



**ORANGE COUNTY - CLARCONA HORSEMAN'S PARK
RESTROOMS AND CONCESSIONS BUILDING
HVAC REPLACEMENT
100% CONSTRUCTION DOCUMENTS**

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

**BY
MATERN PROFESSIONAL ENGINEERING, INC.
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**ORANGE COUNTY – CLARCONA HORSEMAN’S PARK
KITCHEN AND RECREATION BUILDING
HVAC REPLACEMENT
100% CONSTRUCTION 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. Remove existing HVAC system serving the Restroom and Concession Building at Clarcona Horseman’s Park. This includes DX split system and ductwork as shown on the plans.
- 2. Provide new ground-mounted packaged DX units to serve the kitchen, dining room, and restrooms.
- 3. Provide new supply and return ductwork to serve the kitchen, dining room, and restrooms.
- 4. Remove existing dining room air devices. Infill with wood plank ceiling, material, color and finish to match adjacent existing wood plank ceiling.
- 5. Remove and replace the existing kitchen hood.
- 6. Remove the existing roof-mounted grease exhaust fan and replace with a sidewall mounted fan.
- 7. Remove the existing roof-mounted makeup fan and replace with an inline makeup fan for the new kitchen hood.
- 8. Remove/replace existing exhaust fans and other misc. equipment as shown on the plans.
- 9. Remove existing hard ceiling finish and framing in kitchen area. Replace with new washable acoustical tile ceiling.
- 10. Provide R-38 spray foam insulation in attic space.
- 11. Remove and replace existing rooftop exhaust equipment and cap.
- 12. Remove existing transom glass panels as required for new mechanical systems. Infill areas as detailed on drawings.
- 13. Remove existing floor louvers in restrooms. Infill with concrete and stone finish to match surrounding.
- 14. Remove existing restroom exterior door louvers and replace with solid as detailed in drawings.
- 15. Furnish and install new concrete sidewalk around mechanical equipment. Slope to match existing grades.
- 16. Furnish and install new galvanized chain link fencing and gate with vinyl slats.
- 17. Remove and relocate existing flagpole as shown on plan. Pour in place new footing per details.
- 18. Provide electrical work to support the removable and replacement of Mechanical equipment.
- 19. Provide electrical work to support installation support the installation of new mechanical equipment.

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.

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

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 contractors.

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1.6 WORK SEQUENCE

- A. The facility shall remain unoccupied and non-operational while work is in progress, however, the restrooms shall remain open and accessible to the public on the weekends. All work shall be performed during normal business hours. Normal business hours are defined as 8:00 am to 5:00 pm Monday through Friday. Material and equipment deliveries shall be made during normal business hours.
- B. In the event the dining area needs to be used by the public during weekends, contractor shall provide temporary cooling as required.

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 changed.
 - 10. Contractor employees and subcontractors will not fraternize with County employees or the

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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 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 not be occupying the building during construction..
 - 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 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.

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

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

END OF SECTION 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

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

- J. Administrative actions and submittals that shall proceed or coincide with Substantial Completion Payment. Substantial Completion as defined per General Conditions Section "F" application include:
1. Occupancy permits and similar approvals
 2. Warranties (guarantees) and maintenance agreements
 3. Test/adjust/balance records
 4. Maintenance instructions
 5. Start-up performance reports
 6. Change-over information related to Owner's occupancy, use, operation and maintenance
 7. Final cleaning
 8. Application for reduction of retainage, and consent of surety
 9. List of incomplete Work, recognized as exceptions to Project Manager's Certificate of Substantial Completion
- K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment. Application for Payment includes the following:
1. Completion of Project Close-Out requirements
 2. Completion of items specified for completion after Substantial Completion
 3. Assurance that unsettled claims will be settled
 4. Assurance that all work has been completed and accepted
 5. Proof that taxes, fees and similar obligations have been paid
 6. Removal of temporary facilities and services
 7. Removal of surplus materials, rubbish and similar elements
 8. Change of door locks to Owner's access
 9. Submission of all close-out documents. Refer to Section 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

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

1.4 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:

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

1.4 PRE-INSTALLATION CONFERENCE

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

1.5 COORDINATION MEETINGS

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

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planning for the construction activities involved, to include subcontractors and representatives.

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

1.6 PROGRESS MEETINGS

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

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

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

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

- a. Interface requirements
- b. Time
- c. Sequences
- d. Deliveries
- e. Off-site fabrication problems
- f. Access
- g. Site utilization
- h. Temporary facilities and services
- i. Hours of work
- j. Hazards and risks
- k. Housekeeping
- l. Quality and work standards
- m. Change Orders
- n. Documentation of information for payment requests.

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 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.

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- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - 2.. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Project Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Project Manager will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow two weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 221116.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 221116.01.A).
 - 2) Where multiple products are shown, highlight/circle or identify product intended to be used
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.

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- I. Other necessary identification.

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

- F. Substitution request to specified products will be made within 30 days of Notice to Proceed. After the 30 day period, no requests for substitutions from the Contractor will be considered.
 - 1. Substitution submitted within the first 30 days will have product data from specified and requested substitute submitted together and demonstrate better quality, cost savings if of equal quality, or show benefit to the County for excepting the substitute.

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

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.
 - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the Schedule of Values.
 - 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 - 3. Prepare the schedule on a sheet, series of sheets, stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 - 4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.
 - 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.
 - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

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

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

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

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- E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating precalculated and actual costs. On the line show dollar-volume of work performed as the dates used for preparation of payment requests.
 - 1. Refer to Section Applications for Payment for cost reporting and payment procedures.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the project meeting room and temporary field office.
 - 1. When revision are made distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- G. Schedule Updating: Revise the schedule monthly or activity, where revisions have been recognized or made. Issue the updated schedule concurrently monthly pay request.

1.5 SUBMITTAL LOG

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

1.6 DAILY CONSTRUCTION REPORTS

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

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

1.7 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawings and will be rejected.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 1. All required dimensions
 2. Identification of products and materials included
 3. Compliance with specified standards
 4. Notation of coordination requirements
 5. Notation of dimensions established by field measurement
 6. Sheet Size: Except for templates, patterns and similar full-size Drawings on sheets at least 8" x 11" but no larger than 24" x 36".
 7. Number of Copies: Submit one (1) electronic copy of each submittal to the County's Representative, unless copies are required for operation and maintenance manuals. Submit one (1) electronic copy where copies are required for operation and maintenance manuals. Engineer will retain 1 electronic copy. Mark up and retain one returned electronic copy as a Project Record Drawing.
 8. Submit one (1) hard copy once approved for legal seal stamping if needed at jobsite. Coordinate with Engineer and County's Representative.
 9. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
 1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.
 2. Submit coordination Drawings for integration of different construction elements. Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.

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

1.8 PRODUCT DATA

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

1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.
 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Engineer's/Owner's Sample. Include the following:
 - a. Generic description of the Sample
 - b. Sample source

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

1.10 ENGINEER'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Project Manager will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility.

