each type.
- B. Provide three (3) of each type of automatic smoke detector without base.
- C. Provide three (3) of each type of surge suppression device.

1.14 OWNER'S INSTRUCTION:

- A. Provide instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel

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operation and instruction on peripheral device operation, including what are normal indications and alarm indications of each type of new/added device. Videotape all training sessions and deliver (4) copies of tapes to Owner (for use in future training).

1.15 SYSTEM OPERATION

- A. System operation shall meet the operation requirements of all codes and regulatory requirements.
- B. Upon activation of the Fire Alarm System by a manual station, smoke detector, or any other new or existing automatic device (except AHU smoke duct detector), the following shall take place:
 - 1. Energize all alarm signaling devices.
 - 2. Sound all audible alarms and flash visual signals throughout the campus.
 - 3. Alert local fire department or proprietary system.
 - 4. Cause alarm to be displayed on the annunciator section of the control panel.
 - 5. Cause alarm to be displayed on remote annunciator
 - 6. Close all doors or fire shutters, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
 - 7. Unlock all electrically locked time-out room doors (coordinate with the architect and door hardware supplier, provide all electrical required).
 - 8. Shut down all air handlers, exhaust fans supplying or exhausting air, and fan terminal boxes (FTB) in at least the zone where the alarm is initiated.
 - 9. Shut all fire and/or smoke dampers in ducts associated with the air handling units and exhaust fans, which are shut down, in at least the zone where the alarm is initiated.
 - 10. Transmit signals to the building elevator control panel to initiate return to the main floor or alternate floor.
 - 11. Transmit signals to the building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
 - 12. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.
 - 13. Send a signal to all non-fire alarm sound reinforcement systems (i.e. Cafeteria, Gymnasium, Multi-Purpose Room, Theater, etc.). Fire alarm signals shall override all other sound systems. Alarm notification signals shall take precedence over all other signals. Operation of other sound systems shall resume after fire alarm system clears alarm.
- C. System operation shall meet the operation requirements of all codes and regulatory requirements.
- D. Upon activation of the Fire Alarm System by a manual station the following shall take place:
 - 1. Energize all alarm signaling devices.
 - 2. Sound all audible alarms and flash visual signals throughout the building.
 - 3. Alert local fire department or proprietary system.
 - 4. Cause alarm to be displayed on the annunciator section of the control panel.
 - 5. Cause alarm to be displayed on remote annunciator

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6. Close all doors, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
 7. Unlock all electrically locked doors (coordinate with architect and door hardware supplier, provide all electrical required).
- E. Upon activation of the Fire Alarm System by any smoke detector, any sprinkler flow alarm switch or other automatic detection device, the following shall take place in addition to the above:
1. Shut down all air handlers and exhaust fans supplying or exhausting air in at least the zone where the alarm is initiated.
 2. Shut all smoke dampers in ducts associated with the air handling units and exhaust fans, which are shut down, in at least the zone where the alarm is initiated. (Coordinate with mechanical contractor and provide all electrical as required).
 3. Transmit signals to building elevator control panel to initiate return to main floor or alternate floor.
 4. Transmit signals to building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
 5. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.
 6. Send a signal to all non-fire alarm sound reinforcement systems. Fire alarm signals shall override all other sound systems. Alarm notification signals shall take precedence over all other signals. Operation of other sound systems shall resume after fire alarm system clears alarm.
- F. Elevator: Smoke detectors associated with elevator lobbies, hoistways and machine rooms shall be types accepted by the Florida State Fire Marshal under FAC Chapter 69A-47 Uniform Fire Safety Standards for Elevators. Elevator recall shall be initiated ONLY by elevator lobby, hoistways and machine room smoke detectors. In addition to those functions outlined in "A" above, elevator detector(s) shall initiate the following functions.
1. The operation of any one elevator lobby, hoistways, or machine room product of combustion detectors associated with a single bank of elevators shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures, floor(s) of recall, and alternate floor(s) of recall.
 2. The operation of any elevator machine room product of combustion detector that is part of this Fire Alarm System shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures.
 3. The activation of the smoke detector(s) in a machine room, lobby or hoistway shall cause a suitable warning light to flash. The light is to be located adjacent to the "Phase One" recall switch or elevator hall button at the designated and alternate fire department access level.
 4. Fire alarm system shall monitor shunt trip voltage per NFPA 72.
- G. System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall place the system in the trouble mode, which causes the following system operations:
1. Visual and audible trouble signal indicated be zone at the fire alarm control panel.
 2. Visual and audible trouble signal indicated at remote annunciator panel.