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- B. Action Stamp: The Engineer/Project Manager will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:
1. Final Unrestricted Release: Where submittals are marked No Exceptions Taken, that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 2. Final-But-Restricted Release: When submittals are marked Made Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked Revise and Resubmit to be used at the Project site, or elsewhere where work is in progress.
 4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION 01 33 00

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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

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- c. Structural concrete
 - 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

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

PART 3 - EXECUTION

3.1 INSPECTION

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

3.2 PREPARATION

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

3.3 PERFORMANCE

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

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4. Comply with requirements of applicable Sections of Division-2 where cutting and patching required excavating and backfilling.
 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

3.4 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.

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

1.4 FINAL ACCEPTANCE

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

1.5 RECORD DOCUMENT SUBMITTALS

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

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2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 3. Note related Change Order numbers where applicable.
 4. **Submit one (1) hardcopy of the most current record set of drawings when the project is considered 50% substantially complete for review and comment by Owner.**
 5. Organize record drawing sheets, and print. suitable titles, dates and other identification on the cover of each set.
 6. Provide three (3) additional sets of black line drawing sets of As-Built Drawings.
 7. Provide 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

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4. Wiring diagrams
5. Recommended turn-around cycles
6. Inspection procedures
7. Shop Drawings and Product Data
8. Fixture lamping schedule

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLOSE-OUT PROCEDURES

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

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1. Final Certificate of Occupancy
 2. Warranty Service Subcontractors Identification List
 3. Final Lien Waivers and Releases
 4. Warranties and Guarantees
 5. Systems Operations and Maintenance Instruction
 6. Manufacturer's Certificates and Certifications
 7. Maintenance Service Contracts
 8. Spare Parts Inventory List
 9. Special Systems Operating Permits or Approvals
 10. Asbestos free materials notarized statement
- E. Provide all documents for each section listed. List individual documents in each section in the Table of Contents, in the sequence of the Table of Contents of the Project Manual.
- F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the product or work item.
- G. Separate each section with index to sheets that are keyed to the Table of Contents listing.
- H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.
- I. Electronic Close-out DVD: At the completion of the project, submit one copy of a DVD with entire project close out information below in PDF format. All letter, legal and brochure size sheets shall be portrait and the As-build drawings will be landscape. All fonts will be Arial. All items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify words on the scanned documents.
1. Contacts: Set up a separate PDF for the contacts. No bookmarks are needed for this section.
 2. As-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.

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

END OF SECTION 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.

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2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the Contractor.
3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 78 00

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SECTION 02 41 13
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SCOPE OF SECTION

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

1.2 REFERENCE STANDARDS

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

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

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

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

1.3 PROTECTION

- A. Safety: Before commencing any work, provide warning signs, lights, barricades, fences, rails and other safety devices. Exercise caution when working adjacent to spaces occupied by Owner's personnel.

- B. Temporary Work: Do not commence demolition until temporary shoring, bracing, partitions, exits and other support and protective measures have been properly installed.

- C. Temporary Partitions and Closures: Where new existing openings are created and where work is in occupied spaces or existing equipment, provide physical separation and protect from dust and moisture with partitions and closures. Maintain partitions in place until new work has been completed and provide protection from the weather and dust. Before and during removal, clean all surfaces with a vacuum cleaner (to avoid dispersion

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of dust).

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

1.4 SECURITY

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

1.5 HOUSEKEEPING

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

1.6 OCCUPIED SPACES

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

PART 2 - MATERIALS

2.1 LUMBER

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

2.2 TAPE

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

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 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 Engineer. Existing construction that does not interfere with new work and will be concealed may remain in place unless indicated to be removed.

3.2 PORTABLE COVERINGS

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

3.3 DEMOLITION

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

3.4 OWNERSHIP OF MATERIALS

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

3.5 SALVAGE OPERATIONS

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

3.6 REMOVAL

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- 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, concrete slabs, columns, joist and beams.
- C. Patch all existing slab penetrations caused by demolition of mechanical and plumbing with rated and UL listed seal assembly.

3.10 UTILITIES AND RELATED EQUIPMENT, PLUMBING, AND ELECTRICAL WORK

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

3.11 DRYWALL

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

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

END OF SECTION 02 41 13

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SECTION 03 30 34
CONCRETE WORK

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Provide concrete work shown on drawings and specified including formwork, reinforcing steel, placing, finishing and curing.
- B. All concrete for the project shall conform to requirements of this Section.

1.2 REFERENCE STANDARDS

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

ACI INTERNATIONAL (ACI)

- | | | |
|-----|--------------|--|
| 1. | ACI 117 | Standard Tolerances for Concrete Construction and Materials |
| 2. | ACI 214 | Recommended Practice for Evaluation of Strength Test Results of Concrete |
| 3. | ACI 301/301M | Specifications for Structural Concrete |
| 4. | ACI 302.1R | Guide for Concrete Floor and Slab Construction |
| 5. | ACI 304R | Guide for Measuring, Mixing, Transporting and Placing Concrete |
| 6. | ACI 305R | Hot Weather Concreting |
| 7. | ACI 308 | Standard Practice for curing Concrete |
| 8. | ACI 309 | Standard Practice for Consolidation of Concrete |
| 9. | ACI 315 | Details and Detailing for Concrete Reinforcement |
| 10. | ACI 318/318M | Building Code Requirements for Reinforced Concrete |
| 11. | ACI 347R | Guide to Formwork for Concrete |

ASTM INTERNATIONAL (ASTM)

- | | | |
|----|---------------|---|
| 1. | ASTM A 36/36M | Carbon Structural Steel |
| 2. | ASTM A 82 | Steel Wire, Plain, for Concrete Reinforcement |
| 3. | ASTM A 123 | Specification for Zinc (Hot Dip Galvanized) |

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Coatings on Iron and Steel Products

- | | | |
|-----|-----------------|--|
| 4. | ASTM A 184/184M | Welded-Deformed Steel Bar Mats for Concrete Reinforcement |
| 5. | ASTM A 185 | Steel Welded Wire Fabric, Plain, for Concrete Reinforcement |
| 6. | ASTM A 615/615M | Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| 7. | ASTM C 31/31M | Making and Curing Concrete Test Specimens in the Field |
| 8. | ASTM C 33 | Concrete Aggregates |
| 9. | ASTM C 39/C 39M | Compressive Strength of Cylindrical Concrete Specimens |
| 10. | ASTM C 94/C 94M | Ready-Mixed Concrete |
| 11. | ASTM C 143/143M | Slump of Hydraulic Cement Concrete |
| 12. | ASTM C 150 | Portland Cement |
| 13. | ASTM C 260 | Air-Entraining Admixtures for Concrete |
| 14. | ASTM C 404 | Aggregates for Masonry Grout |
| 15. | ASTM D 1751 | Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

- | | | |
|----|------|-----------------------------|
| 1. | CRSI | Design Handbook |
| 2. | CRSI | Manual of Standard Practice |

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1. 2010 Issue with modifications and updates

- B. The Contractor shall comply with the above standards: Should copies be required, they may be obtained, at the Contractor's expense from:

AMERICAN CONCRETE INSTITUTE (ACI)
P. O. Box 9094
Farmington Hills, MI 48333
Ph: 248-848-3700
Fax: 248-848-3801
internet: <http://www.aci-int.org>

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ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
Ph: 610-832-9585
Fax: 610-832-9555
internet: <http://www.astm.org>

Concrete Reinforcing Steel Institute
933 N. Plum Grove Road
Schaumburg, Illinois 60173-4758
Ph: 847-517-1200
Fax: 847-517-1206
internet: <http://www.crsi.org>

- C. Compliance with the Preceding Specifications: Procedure, material or operation specified shall comply with the applicable ASTM, ACI, Concrete Reinforcing Steel Institute (CRSI) Standards; or the Florida Building Code. This Project Specification shall govern in conflict between this specification and listed standards. In conflicts between standards, the one having the more stringent requirement shall govern.

1.3 QUALITY CONTROL

- A. Concrete Testing Service: The Contractor shall employ and pay an independent testing laboratory to perform concrete testing.

1.4 SUBMITTALS

- A. Shop Drawings: Submit for fabrication and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules and arrangement of reinforcement.
- B. Mix Design Test Reports: Submit two copies of testing facility reports for each proposed mix at least 10 days prior to start of work.
- C. Concrete Test Reports: Submit two copies of each test specified. Submit test reports to the Architect and Contractor on same day that tests are made. Reports of compressive strength test shall contain the project title and commission number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, location of concrete batch in the structure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ready Mixed Concrete: Conform to ASTM C 94/C 94M.
- B. Concrete shall have a minimum cement factor of 5½ sacks per cubic yard and 28 day compressive strength of 3000 psi and 2500 psi at fence footings. Concrete mixes shall be proportioned by the field experience method or the laboratory trial method in accordance with ACI 318/318R.
- C. Slump:
 - 1. Concrete grout for filling masonry cells and cavities shall have a slump of 7½-

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inches, $\pm 1\frac{1}{2}$ - inch.

2. Unless otherwise indicated, all other concrete shall have a slump of $4\frac{1}{2}$ -inches, $\pm 1\frac{1}{2}$ -inch.

D. Concrete Materials:

1. Portland Cement: ASTM C 150, Type 1.
2. Water: Clean and potable.
3. Air-Entraining Admixture: ASTM C 260.
4. Water Reducing Admixture: ASTM C 494, Type A.

E. Aggregates:

1. Regular Weight Concrete: ASTM C 33.
2. Grout: ASTM C 404.

F. Concrete Reinforcing:

1. Deformed Reinforcing Bars: ASTM A 615, Grade 60.
2. Welded Wire Fabric: ASTM A 185. Provide 6 x 6 W 1.4 X W 1.4 WWF unless otherwise indicated.

- G. Water Curing - Moisture Retaining Cover: Provide waterproof kraft paper, 4 mil polyethylene sheet or burlap.

- H. Preformed Joint Material: ASTM D 1752 Type I, II or III or ASTM D 1751. Provide Sealtight by W.R. Meadows or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Formwork: Construct for concrete members and structures of size, shape, elevation and position indicated. Chamfer exposed edges and corners of formed concrete $\frac{3}{4}$ -inch unless otherwise indicated. Conform to ACI 347. Design of formwork is the responsibility of the Contractor.
- B. Reinforcement: Locate and support with metal accessories in compliance with ACI 315, ACI detailing Manual.
- C. Install welded wire fabric in as long lengths as practicable, lapping at least one mesh.
- D. Joints: Provide construction, isolation and control joints as indicated or required. Locate construction joints so strength and appearance of the structure are not impaired. Control joints may be tooled or sawed.
- E. Concrete Placement: conform to ACI 304R. Place concrete in a continuous operation

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with planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.

- F. Consolidate place concrete using mechanical vibratory equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of forms. Conform to ACI 309.
- G. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.

3.2 FINISH FORMED SURFACES

- A. All Surfaces: Immediately after form removal, remove fins, surface blemishes and other surface irregularities. Cut out defective surfaces including voids, honeycomb and rock pockets. Fill voids and form tie holes with 1:3 cement-fine aggregate grout and rub smooth; match color and texture of adjacent surfaces.
- B. Exposed to View Surfaces: Within 24 hours after form removal, wet surface and rub with carborundum brick until a smooth uniform finish is obtained. Provide rubbed finish for all exposed concrete.

3.3 SLAB FINISH

- A. Screed concrete to a uniform level surface, rod and spade to fill solid at form edges, corners and at penetrations. Tamp surface to drive coarse aggregate below top surface. Screed again to a level, smooth surface. Start finishing procedures after bleedwater has disappeared from the surface.
- B. Troweled Finish: Power trowel to an ACI 117 Class A tolerance ($\frac{1}{8}$ -inch in 10-feet when tested with a 10-foot straightedge). Follow with additional passes with the hand trowel until a ringing sound is produced with trowel is moved over surface. Finished surface shall be smooth, dense and uniform in texture and appearance. Provide for all interior exposed slabs and for slabs to receive resilient flooring, thin-set ceramic tile, carpet and floor coatings. ACI 117 Class B tolerance ($\frac{1}{4}$ -inch in 10 feet when tested with a 10-foot straightedge) is acceptable for concrete slabs on metal deck.
- C. Non-Slip Broom Finish: After concrete has received a floated finish to an ACI Class B tolerance ($\frac{1}{4}$ -inch in 10 feet when tested with a 10-ft. straightedge) and while surface is still wet and workable, finish with soft bristle broom. Draw broom across surface perpendicular to traffic pattern. Provide for all exterior slabs, stairs, platforms and ramps subject to traffic and elsewhere as shown on the drawings.

3.4 CURING

- A. Conform to ACI 308. Begin initial curing as soon as free water has disappeared from exposed surfaces. Keep all concrete continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protection as required to prevent damage to exposed concrete surfaces. Water curing may be used for all surfaces but must be used for surfaces to be painted and surfaces to which cementitious materials are to be bonded. Water cure 7 days.

3.5 CONCRETE WALKS

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- A. Construct 4 inches thick, tool edges and provide non-slip broom finish. Provide expansion joints at 20 feet on center and where walks abut curbs, walls, slabs and other restrictions. Provide control joints, sawed or tooled, at 4 feet on center.

3.6 CONCRETE TESTING

- A. Compressive Strength Tests: Conform to ASTM C 31/C 31M and ASTM C 39/C 39M. One set of four cylinders for each 50 cubic yards or fraction thereof, of each strength concrete placed in any one day. Test two specimens at seven days; test two specimens at 28 days.
- B. Slump Tests: Conform to ASTM C 143/C 143M. Perform one test for each load point of discharge and one for each set of compressive strength test specimens.