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3. Trouble signal transmitted to central station.
 4. Manual acknowledgement function at fire alarm control panel shall silence audible trouble signal; visual signal shall be displayed until initiating failure or circuit trouble is cleared.
- H. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.
- I. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.
- J. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.
- K. Where required by codes or Authority Having Jurisdiction:
1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.
- L. The fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.
- M. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

1.16 ZONING

- A. Alarm Zones.
1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
 - a) One per building, per floor for pull stations.
 - b) One per building, per floor for automatic devices.
 - c) One for each duct smoke detector.
- B. Notification Zones.
1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
 - a) One (or more) circuit(s) for administration building
 - b) One (or more) circuit(s) for exterior horns
 - c) One (or more) circuit(s) for remainder of campus.
 2. Breakdown circuits as required for load and distances involved.
- C. Alarm Zones.
1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
 - a) One per 3000 square feet per floor, for pull stations and heat detectors.
 - b) One per 3000 square feet per floor, for smoke detectors.
 - c) One for each duct smoke detector.
- D. Notification Zones.
1. Regardless of the number of zones shown on drawings the minimum notification zones

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(horns and strobe lights) required are:

- a) One per floor. Breakdown circuits as required for load and distances involved.

PART 2- PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.
- B. Provide all equipment to match existing equipment required to perform all functions and/or features included in this section of the specifications although not specifically noted or specified herein.
- C. Modify/rework existing system as required for extension to new devices and/or as required for proper operation of system with new devices, adding new zone modules, adding surge suppression, adding power supply and battery capacity to meet regulatory requirements with new devices, etc.

2.2 RACEWAYS

- A. General:
 1. All raceways (conduit, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Divisions 26, 27, 28 of these specifications.
 2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.
- B. Conduit: Comply with Section Conduit except as noted below:
 1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
 2. Size: Minimum size shall be 3/4" conduit.
- C. Boxes:
 1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
 2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

- A. Terminal cabinets are to comply with applicable sections of these specifications.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

- A. Bus to comply with applicable sections of these specifications.
- B. Wall Mount Equipment Enclosure
 1. The control panel, and all associated equipment, shall be housed in an enclosure designed for mounting directly to a wall or vertical surface. The back box and door shall be constructed of 16 gauge steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
 2. The enclosure(s) shall be of sufficient size to house all equipment required for this project. All equipment shall be mounted in the enclosure(s) as designed by the manufacturer. Provide enclosures in quantities as required to provide a complete, UL Listed Fire Alarm

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system.

2.5 REMOTE ANNUNCIATOR

- A. The Fire Alarm Annunciator Panel (FAAP) shall be a serial annunciator panel and must be capable of being mounted in a remote location.
- B. The annunciator shall be modular using low current circuitry. The annunciator shall be capable of operating on nominal 24 VDC and be battery backed up.
- C. The annunciator modules shall be capable of activating local or remote LED's, relays or graphic panels.
- D. All switches shall be a point in the system and be capable of controlling any system output or functions. All LED's and outputs shall be capable of being controlled by any change of state in the system or as a result of a time control, sequence or logic function. The LED's and switches shall be able to be clearly marked by the end user.
- E. The modular components of the annunciator shall be mounted in a recessed cabinet with hinged door and a lexan window with key lock.

2.6 MANUAL STATION (NON-BREAK GLASS)

- A. Manual fire alarm station shall be non-code, non break glass type providing noncoded signals and operating with a double action motion. Upon actuation, they shall not be restorable to normal except by use of a key. The key shall also allow stations to be tested nondestructively. The stations shall be constructed of high impact, flame retardant plastic, with operating directions provided on the cover in highlighted, embossed lettering. The words "FIRE ALARM" shall appear on the door in embossed letters one-half inch high or larger. Mount at 48" above finished floor to top and in accordance with NFPA and handicap standards. Manual stations shall be UL listed. Unit shall be equipped with an addressable interface module.

2.7 PHOTOELECTRIC SMOKE DETECTOR

- A. The contractor shall furnish and install Analog addressable photoelectric smoke detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
- B. The smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Actuating the control panel reset switch may reset the detector.
- C. The sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.
- D. The vandal-resistant, security locking feature shall be used in those areas as indicated on the drawings. The locking feature shall be field removable when not required.
- E. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.
- F. To facilitate installation, the detector shall be nonpolarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.
- G. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

2.8 IONIZATION SMOKE DETECTOR

- A. The contractor shall furnish and install Analog addressable ionization smoke detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed

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compatible with a UL-listed fire alarm panel.

- B. The smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Actuating the control panel reset switch may reset the detector.
- C. The sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.
- D. The vandal-resistant, security locking feature shall be used in those areas as indicated on the drawings. The locking feature shall be field removable when not required.
- E. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.
- F. To facilitate installation, the detector shall be nonpolarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.
- G. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

2.9 DUCT MOUNTED SMOKE DETECTOR

- A. The Duct Mounted Smoke Detector for the fire and smoke detection system shall be a high velocity rated Analog addressable series smoke detector intended for use with ventilation and conditioning ducts.
- B. The detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with NFPA 90A. The detector shall be UL-listed specifically for the use in air handling systems.
- C. The detector shall operate at air velocities ranging from 300 feet per minute to 4000 feet per minute without requiring compensation for operation at specific air velocities. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.
- D. Whether shown on drawings or not, a remote alarm indicator/test station shall be provided for each duct mounted smoke detector to annunciate smoke detector operation remotely. Mount unit in ceiling or wall near respective remote smoke detectors (in an occupied space).