END OF CONCRETE WORK

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes the following:

1. Framing with preservative-treated dimension lumber.
2. Wood grounds, nailers, blocking, and panels.
3. Wood furring.

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

1. Section 06 41 06 – FINISH CARPENTRY

1.2 REFERENCE STANDARDS

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

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

1. APA F405 Product Guide Performance Rated Panels

AMERICAN FOREST AND PAPER ASSOCIATION (AFPA)

1. Manual for Wood Frame Construction

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI B18.2.1 Square and Hex Bolts and Screws Inch Series
2. ANSI B18.6.1 Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

1. ASTM A 153/A 153M Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. ASTM A 307 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
3. ASTM A 563 Carbon and Alloy Steel Nuts
4. ASTM C 79/C 79M Treated Core and Nontreated Gypsum Sheathing Board
5. ASTM D 226 Asphalt-Saturated Organic Felt Used in Roofing and

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Waterproofing

6. ASTM E 84 Surface Burning Characteristics of Building Materials
7. ASTM E 96 Water Vapor Transmission of Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

1. AWPA C2-01 Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processing
2. AWPA C20-99 Structural Lumber - Fire-Retardant Pressure Treatment
3. AWPA C27-99 Plywood - Fire-Retardant Pressure Treatment
4. AWPA C31-00 Lumber Used out of Contact with the Ground and Continuously Protected from Liquid Water - Treatment by Pressure Process
5. AWPA M4-01 Care of Preservative-Treated Wood Products

FEDERAL SPECIFICATIONS (FS)

1. FS FF-N-105 Nails, Brads, Staples and Spikes: Wire, Cut and Wrought

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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1. Manual for House Framing

SOUTHERN PINE INSPECTION BUREAU (SPIB)

1. Standard Grading Rules for Southern Pine Lumber

U.S. DEPARTMENT OF COMMERCE PRODUCT STANDARDS (PS)

1. PS-1.. Construction and Industrial Plywood
2. PS-20 American Softwood Lumber Standard

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

1.3 QUALITY ASSURANCE

- A. Lumber Standard: Comply with NBS Voluntary Product Standard PS 20, American Softwood Lumber Standard.
- B. Plywood Standard: Comply with U.S. Product Standard PS 1, Construction and

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Industrial Plywood.

- C. Wood Treatment: American Wood Preservers Association (AWPA).

1.4 SUBMITTALS

- A. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use as well as design values approved by the Board of Review of American Lumber Standards Committee.
- B. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
 - 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 water-borne treated products include statement that moisture content of treated materials was reduced to levels indicate prior to shipment to project site.
 - 3. For fire-retardant-treated wood products include certification by treating plant that treated material compiles with specified standard and other requirements.
 - 4. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.
 - 5. Warranty of chemical treatment manufacturer for each type of treatment.
- C. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction evidencing compliance of the following wood products with specified requirements and Florida Building Code.
 - 1. Fire-retardant-treated wood.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
- B. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

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- B. Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
 - 2. WCLIB - West Coast Lumber Inspection Bureau.
 - 3. WWPA - Western Wood Products Association.
- C. 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.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.2 DIMENSION LUMBER

- A. For light framing (2 to 4 inches thick, 2 to 4 inches wide) provide the following grade and species:
 - 1. "Construction" Grade.1
 - 2. Southern Pine graded under SPIB rules or approved equivalent.
- B. For structural light framing (2 to 4 inches thick, 2 to 4 inches wide), provide the following grade and species:
 - 1. SPIB "No. 2" Grade
 - 2. Same species as indicated for structural framing grade below.
- C. For structural framing (2 to 4 inches thick, 5 inches and wider), provide the following grade and species:
 - 1. SPIB "No. 2" Grade.
 - 2. Southern Pine graded under SPIB rules.
- D. For exposed framing lumber provide material complying with the following requirements:
 - 1. Definition: Exposed framing refers to dimension lumber that is not concealed by other construction and is indicated to receive a stained or natural finish.
 - 2. Grading: Material hand-selected at factory from lumber of species and grade indicated below that complies with "Appearance" grade requirements of ALSC

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National Grading Rule; issue inspection certificate of inspection agency for selected material.

3. Same species and grade as indicated for structural framing.

2.3 MISCELLANEOUS LUMBER

- A. 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.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required. "No. 3 Common" or "Standard" grade boards per WCLIB or WWPA rules or "No. 2 Boards" per SPIB rules.

2.4 CONCEALED PERFORMANCE-RATED CONSTRUCTION PANELS

- A. General: Where construction panels are indicated for the following concealed types of applications, provide APA F405 Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.
- B. Wall Sheathing: APA F405 Rated Sheathing.
 1. Exposure Durability Classification: EXPOSURE 1.
 2. Span Rating: As required to suit stud spacing indicated.

2.5 CONSTRUCTION PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA F405 C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153/A 153M or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Wood Screws: ANSI B18.6.1

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- D. Lag Bolts: ANSI B18.2.1.
- E. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.7 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.
- E. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.8 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 lumber and AWPA C27 plywood.

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1. Use treatment that does not promote corrosion of metal fasteners.
 2. Use Exterior type for exterior locations and where indicated.
 3. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 4. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- D. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking.
 2. Roof construction.
 3. Plywood backing panels.
- E. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required to accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
- E. Countersink nail heads on exposed carpentry work and fill holes.
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be

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exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.2 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS

- A. Install fire-retardant-treated wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink 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.

3.3 WOOD FURRING

- A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.
 - 1. Firestop furred spaces on walls at ceiling line, with wood blocking or noncombustible materials, accurately fitted to close furred spaces.
- B. Furring to Receive Gypsum Drywall: Install 1-inch by 2-inch furring at 16 inches o.c., vertically.
- C. Suspended Furring: Install suspended furring members of size and spacing indicated, including hangers and attachment devices. Level to a tolerance of 1/8-inch in 10 feet, except 1/4-inch in 10 feet for thick-coat plaster work.

3.4 WOOD FRAMING, GENERAL

- A. Framing Standard: Comply with AFPA Manual for Wood Frame Construction, unless otherwise indicated.
- B. Install framing members of size and spacing indicated.
- C. Anchor and nail as shown, and to comply with the following:
 - 1. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.
 - 2. Published requirements of manufacturer of metal framing anchors.
 - 3. "Recommended Nailing Schedule" of referenced framing standard and with NFPA "National Design Specifications for Wood Construction".
 - 4. Florida Building Code.
- D. Do not splice structural members between supports.
- E. Firestop concealed spaces of wood framed walls and partitions at the ceiling line. Where firestops are not automatically provided by the framing system used, use closely fitted wood blocks of nominal 2-inch-thick lumber of the same width as framing

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members.

3.5 STUD FRAMING

- A. General: Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Install single bottom plate and double top plates using 2-inch-thick members whose widths equal that of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.
1. For walls and partitions install 2-inch by 4-inch wood studs spaced 16 inches o.c.
 2. Construct corners and intersections with not less than three studs. Install miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items, and trim.
 3. Install continuous horizontal blocking row at mid-height of single-story partitions over 8 feet high and at midpoint of multi-story partitions, using 2-inch thick members of same width as wall or partitions.
- B. Frame openings with multiple studs and headers. Install nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
1. For nonbearing partitions, install double-jamb studs and headers not less than 4-inches deep for openings 3-feet and less in width, and not less than 6-inches deep for wider openings.
 2. For load-bearing partitions, install double-jamb studs for openings 6-feet and less in width, and triple-jamb studs for wider openings. Install headers of depth shown, or if not show, as recommended by AFPA Manual for Wood Frame Construction.