2.10 HEAT DETECTORS

- A. The contractor shall furnish and install Analog addressable heat detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
- B. The heat detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Actuating the control panel reset switch may reset the detector.
- C. Fixed temperature automatic heat detectors shall be rated at 135°F. The fixed temperature element shall use dual thermistor technology. Detectors shall have a smooth ceiling rating of 625 square feet and 2 Form 'A' contacts with rating of 3 amps at 6 to 125 volts AC and 1 amp at 6 to 28 volts D.C.
- D. Detectors shall be installed in accordance with appropriate articles of National Fire Protection Association and the spacing rating assigned by the Underwriters' Laboratories and located as shown on the drawings. Automatic heat detectors shall be Underwriter's Laboratories and Factory Mutual approved.
- E. Where indicated on the drawings the contractor shall provide heat detectors rated, by the

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manufacturer, as explosion proof. If not an integral part of the heat detector assembly, the addressable module shall be located outside the area protected by the explosion proof heat detector (but interior to the building) in an accessible area. If the addressable module is located above a gypsum ceiling the contractor shall provide a fire rated access panel.

2.11 ADDRESSABLE MODULE

- A. Analog addressable device shall be furnished as required to monitor fire alarm or supervisory initiating devices or control auxiliary functions. Each module shall contain address switches to assign a unique input point for programming or control by the system.

2.12 RELAYS

- A. Relays required for control (i.e. Air Handler shutdown, Supply Fan shutdown, Exhaust Fan shutdown, Fan Terminal Box shutdown, Door Lock release, Fire Shutter release, Smoke Damper closure, Fire Damper closure, Smoke/Fire Damper closure, or any other interface required by these specifications or applicable codes) shall be UL listed relays suitable for use in Fire Alarm systems.
- B. Per NFPA, relays used for control of other systems shall be located within three feet (3') of the device to be controlled.
- C. Relays shall be analog addressable devices powered and controlled from the fire alarm system. Each relay shall contain address switches to assign a unique input point for programming or control by the system.
- D. Each relay shall provide at least one set of Form "C" dry relay contacts.

2.13 AUDIBLE NOTIFICATION DEVICES

- A. Audible notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
- B. The audible notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4" sq. x 2 -1/8" backbox.
- C. The audible notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet or more than 120 dBA at the minimum hearing distance from the audible appliance.
 - 1. The audible notification device shall comply with ANSI S3.41 for signal character conformance.
- D. Audible notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

2.14 AUDIBLE/VISUAL NOTIFICATION DEVICES

- A. Audible/visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
- B. The audible/visual notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4" sq. x 2 -1/8" backbox.
- C. The audible portion of the audible/visual notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet or more than 120 dBA at the minimum hearing distance from the audible appliance.
 - 1. The audible portion of the audible/visual notification device shall comply with ANSI S3.41 for signal character conformance.
- D. The audible portion of audible/visual notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in

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wet locations.

- E. The visual portion of the audible/visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
1. The lamp shall be a xenon strobe type or equivalent.
 2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).
 3. The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
 4. The intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75, 15 or 30 candela shall not be acceptable. Field selectable devices may be utilized provided the device is set at 75 candela or higher and the setting of the device selector switch is visible when the device is installed.
 5. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
 6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

2.15 VISUAL NOTIFICATION DEVICES

- A. Visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein. Visual notification devices shall be of the flashing type in compliance with Americans with Disabilities Act.
- B. The visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
1. The lamp shall be a xenon strobe type or equivalent.
 2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).
 3. The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
 4. The intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75, 15 or 30 candela shall not be acceptable. Field selectable devices may be utilized provided the device is set at 75 candela or higher and the setting of the device selector switch is visible when the device is installed.
 5. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
 6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

2.16 WEATHERPROOF COVER (FOR AUDIBLE AND/OR VISUAL DEVICES)

- A. Constructed of clear polycarbonate.
- B. For flush or surface mount devices.
- C. Provide slotted version for audible/visual devices.
1. Maximum of 5 dB loss.
 2. Provide with brass weep hole.
- D. Provide unslotted version for visual only devices.

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1. Maximum of 3 candela light intensity loss up to 110 candela light source.
 2. Provide without weep hole.
- E. Provide with weather gasket.
- F. Spacers for additional depth as required.
- G. Provide with tamper proof screws.
- H. Design criteria:
1. Safety Technology International, Inc. #1220 (audible/visual) or #1221 (visual) series.