END OF SECTION ROUGH CARPENTRY

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SECTION 06 41 06
FINISH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide finish carpentry to include wood ceiling planks to match existing as indicated and specified, complete.

1.2 RELATED WORK

- A. 06 10 00 – ROUGH CARPENTRY.

1.3 QUALITY ASSURANCE

- A. Fabricator/installer qualifications: Experienced in producing millwork equivalent to specified standards and qualified to obtain certification by AWI.
- B. Source quality control:
 - 1. Provide materials, workmanship, and installation in accord with AWI Quality Standards.
- C. Reference specifications and standards:
 - 1. AWI: Architectural Woodwork Quality Standards.

1.4 SUBMITTALS

- A. Samples: Provide the following:
 - 1. Ceiling Planking: 12 in. length of each species required.
 - 2. Wood - general: Supply finish wood samples to painting trade for preparation of stained finishes for approval. Provide same type materials as will be used in the finish work.
- C. Shop drawings:
 - 1. Indicate all materials and dimensions.
 - 2. Indicate fabrication, assembly, and fastening details, including large-scale joinery details.
 - 3. Indicate installation details.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Wood: Match existing wood species, size and configuration.
- B. Fasteners: Screws and nails as applicable for specific installation conditions.

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2.2 STAIN

- A. Match stain of existing wood ceiling planking.

2.3 FABRICATION

- A. Cut to size of opening of planking to be replaced.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces abutting to finish carpentry work for satisfactory installation conditions.
- B. Do not commence installation until unsatisfactory conditions have been corrected.

3.2 BACKPAINTING

- A. Coordinate work requiring priming and backpainting with painting trade.
 - 1. The contact side(s) of all wood in contact with plaster, concrete, or masonry shall be backpainted.
 - 2. All other concealed surfaces require primer for opaque finished work and clear sealer for transparent finish work.
 - 3. Do not install finish work until primer and backpainting is dry.

3.3 INSTALLATION - FINISH CARPENTRY

- A. Install work in accord with approved shop drawings and referenced standards.
- B. Install finish work using concealed fastenings (blind nailing) to fullest extent possible. Where surface nailing is unavoidable, set nail heads approximately 3/32 in. below surface.
- C. Cut joints accurately to a hair line fit. Miter all external corners. Cope all internal corners.
- D. Make all finish work free from open joints, hammer and machine marks, or other surface blemishes.
- E. Repair, refinish, and touch up finishes damaged during or resulting from fitting and installation.

END OF FINISH CARPENTRY

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SECTION 07 21 30
SPRAYED FOAM INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Medium density, closed cell polyurethane spray foam insulation applied in the attic area as detailed.
- B. Apply at thickness to achieve an R of 38.

1.2 REFERENCE STANDARDS

- A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2004.
- B. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials.
- E. ASTM E 283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- F. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2008.

1.3 SUBMITTALS

- A. Product Data: Provide Manufacturer's detailed technical material data, including independent test reports indicating conformance with the specified criteria.
- C. Product Data for insulation product specified.
- D. Product test reports performed by a qualified third-party testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, and other properties, based on comprehensive testing of current products.
- E. Evaluation Report: Evidence of compliance of foam-plastic insulations with International Building Code (IBC), International Residential Code (IRC), International Energy Conservation Code (IECC).
- F. Manufacturer's certificate certifying insulation provided meets or exceeds specified requirements.
- G. Installer's certificate showing the manufacturer's installation certification.
- H. Products Specified by Flammability or Combustibility Criteria: Listed and classified by Underwriters Laboratories Inc. or Warnock Hersey.

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I. Performance criteria:

1. Flame spread: Class 1 rating when tested in accord with ASTM E84.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Product produced in an ISO 9001 registered factory.
- B. Single Source Responsibility: Single source product from one Manufacturer.
- C. Installer Qualifications: Engage a Licensed Dealer (installer) who has been trained and certified by the Manufacturer of this product.
- D. Fire-Test-Response Characteristics: Provide materials specified as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 1. Surface-Burning Characteristics: ASTM E 84.
- E. Toxicity/Hazardous Materials
 1. Provide products that contain no urea-formaldehyde.
 2. Provide products that contain no PBDEs
 3. Provide products that are "Low-emitting".

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturers written instructions for handling and protection prior to and during installation.
- B. Store both components in a temperature controlled area between 65 and 85 degrees F. Do not allow product to freeze.
- C. Use only those components that are supplied by the Manufacturer.

1.6 FIELD CONDITIONS

- A. Do not install insulation when ambient and surface temperatures are lower than the temperature and humidity recommended by manufacturer.
- B. Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation materials, in accordance with manufacturer's recommendations.

1.7 PROJECT CONDITIONS

- A. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

1.9 WARRANTY

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- A. Residential projects: Manufacturer's standard limited lifetime warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Polyurethane Spray Foam Insulation: ICYNENE MD-C-200 by Icynene Inc.
- B. Approved Equivalent Spray Foam Insulation.

2.2 MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
- B. Spray Foam Insulation: Medium-density, conforming to the following:
 - 1. Thermal Resistance (for 1 inch of material) (R-Value/inch @75 deg F): ASTM C 518; 6.5 hr. sq ft. degree F/BTU, 12 = 6.0 per inch.
 - 2. Air Permeance (for 1 inch of material): ASTM E 283: <0.02 L/s.m² @75 Pa.
 - 3. Water Vapor Transmission (for 1.5 inches of material): ASTM E 96; 0.9 perms.
 - 4. Flame Spread and Smoke Developed Rating: ASTM E 84.
 - a. Flame Spread: Less than 25.
 - b. Smoke Development: Less than 450.
 - 5. Density: closed cell 2 lbs./cu. ft., ASTM 1622.

2.3 SOURCE QUALITY CONTROL

- A. Product produced in an ISO 9001 registered factory.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.
 - 1. Review placement area to determine final location will not be within 3 inches of any heat source where the temperature will exceed 180 deg F per ASTM C 411 or in accordance with authorities having jurisdiction.

3.2 PREPARATION

- A. Clean substrates and cavities of loose materials capable of interfering with insulation placement.

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3.3 APPLICATION

- A. Site mix liquid components supplied by Icynene and installed by Independent Icynene Licensed Dealer.
- B. Apply insulation to substrates in compliance with manufacturer's written instructions.
- C. Apply insulation to produce thickness of 10-1 / 2-inches required to achieve R Value of 38.
- D. Extend insulation in thickness indicated to envelop entire attic area to be insulated.

3.4 REPAIRS

- A. Any repairs must be effected by an Icynene Licensed Dealer.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse.