2.17 PULL STATION SECURITY COVER

- A. Provide where pull station devices are required to be protected as indicated on the drawings.
- B. Shall be UL Listed.
- C. Constructed of clear polycarbonate.
- D. Provide with battery operated warning horn.
- E. For flush or surface mount devices.
- F. Provide with weather gasket.
- G. Spacers for additional depth as required.
- H. Provide with tamper proof screws.
- I. Design criteria:
1. Safety Technology International, Inc. #1100 Series.
- J. Master Panel
1. The Areas of Rescue Assistance communication system master panel shall include one alternate action switch with internal LED indicator for each zone. An audible alarm will be mounted on the master panel, which will emit a minimum sound level of 90 dB at 30 cm. A yellow LED light on the master panel will illuminate and the alarm will emit a repeating sound if any of the supervised lines are faulted.
 2. The master panel shall be constructed of .125" thick anodized aluminum with permanently silk-screened zone designations on the panel as well as a designation strip.
- K. Control Module
1. The control module shall provide a set of contacts and a fault indicator light for each zone.
- L. Call Station
1. The call station shall consist of one momentary switch with LED and one audible alarm device with a sound level minimum of 90 dB at 30 cm. The call station will be wall mounted of a flush, stainless steel plate.
- M. Design Criteria
1. Cornell Communications Series #4100 Rescue Assistance System

2.18 DOOR HOLDERS

- A. Electromagnetic door holder/releases shall be installed on each door as detailed on the drawings and/or as specified herein. Holder/releases shall consist of wall mounted and floor mounted electromagnets and a door mounted armature with an adjustable contact plate. Electromagnets shall have a force of attraction of 24 pounds when energized and less than 3 pounds residual power disconnected. Armature contact plates shall have a horizontal adjustment of 25 degrees.

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The holding force of holder/releases shall be totally electromagnetic and without the use of mechanical linkage or other moving parts, and they shall normally be energized, and a release accomplished, by interrupting the circuit. Electromagnetic holder/releases shall be controlled by either automatic or manual alarm. Operating voltage shall be 24 volt DC.

- B. Electromagnetic door holder/releases, where required, to be supplied and installed by the [Door Contractor] [Contractor] and wired in to fire alarm system by systems contractor. Electromagnetic holder/releases shall be controlled by either automatic or manual alarm. Operating voltage shall be 24 volt DC.

2.19 SURGE SUPPRESSION

A. Non-Addressable Initiation Devices:

1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 μ s waveform, 500A per line with 10 x 700 μ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 1500 pf.
9. Manufacturer:
 - a) EDCO #PC642C series with #PCBIB base.

B. Addressable Initiation Devices and Data Loops:

1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 μ s waveform, 500A per line with 10 x 700 μ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 50 pf.
9. Manufacturer:
 - a) EDCO #PC642C-LC series with #PCBIB base.

C. Horn, Strobe, Control Power (Low Voltage):

1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.

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4. Fail short/fail safe.
 5. Surge Capacity: 5KA with 8 x 20 μ s waveform.
 6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
 7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
 8. Series Resistance: 0.2 ohms total per pair.
 9. Manufacturer:
 - a) EDCO #P164 series (1 pair); #P264 series (2 pair), each with #SD12-PC base.
- D. Power Circuit (120 volt):
1. UL 1449 listed.
 2. 15 amp, 120V rated.
 3. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
 4. Normal mode (L-N), and common mode (L+N-G) protection.
 5. Internal fusing.
 6. Hybrid design.
 7. Indicators for normal operation and failure indication.
 8. Enclosure:
 - a) Fire retardant high impact, phenolic or plastic housing or metal enclosure.
 9. Clamping voltage UL 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20 μ s): 385V @ 120V.
 10. Maximum Surge Capacity: 20,000 amps.
 11. Maximum Continuous Operating Voltage: 115% of line voltage.
 12. Provide hardwire connection or add 15 amp receptacle device to hardwired devices to match equipment being protected and maintain UL listing.
 13. Provide additional 15 amp in-line fusing as required to comply with UL and the NEC when connected to a 20 amp, 120V circuit.
 14. Manufacturers:
 - a) Leviton #51020-WM (hardwired).
 - b) EDCO #HSP-121BL2.
 - c) Or approved equal
- E. Telephone Line Circuits
1. Must be UL 497 listed and labeled for primary protection.
 2. Multi-stage hybrid protection circuit.
 3. Plug-in replaceable modular design or individually mounted units.
 4. Fail short/fail safe.
 5. Surge capacity: 500 amp with 10 x 700 μ s waveform.
 6. Clamp voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.

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7. Maximum continuous operating voltage: 125% of peak operating voltage, minimum.
8. Manufacturers:
 - a) EDCO #COHP(FS).
 - b) Or approved equal

F. Terminations

1. Provide terminals sized for circuits required on project.
2. Where surge suppression modules are for mounting on 'M' block assembly, provide M block assembly complete with grounding system that mates with surge suppression equipment.

G. Terminal Cabinets

1. Provide terminal cabinets for all terminations and surge suppression equipment including 120VAC power surge suppressor as required in Section Surge Suppression. Size terminal cabinets as required to facilitate installation of terminations and surge suppression in a neat and workmanlike manner.
2. Terminal cabinet to meet specifications in Section Cabinets and Enclosures unless specifically manufactured for use.
3. Manufacturers:
 - a) Interior.
 1. Square "D"
 2. Hoffman
 3. BUD
 - b) Exterior.
 1. Hoffman
 2. BUD
 3. Carlon

2.20 CABLE

- A. Contractor shall provide and install cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed Fire Alarm system.
- B. Fire alarm system cables installed in exterior and/or underground raceways shall comply with the applicable sections of NEC Article 800.

2.21 WATERFLOW DETECTOR

- A. Waterflow switch to be supplied and installed by the mechanical contractor and wired in to Fire Alarm System by systems contractor. Zone as shown on zone schedule.

2.22 SPRINKLER SUPERVISORY SWITCHES

- A. Supervisory Switch to be supplied and installed by mechanical contractor and wired in to Fire Alarm System by systems contractor. Zone as shown on zone schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required

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for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.

- B. Locate, install, and test fire alarm and detection systems in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electrical Code, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.
- C. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.
- D. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.
- E. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.
- F. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.
- G. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.
- H. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate-of-registration number of the registered firm.
- I. Installation of detectors:
 - 1. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.
 - 2. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.
 - 3. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

3.2 RACEWAYS AND BOXES

- A. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.
- B. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.

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- C. Provide supporting devices per Section Hangers and Supports.
- D. Identify raceways and boxes per Section Electrical Identification.

3.3 WIRE/CABLE

- A. Conductor: 98% conductivity, solid copper or stranded copper. If stranded conductors are used, then a compression lug shall be installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductors without crimp-on lugs may be terminated into terminal strips of box-lug connectors.
- B. Insulation: A type accepted by NEC for the application. Individual conductors shall be Type THHN/THWN. All cable shall be UL listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types.
- C. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:
 - 1. Multiplex Signaling Line Circuit: AWG #14, shielded twisted pair cable.
 - 2. Initiating Circuits, Hard-Wired Devices: AWG #14, THHN/THWN conductors.
 - 3. Notification Circuits: AWG #14, THHN/THWN conductors.
 - 4. Initiating Circuits, Addressable Devices: AWG #14, shielded twisted pair cable.
 - 5. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.
- D. The above wire sizes shall be increased to size as required to comply with Authority Having Jurisdiction or as required for voltage drop, load, etc.
- E. Color Coded:
 - 1. Wiring shall be color coded as required to match existing system.
 - 2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.
- F. UL:
 - 1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
 - 2. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, Power Limited Fire Protective Signaling Cable. All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
 - 3. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760.179. All such cable shall bear a cable marking that includes a Type designation as given in NEC Table 760.179(I). Provide Type FPL.
- G. Connections of Installation Wiring:
 - 1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
 - 2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
 - 3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.

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4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

H. Rated Enclosures:

1. All vertical fire alarm wiring traversing more than one level shall be routed in rated enclosures. In addition, all horizontal wiring serving devices location on floors other than where wiring originates shall be routed in 2-inch concrete encasement, suitable rated building construction, or 2-hour wrap application enclosure accepted by local Authority Having Jurisdiction.

3.4 MANUAL PULL STATIONS

- A. Install at 48 inches to top above finished floor.
- B. All manual stations shall be in unobstructed locations.
- C. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.
- D. Provide, install, and connect additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.5 AUDIBLE SIGNAL DEVICES, VISUAL SIGNAL DEVICES OR COMBINATION AUDIBLE/VISUAL SIGNAL DEVICES

- A. Shall comply with NFPA, the Americans with Disabilities Act and other applicable handicap/accessibility codes including but not limited to the following:
 1. Wall mounted devices shall have their bottom edge at heights above the finished floor of not less than 80 inches and no greater than 96 inches.
 2. In general, no place in any room or space required to have a visual signal appliance shall be more than 50 ft. (15 m) from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft. (30 m) across, without obstructions 6 ft. (2 m) above the finished floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft. (30 m) apart, in lieu of suspending appliances from the ceiling. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.
 3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 ft. (15 m) from the signal. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3.6 END-OF-LINE DEVICE

- A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.7 AUXILIARY CONTROL RELAYS

- A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.
- B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.
- C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.8 SPRINKLER FLOW SWITCHES

- A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm

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panel.

- B. Run conduit and wiring to the flow switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
- C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.9 SPRINKLER VALVE SUPERVISORY SWITCHES

- A. Coordinate the electrical and operating characteristics of the supervisory switches with the fire alarm panel.
- B. Run conduit and wiring to the supervisory switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
- C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.10 DOOR ELECTRIC LOCK AND HOLD-OPEN POWER SYSTEMS