END OF SECTION 07 21 30

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SECTION 07 92 00
SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide each type of sealant and caulking indicated on drawings and specified herein.
- B. Uses and Locations of Sealants and Caulking:
 - 1. Elastomeric Sealants: Use for all exterior building and paving joints and for interior joints subject to movement and classified as follows by ASTM C 920.
 - a. Grade NS for vertical and inclined joints and joints in copings and sills.
 - b. Grade P, self leveling, for horizontal joints.
 - c. Type M or S, Class 25, Use T, non-tracking, for use in traffic areas.
 - 2. Caulking Compound: Use for interior joints, not subject to a high degree of movement.
- C. Colors for exposed materials will be selected by Architect.

1.2 SUBMITTALS

- A. Submit manufacturer's product data, including color samples and installation instructions, for each type material required.

1.3 WARRANTY

- A. Upon completion of the work, furnish to the owner the manufacturer's written and signed warranty against adhesive and cohesive failure of sealant and water tightness of sealed joints for a period of five years. This warranty shall certify the properties of the products affecting their performance and that the products are used in accordance with the recommendations of the manufacturer.
- B. The contractor shall submit the following written and signed document to the Architect for delivery to the Owner.

CONTRACTOR WARRANTY

The undersigned warrants all materials furnished and work performed in the installation of exterior sealant systems on the _____ will remain free from leaks and other defects for a period of five years extending from the date of completion and acceptance of the sealant system and agrees during that period to make all necessary repairs and replacement of defective work, and all other work, exclusive of contents and furnishings damaged thereby, without additional cost to the Owner. This warranty shall have no dollar limit and shall cover all labor and materials required for repairs and replacement.

General Contractor

Caulk/Sealant Contractor

Signed

Signed

Title

Title

-
- C. Temporary repairs may be made by the Owner to meet emergency conditions without invalidating either of these warranties.
 - D. The Contractor is to cover damages to the building resulting from failure to prevent penetration of water during construction.

PART 2 - PRODUCTS

2.1 ELASTOMERIC SEALANTS

- A. Two-Component Polyurethane Sealant: ASTM C 920, Type M, Class 25, Grade NS. Provide one of the following or approved equal:
 - 1. Chem-Calk 500; Bostik
 - 2. Dynatrol II; Pecora
 - 3. Sonolastic NP-2; Sonneborn
 - 4. Spectrem 1; Tremco
 - 5. Vulkem 922; Mameco
- B. One-Component Polyurethane Sealant: ASTM C 920, Type S, Class 25, Grade NS. Provide one of the following or approved equivalent:

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1. Chem-Calk 900; Bostik
 2. Dynatrol I; Pecora
 3. Sonolastic NP-1; Sonneborn
 4. Spectrem 2; Tremco
 5. Vulkem 921; Mameco
- C. Silicone Sealants: ASTM C 920, Type S, Grade NS, Class 25. Provide one of the following or approved equivalent:
1. Silpruf 2000/Silglaze II; G.E. Silicones
 2. Silicone Building Sealant 790/795
- D. Sealants for Concrete Floors and Walks: ASTM C 920, Type S or Type M, Class 25, Grade P. Provide one of the following or approved equivalent:
1. Vulkem 45 or Vulkem 245; Mameco
 2. NR-200 or NR-201; Urexpan; Pecora
 3. Sonolastic SL-1, SL-2 or Wide Joint Sealant; Sonneborn

2.2 CAULKING COMPOUND

- A. Acrylic-Latex Sealant: Formulated to withstand a maximum total joint movement of 15% of the normal joint width and complying with ASTM C 834 for interior use. Interior use sealant shall be of a type which will accept a paint finish. Provide one of the following or equivalent:
1. AC-20; Pecora
 2. Sonolac; Sonneborn
 3. Acrylic-Latex; Dap

2.3 MISCELLANEOUS MATERIALS

- A. Joint Primer-Sealer: Provide the type of joint primer-sealer recommended by the sealant manufacturer for the joint surfaces to be sealed.
- B. Sealant Backer Rod: Compressible rod stock of closed cell polyethylene or other material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 JOINT PREPARATION

- A. Clean joint surfaces immediately before installation of sealant material.

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- B. Prime or seal joint surfaces when recommended by sealant manufacturer. Do not allow primer-sealer to spill or migrate onto adjoining surfaces.
- C. Use primer recommended by sealant manufacturer at joint locations where aluminum is finished with a polyvinylidene fluoride (Kynar500/Hylar5000) protective coating and where field adhesion tests indicate the use of a primer is required.

3.2 INSTALLATION

- A. Comply with manufacturer's printed instructions for exterior use of elastomeric sealants and interior use of acrylic/latex sealant (caulking compound).
- B. Set backer rod at proper depth in the joint. Do not leave voids or gaps between the ends of joint filler joints.
- C. Install backer rod for pourable elastomeric sealants.
- D. Deposit sealants in uniform, continuous ribbons without gaps or air pockets with complete "wetting" of the joint bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
- E. Joint Size and Shape: Install sealants to depths recommended by sealant manufacturer. Fill joints to a depth equal to 50% of joint width, but not more than 50% of joint width, but not more than ½-inch deep nor less than ¼-inch deep.

END OF SECTION 07 92 00

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SECTION 09 51 13
ACOUSTICAL CEILINGS, EXPOSED GRID

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide acoustical panel ceilings with exposed suspension system as shown on the drawings, schedules and as specified.

1.2 REFERENCE STANDARDS

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

ASTM INTERNATIONAL (ASTM)

- 1. ASTM A 641 Zinc-Coated (Galvanized) Carbon Steel Wire
- 2. ASTM C 635 Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
- 3. ASTM C 636 Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
- 4. ASTM E 1264 Acoustical Ceiling Products

UNDERWRITER’S LABORATORY (UL)

- 1. Building Materials Directory

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Ceiling Units: Obtain each acoustical ceiling panel from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- D. Suspension Systems: ASTM C 635 and ASTM C 636.
- E. Acoustical Panels: ASTM E 1264.
- F. Fire Hazard Classification: Panels tested, and UL listed and labeled as Class A (flame spread 25 or less).

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- G. Fire Resistance Rating: System UL tested listed and labeled for the UL design and hours of resistance as indicated on the drawings.

1.4 SUBMITTALS

- A. Submit manufacturer's product data and installation instructions for each material and each suspension system.
- B. Submit certified laboratory test reports and other data for suspension system and acoustical units to show compliance with these specifications. Include metal thickness of each member in suspension systems.
- C. Submit manufacturer's recommendations for cleaning and refinishing acoustical units.
- D. Samples:
 - 1. Submit two 12-inch square samples for each acoustical unit required.
 - 2. Submit two 6-inch long samples of each main runner, cross runner and molding.

1.5 MAINTENANCE STOCK

- A. At completion of project, deliver to Owner full size acoustical units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels. Quantity shall be 1.0% of the amount of each type installed.

1.6 JOB CONDITIONS

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

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING PANELS

- A. General: Provide acoustical lay-in ceiling panels of the type recommended by the manufacturer for the application indicated. Provide sizes to construct the grid patterns shown by reflected ceiling plans.
- B. Panel Size: 24" x 24".
- C. Edge Type: Square-cut.
- D. Acoustical Panels: Provide white washable USDA approved mineral fiber units not less than 3/4-inch thick, 1.33 lbs. per sq. ft., NRC .70, LR (light reflectance) 80%, Class A. Provide one of the following:
 - 1. Optima Health Zone, by Armstrong World Industries, Inc.