- A. General: Provide 24V-dc low voltage power to all building doors with openers, hold-open devices, closers or electric locks. Refer to Architectural door hardware schedule for doors that may have electric holders or locks. Low voltage power supplies for door hardware shall be furnished separately from the fire alarm system. The fire alarm system shall only provide the unlocking or release control signals and auxiliary control relays at power supplies, in order to reduce power draw on fire alarm system power supplies and batteries.
- B. Low Voltage Power: Provide a low voltage transformer on each floor having doors with electric hardware. Transformer shall be 120-24V ac, sized as required to handle load served. Mount in a NEMA 1 enclosure above accessible corridor ceiling outside the first door closest to fire alarm riser. Provide transformer primary fusing to comply with NEC. Provide a 24V ac-24V dc rectifier on the secondary side of the transformer. Provide dedicated branch circuit from closest 120V normal power panel. Provide necessary interposing auxiliary control relay(s) to accept unlocking/release and restore signals from the fire alarm system.
- C. Wiring: Electric hardware shall be connected for fail-safe operation. Upon loss of normal power hardware shall unlock without unlatching. Hold-open doors shall release for closure. Restoration of hardware power shall be automatic after the fire alarm system unlock control is reset. Provide all wiring necessary to connect transformer. Provide all low voltage wiring to connect electric locks. Extend wiring down hinge side of stair door jam through hinge plate into door and through door to electric lock mechanism.
- D. Fire Alarm Unlocking Control: All door hardware circuits shall be controlled by fire alarm system. Upon receipt of signal from fire alarm system all door holders shall release and stair/egress door electric locks power system shall be disabled allowing all locks to unlock (without unlatching). Signal to activate shall be automatic fire alarm signal or manual command initiated in the building Fire Control Room. Manual unlock override command shall be through override system. Reference paragraph entitled Fire Department Override control Panel. Provide pilot light and 3-position override switch. ON position (illuminated red pilot light) shall initiate fail-safe operation. OFF position shall restore low voltage power. Provide separate override switch for door openers associated with Atrium Smoke Exhaust System.
- E. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.

3.11 GAS/FUEL SHUT-OFFS

- A. Whether shown on drawings or not provide gas/fuel shut-off systems for each and every gas/fuel supply as required by the applicable codes and standards.

3.12 CABLE IDENTIFICATION

- A. Provide and install permanent cable markers on all cables/wire lines, telephone lines, etc. at terminal strips, terminal cabinets and at main equipment.

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3.13 TELEPHONE TIE

- A. Provide new conduit/wire from FACP and terminal cabinet to main telephone board. Connect as directed by owner/telephone company. Provide and install dialer with surge suppression on telephone line.

3.14 SURGE PROTECTION

A. General

- 1. Provide, install and connect new surge suppression equipment as specified herein, including protection of equipment power source, cable/wire entering or leaving building housing, main fire alarm system equipment, ground lugs, #6 copper ground wire in 3/4" c. to existing main building service ground.
- 2. Extreme care shall be taken by contractor to assure a properly surge protected system.
- 3. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
- 4. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.

B. Equipment Selection

- 1. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

C. Equipment Installation

- 1. Install surge suppression equipment per manufacturers recommendation at each wire terminal as noted under Part 1.
- 2. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
- 3. Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet (FACP).
- 4. Coordinate with Section Surge Suppression 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.

D. Ground Installation

- 1. Ground Bus Connections.
 - a) Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
 - b) Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
 - c) Connect terminal cabinet "local" ground bus to "systems" ground bus installed per 16170 with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
 - d) Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
- 2. Surge suppression equipment grounding.
 - a) Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge

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suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.

- b) Coordinate with Section Surge Suppression 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. fire alarm, intercom, television, etc.).
3. Conductors.
- a) Conductors shall meet requirements of Section Building Wire and Cable. Minimum size to be #12 THWN.
 - b) Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.
 - c) Do not bundle unprotected conductors with protected conductors.
 - d) Conductors shall be kept as short as possible.
 - e) Conductors shall be secured at 12" intervals with an accepted copper clamp.
 - f) Grounding conductors shall be properly connected to the building service ground by accepted clamps.
4. Grounding Connectors
- a) Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.
 - b) All connectors and fittings shall be of the Nicopress crimp or compression set screw type.
 - c) Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.
5. Telephone Circuits
- a) Systems utilizing telephone company pairs as a transmission medium shall be provided with a suppressor conforming to device in Part 2 of this specification.
 - b) Suppressors shall be installed at each point where interface is made to telephone company pairs.
 - c) In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:
 - 1. Where the modem or coupling device is furnished by the telephone company the suppressors shall be installed on the system side of the modem or coupling device.
 - 2. Where the modem or coupling device is furnished by the system contractor, the suppressor shall be installed on the telephone line side of the modem or coupling device.

3.15 CONDUIT/BOX IDENTIFICATION

- A. Contractor shall identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" on center.

3.16 DEMONSTRATION

- A. When system is complete it shall be demonstrated to owner's representative who shall be given complete instructions, spare parts, manuals and maintenance information.

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3.17 SYSTEM TESTING

- A. Prior to certification of the fire alarm system the contractor shall accomplish a complete test of the fire alarm system in accordance with NFPA 72, Chapter 10, Paragraph 10.4 Testing.
- B. Perform a complete, functional, component by component test of the entire fire alarm and detection system. Provide a detailed step by step testing procedure, which is unique to this project, reflecting the type of system and the number and location of all components.
- C. Demonstrate the proper operation of each component as follows:
 - 1. Ionization, photoelectric, and duct smoke detectors: activate the detector with a "false smoke" product which has been specifically formulated for testing smoke detection systems.
 - 2. Heat detectors: activate the detector by utilizing the detector check button.
 - 3. Pull Stations: activate the station by operating the station in its normal mode.
 - 4. Audible and Visual Alarms: verify proper operation when the system is put into the alarm mode.
 - 5. Sprinkler Flow Switches: open the sprinkler system's inspection test valve. Verify that the flow switch sends an alarm signal within the allowed time corresponding to the switch's time delay setting.
 - 6. Fire Alarm Panels: functionally check-out and test the panel per the manufacturer's written instructions. Demonstrate the proper operation of each modular component. Demonstrate automatic power change to batteries and back to building power upon a drop in voltage below the voltage threshold as specified by the panel manufacturer.
- D. Demonstrate the supervisory function at each device loop circuit, and at all single component wiring runs such as for the sprinkler valve supervisory switches.

3.18 CERTIFICATION

- A. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing Form. The Inspection and Testing form format shall be as indicated in NFPA 72, Chapter 10, Figure 10.6.2.3 Inspection and Testing Form. When an Inspection and Testing Form has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.
- B. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.19 FINAL DRAWINGS

- A. As-built drawings shall be given to the Owner's representative, at time of instruction, in addition to those to be supplied as general requirements of the job.

3.20 AUTHORITY HAVING JURISDICTION

- A. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the Authority Having Jurisdiction.

END OF SECTION

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SECTION 31 31 16
TERMITE CONTROL

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 the following for termite control:
 - 1. Soil treatment.

1.3 DEFINITIONS

- A. EPA: Environmental Protection Agency.
- B. PCO: Pest control operator.

1.4 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- 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. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A pest control operator who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located.

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- B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.
- C. Independent Testing: Independent testing laboratory shall certify that treatment meets the requirements.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

- A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

a. Provide optional renewal on the same terms.

- B. Should damage occur during the guarantee period, the Contractor shall make repairs to structurally damaged surfaces to a dollar value based on the size of the building.

1.9 MAINTENANCE SERVICE

- A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and re-treatment for occurrences of termite activity, from applicator to Owner, in the form of a standard continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate.
 - 1. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings.
 - 1. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.
 - 1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 - 3. Masonry: Treat voids.
 - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

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- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 16

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SECTION 32 31 26
CHAIN LINK FENCING AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of chain link fences and gates in indicated on drawings.

1.3 QUALITY ASSURANCE

- A. Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Galvanized Steel Fencing and Fabric:
 - a. Allied Tube and Conduit Corp.
 - b. American Fence Corp.
 - c. Anchor Fence, Inc.
 - 2. Aluminized Steel Fencing and Fabric:
 - a. Page Fence Div./Page-Wilson Corp.
 - b. Cyclone Fence/United States Steel Corp.
 - c. or approved equal
 - 3. Aluminum Fencing and Fabric:
 - a. Chain Link Fence Company of Pennsylvania.
 - b. Security Fabricators, Inc.
 - c. or approved equal
 - 4. Barbed Type:

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- a. American Fence Corp.
- b. Man Barrier Corp.

2.2 STEEL FABRIC

- A. Fabric: No. 9 ga. (0.148" + 0.005") size steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high.
 - 1. Furnish one-piece fabric widths for fencing up to 12' high.
 - 2. Fabric Finish: Galvanized, ASTM A 392, Class II, with not less than 2.0 oz. zinc per sq. ft. of surface.
 - 3. Fabric Finish: Aluminized, ASTM A 491, Class II, with not less than 0.40 oz. aluminum per sq. ft. of surface.

2.3 FRAMING AND ACCESSORIES

- A. Steel Framework, General: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.
 - 1. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.
- B. End, Corner and Pull Posts: Minimum sizes and weights as follows:
 - 1. Up to 6' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft., 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
 - 2. Over 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
- C. Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.
 - 1. Up to 6' fabric height, 1.90" OD steel pipe, 2.70 lbs. per lin. ft. or 1.875" x 1.625" C-sections, 2.28 lbs. per lin. ft.
 - 2. 6' to 8' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 2.64 lbs. per lin. ft.
 - 3. Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 3.26 lbs. per lin. ft.
- D. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

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1.	Leaf Width	Gate Post	lbs./lin. ft.
	Up to 6'	3.5" x 3.5" roll-formed section or 2.875" OD pipe	4.85 5.79
	Over 6' to 13'	4.000" OD pipe	9.11
	Over 13' to 18'	6.625" OD pipe	18.97
	Over 18'	8.625" OD pipe	28.55

- E. Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.
1. 1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.
- F. Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.
1. Locate at bottom of fabric.
- G. Wire Ties: 11 ga. galvanized steel or 11 ga. aluminum wire, to match fabric core material.
- H. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.
- I. Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.
- J. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.
- K. Stretcher Bars Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.
- L. Barbed Wire Supporting Arms: Manufacturer's standard barbed wire supporting arms, metal and finish to match fence framework, with provision for anchorage to posts and attaching 3 rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap and must be capable of withstanding 250 lbs. downward pull at outermost end. Provide following type:
1. Single 45 deg. arm; for 3 strands barbed wire, one for each post.
- M. Barbed Wire: 2 strand, 12-1/2 ga. wire with 14 ga. 4-point barbs spaced not more than 5" o.c., metal and finish to match fabric.
- N. Barbed Tape: Continuous helical coils of barbed stainless steel tape, fabricated from .025" thick x 1" wide austenitic stainless steel with 4 needle sharp barbs on 4" centers and permanently clenched to .098" diameter core wire of high tensile zinc-coated steel. Adjacent loops clipped together to limit extension of coil. Provide coil diameter, type and configuration as indicated; if not otherwise indicated, provide 24" diameter, single concertina

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type coil.