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2. Ecophon Hygiene Advance, by CertainTeed Corp.
3. “Superpanel” Climaplus, by USG Co.

2.2 SUSPENSION SYSTEM MATERIALS

- A. Comply with ASTM C 635, as applicable to the type of suspension system required for the type of ceiling units indicated.
- B. System Manufacturer: One of the following:
 1. Armstrong World Industries, Inc.
 2. U.S. Gypsum (Donn).
 3. Chicago Metallic Corp.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Type 1, direct hung.
- D. Hanger Wires: Galvanized carbon steel, ASTM A 641, soft temper, prestretched, yield-stress load of at least three times design load, but not less than 12 gage.
- E. Type of System: Direct-hung suspension system.
- F. Carrying Channels: 1½-inch steel channels, hot-rolled or cold-rolled, not less than 0.47 pounds per linear foot, galvanized after fabrication.
- G. Suspension System Members:
 1. Main Runners and Support Cross Runners: Steel double web bulb tees, not less than 1½-inch high, designed for ASTM C 635 structural classification specified.
 2. Cross Runners: Steel double web bulb tees, not less than 1¾-inch high designed for ASTM C 635 structural classification specified.
 3. Finish: Electro-galvanized, hot dip galvanized or cadmium plated. Exposed face capped with factory finished metal cap.
- H. Structural Classification: Minimum load carrying capabilities of main runner member shall conform to ASTM C 635, Table 1 for direct hung, Intermediate Duty, 12.0 pounds per linear foot
- I. Edge Moldings: Provide angle molding, not less than 24 gage for edges and penetrations of ceiling with exposed white baked enamel finish to match exposed main runners and cross runners.

2.3 EXPOSED SUSPENSION SYSTEM

- A. Provide exposed main runners, cross-runners and accessories, of the types and profiles specified and indicated, with exposed cross runners coped to lie flush with main runners.

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- B. Cross runners shall lock into main runners to prevent rotation of members and provide a tight hairline joint on exposed face.
- C. Finish of Exposed Members: Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system including moldings, trim and accessories as follows:
 - 1. Manufacturer's standard white, baked enamel finish.

2.4 MISCELLANEOUS MATERIALS

- A. Acoustical Sealant: A heavy-bodied, non-shrinking, non-drying, non-sag grade mastic compound intended for interior sealing of concealed construction joints.
- B. Concrete Inserts: Type recommended by suspension system manufacturer, sized for pull-out resistance of not less than five times the hanger design load for structural classification indicated, ASTM C 635, Table 1, Direct Hung. For wire-type inserts, provide units of not less than 8 gage galvanized wire construction.
- C. Metal Deck Inserts: Galvanized steel, type recommended by suspension system manufacturer.
- D. Hold-Down Clips: Manufacturer's standard, UL approved, to snap on runners to hold panels securely in grid system.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION WORK

- A. Examine the conditions under which the acoustical ceiling work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid the use of less-than-half width unit at borders, and comply with reflected ceiling plans shown on drawings.
- C. Concrete Inserts: Deliver inserts well in advance of time formwork is completed. Furnish layouts for insert locations and spacings. Refer to Concrete Section CONCRETE in Division 3 for installation.
- D. Supports in Metal Decking: Furnish layout of required clips or slots well in advance of decking installation.

3.2 INSTALLATION

- A. Install materials in accordance with ASTM C 636 and manufacturer's printed instructions. Comply with governing regulations, fire resistance rating requirements as shown or specified, and industry standards applicable to the work.
- B. Lay out ceilings as shown by reflected ceiling plans.
- C. Install suspension systems in compliance with ASTM C 636, with hangers supported only from building structural members as indicated. Locate hangers near each end and

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spaced 4'-0" along each carrying channel or main runner, unless otherwise indicated.

- D. Secure wire hangers by looping and wire-tying, either directly to structural members; to inserts or eye-screws or to devices bolted or welded to structural members.
 - 1. Drive-on type hanger supports are not acceptable.
 - 2. Do not support suspension from metal deck.
- E. Install edge moldings of the type indicated at edges of each acoustical ceiling area, and at locations where edge of units would otherwise be exposed after completion of the work.
 - 1. Secure moldings to building construction by fastening with screw-anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3 inches from each end and not more than 16 inches o.c. along each molding.
 - 2. Level moldings with ceiling suspension system, to a level tolerance of 1/8-inch in 12'-0".
 - 3. Miter corners of moldings accurately to provide hair-line joints, securely connected to prevent dislocation.
 - 4. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before fastening to vertical surface.
- F. Cope exposed flanges of intersecting suspension system members, so that flange faces will be flush. Cope flange of member supported by other member.
- G. Provide additional hangers, carrying channels, hanger supports and accessories for support of light fixtures, mechanical devices and other equipment where hanger spacing is interrupted and where the design load of suspension member is exceeded.
- H. Scribe and cut panels to fit accurately at walls, columns and penetrations.
- I. Provide hold-down clips within a 10-foot radius of all exterior doors and where required for fire-rated ceilings.

3.3 CLEANING AND PROTECTION

- 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. Protect the acoustical ceilings, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09 51 13

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SECTION 09 91 05
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide painting work specified herein and when shown on the drawings. The word paint means to apply paint materials and refers to the paint materials specified including primers, undercoats, sealers, fillers, stains and the finish coats of paint material.
- B. Shop priming and primer touch-up miscellaneous steel items is specified in other sections.
- C. The work includes painting of interior and exterior unfinished and primed items and surfaces throughout the project, unless otherwise specified or shown on drawings. Where items and surfaces are not specifically identified but are not specifically excluded from the painting work, paint the same as specified for adjacent similar surfaces and items.
- D. Colors to match adjacent surfaces where noted or will be selected by Architect.
- E. Coordinate painting with all other sections for surfaces and items specified to be shop primed and for items to be factory and shop finished.

1.2 SURFACES NOT TO BE PAINTED

- A. Surface preparation and priming of items and surfaces specified in other sections to be factory or shop primed.
- B. Surfaces and items specified in other sections to be factory or shop finished.
- C. Concealed wall and ceiling surfaces and inaccessible surfaces such as in pipe and duct chases and shafts, elevator shafts and similar areas.
- D. Galvanized steel surfaces that will be concealed in completed work.
- E. Fire rating labels, equipment labels and name plates.

1.3 SUBMITTALS

- A. Manufacturer's Product Data: Submit for each product. Include manufacturer's identification numbers, major pigment and vehicle constituents by volume, surface preparation, mixing, thinning, application and curing instructions.
- B. Material List: Submit a typewritten list of manufacturer's brand name and number of each material proposed for use. Identify surface(s) to receive material.

1.4 JOB CONDITIONS

- A. Paint Coordination: Review other sections in which primer paints are specified to ensure chemical compatibility with finish coating system. Furnish finish products which

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are compatible with primer products, or apply barrier coats over incompatible primers or remove and re-prime.