2.4 GATES

- A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets, for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.
1. Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretchers bars to gate frame at not more than 15" o.c.
 2. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.
 3. Where barbed wire is indicated above gates, extend end members of gate frames 1'-0" above to member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.
- B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.
- C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:
1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 deg. gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
 3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.
 4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
- D. Sliding Gates: Provide manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
- B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and

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spacings indicated, in firm, undistributed or compacted soil.

1. If not indicated on drawings, excavate holes for each post to minimum diameters as recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
 2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
1. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 - a. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to a crown to shed water.
- D. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- E. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.
- H. Fabric: Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- I. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.
- J. Barbed Wire: Pull wire taut and install securely to extension arms and secure to end post or terminal arms in accordance with manufacturer's instructions.
- K. Barbed Tape: Install barbed tape in configurations indicated in accordance with manufacturer's recommendations and securely fasten to fencing to prevent movement or displacement.
- L. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- M. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasp pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize

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hazard to persons or clothing.

1. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.
- N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 32 31 26

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SECTION 32 92 00 - GRASSING

PART 1– GENERAL

1.1 SCOPE:

- A. This section includes the furnishing and installation of grassing materials at areas indicated on the drawings.
- B. Grassing shall be performed by a knowledgeable nurseryman or landscaping specialist knowledgeable with climate conditions and planting requirements of the geographical area.

PART 2 – PRODUCTS

2.1 TOPSOIL:

- A. Topsoil shall be stockpiled for re-use in grass work. If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required to complete grassing.

2.2 GRASS MATERIALS:

A. SOD:

- 1. Shall be strongly rooted sod, not less than two years old, free of weeds and undesirable native grasses and machine cut to pad thickness of 2" (\pm 1/4"), excluding top growth and thatch. Provide only sod capable of vigorous growth and development when planted (viable not dormant).
- 2. Sod shall be furnished in uniform pad sizes with maximum 5% deviation in length or width. Broken pads or uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10% of pad will be rejected.
- 3. Sod shall be St. Augustine 'Floritam' grass.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required.
- B. Correlate planting with specified maintenance periods to provide maintenance to the date of Final Acceptance by Owner.

3.2 PREPARATION:

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A. Preparation for Planting Portions of Lawns:

1. Loosen subgrade of lawn areas to a minimum depth of 4". Remove stones over 1-1/2" in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
2. Spread topsoil to minimum depth required to meet lines, grades and specified elevations, after light rolling and natural settlement. Add specified soil amendments and mix thoroughly into upper 4" of topsoil.
3. Place approximately 1/2 of total amount of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil. Add specified soil amendments and mix thoroughly into upper 4" of topsoil.
4. Preparation of Unchanged Grades: Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: Till to a depth of not less than 6"; apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter.
5. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf as indicated on grading drawings. Dispose of such material outside of Owner's property; do not turn over into soil being prepared for lawns.
6. Apply specified commercial fertilizer at rates specified and thoroughly mix into upper 2" of topsoil. Delay application of fertilizer if lawn planting will not follow within a few days.
7. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
8. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

3.3 SODDING NEW AREAS OF LAWNS:

- A. Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen.
- B. Allow for sod thickness in areas to be sodded. It shall be the responsibility of the Contractor to bring the sod edge in a neat and clean manner to 1" below the elevation of edges of pavement and even with the elevation of edge of shrub areas. After placement of sod, a top dressing of clean sand shall be evenly applied over the entire surface and thoroughly washed, if determined necessary by the Architect. Top dressing will not be required on properly installed sod.
- C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips;

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do not overlap. Stagger strips to offset joints in adjacent courses. Tamp or roll lightly to ensure a smooth, even surface that is in contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

- D. Anchor sod on slopes with sod staples to prevent slippage.
- E. Water sod thoroughly with a fine spray immediately after planting.

3.4 MAINTENANCE:

- A. Begin maintenance immediately after planting.
- B. Maintain lawns for not less than the period stated below:
 - 1. All lawns - not less than the date of Final Completion.
 - 2. A minimum of one mowing of all grassed areas is required following the completion of sodding and irrigation system installation/sprinkler head adjustment.
 - 3. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

3.5 CLEANUP AND PROTECTION:

- A. During grassing work, keep pavements clean and work area in an orderly condition.
- B. Protect grassing work and materials from damage due to grassing operations, operations by other Contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged grass work as directed.

3.6 INSPECTION AND ACCEPTANCE:

- A. When grass work is completed, including maintenance, the Architect will, upon request, make an inspection to determine acceptability.
- B. When inspected grassing work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by the Architect and found to be acceptable. Remove rejected plants and grassing materials promptly from project site.

END OF SECTION 32 92 00