- B. Protection: Remove or otherwise protect hardware, light fixtures, sprinkler heads, electric outlet plates, A/C grilles and registers and similar items in place prior to painting and re-position upon completion of operations. Protect floors and other adjacent work by use of clean drop cloths or similar coverings. Protect the work of other trades from damage. Post signs on freshly painted surfaces immediately following their completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Paint systems, primers, sealer, fillers and finish paint shall be by one manufacturer for each type surface. Products shall be factory ready mixed for immediate application without thinning or other modification.

2.2 ACCEPTABLE MANUFACTURERS

- A. First grade products of the following manufacturers are acceptable, subject to submittal and approval of a schedule of products listing the surfaces for which they are intended.
 - 1. Benjamin Moore & Co.
 - 2. ICI Paints; Devoe & Reynolds Division
 - 3. ICI Paints; Glidden Division
 - 4. PPG Industries, Inc.
 - 5. Pratt & Lambert Co.
 - 6. Sherwin-Williams Co.
- B. Products of ICI Paints; Glidden Division are listed in the Product Schedule to illustrate paint material quality and type. Equivalent products of the listed acceptable manufacturers are also acceptable.

2.3 PRODUCT SCHEDULE

- A. Primers for Metals:
 - 1. All-purpose Metal Primer No. 5229: Oil-Alkyd base metal primer for all galvanized and non-ferrous metal and interior ferrous metal.
 - 2. Rust-Inhibitive Primer No. 5207: Alkyd base metal primer for all exterior ferrous metal and may be used for all galvanized and non-ferrous metal and interior ferrous metal in lieu of No. 5229 above.
- C. Primers for Wood:
 - 1. Oil-alkyd Base No. UH450: Primer for exterior wood to receive paint finish.
 - 2. Oil Base No. UH400: Undercoater for interior wood to receive paint finish.

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- D. Primer-Sealer No. 5019: Premium quality latex primer-sealer for drywall.
- E. Gloss Enamel No. Y4550: Alkyd Base enamel for gloss exterior finish coat.
- F. Flat Masonry Paint No. 3525: Acrylic latex base masonry paint for exterior concrete and stucco.
- G. Interior Flat No. 4000: Acrylic-Latex Base low sheen finish coat.
- H. Interior Satin No. 4100: Acrylic-Latex Base eggshell sheen finish coat.
- I. Interior Semi-Gloss No. UH8400: Latex Alkyd Base semi-gloss enamel finish coat.

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES

- A. Cleaning: Remove accumulated dirt and loose dust by brushing or wiping.
- B. Concrete Masonry: Clean all excess mortar, loose and foreign material using metal scraper and wire brush. Remove all grease and oil spots by suitable cleaning compound and rinse (to remove alkali). If necessary, neutralize by washing with zinc sulphate solution.
- C. Gypsum Board: Inspect joint and nail-head treatment; correct all imperfections before proceeding. Remove all dust and dirt by use of a soft cloth or brush.
- D. Metal: Surfaces shall be free of rust and loose scale. Clean with mineral spirits before painting. Surfaces which will be inaccessible after installation shall be completely painted before installation. Prime field welds, bolts and rivets.
 - 1. Aluminum: Clean and remove all lacquer or other protective coating.
 - 2. Steel: Wipe shop primed metal clean of foreign matter, retouch where scratched, marred or rusted using similar primer. As soon as practical after erection (to minimize rusting) wire brush structural and miscellaneous steel and touch-up welds, scratches and abrasions of shop applied primer.
- E. Wood: Sandpaper smooth. Before installation apply wood-sealer. Back-prime trim and prime cut ends to match finished surface. Ease sharp knife-edge corners by rubbing with fine sandpaper. Remove soil by wiping using clean cloth moistened with alcohol.

3.2 APPLICATION

- A. Workmanship: Read and conform to instructions in label on containers. Materials uniformly spread and smoothly finished. Do not thin in excess of the printed directions. Mix and apply in accordance with manufacturer's directions. Field applied priming coats shall be applied as soon as possible after the work is received or in place. Apply coats by brush or roller. Coverage of products shall not be less than that recommended by manufacturer. When finishing operating parts, the parts shall be painted in the "open" position and shall remain so until dry. Metal surfaces required to be bare for proper operations shall be kept free of paint. Cut sharp lines at different colors, glass and other

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unpainted materials. In painted work each coat shall differ in color from the preceding and succeeding coats.

3.3 COLORS

- A. Colors shall match colors scheduled from manufacturer's colors.
- B. Colors for surfaces not scheduled:
 - 1. Access Panels: Match adjacent wall or ceiling.
 - 2. Electric and Telephone Panels: Match adjacent walls.
 - 3. Closets: Match spaces into which they open.
 - 4. Steel Door Frames: Match door.
 - 5. Hardware (prime coated hinges and closers): Match door and frames to which attached.
 - 6. Interior of Ducts Visible Through Grilles: Matte black.

3.4 INTERIOR PAINT SCHEDULE

- A. Ferrous, Non-Ferrous and Galvanized Metal: All purpose metal primer and two coats interior semi-gloss enamel.
- B. Gypsum Drywall:
 - 1. Walls to Receive Fabric Wallcovering: One coat wood undercoater.
 - 2. Walls: Primer-Sealer and two coats [flat][satin] latex finish coat.
 - 3. Ceilings: Primer-Sealer and two coats flat latex finish coat.
- C. Wood Trim: Undercoater and two coats semi-gloss enamel.

3.5 TOUCH-UP

- A. Retouch finished surfaces, including factory finished items, necessary so work is neat, clean and unblemished at time of substantial completion.

3.6 CLEANING

- A. Keep freshly coated surfaces, brushed and cans clean and dust free. Remove paint splatters and daubs from hardware, glass, floors and any other surfaces not indicated to be painted.

3.7 MAINTENANCE STOCK

- A. At completion of Project, deliver to Owner a minimum of 2 gallons of each paint specified on this Project.

END OF SECTION 09 91 05

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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 1 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.

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- J. When the contract documents indicate the removal of existing equipment to be 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 photographs shall be taken showing existing conditions of adjoining construction and site improvements, including finished surfaces that might be misconstrued as damage caused by selective demolition operations. Photograph items requested to be salvage by the Owner. Submit all photographic documentation before the start of demolition.
- M. 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 1 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 General Conditions.
- B. Permits, Fees and Notices: Comply with the General Conditions.
- 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.

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- F. Record Drawings: Comply with the General Conditions.
- 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 General Conditions.
- 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.
- I. Submittals: Comply with the General Conditions.
- J. Product Requirements, Equals and Substitutions: Comply with the General Conditions.
- 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

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instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.

- L. Transportation and Handling: Comply with General Conditions.
- 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 General Conditions.
- O. Cleaning Up/Removal of Debris:
 - 1. Comply with the General Conditions.
 - 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 General Conditions.
- 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

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emphasize safe and proper operating requirements and preventative maintenance.

S. Guarantee of Work:

1. Comply with the General Conditions.
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.

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 1 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. Fabricated steel supports.
- 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 Section 23 05 00 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.

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PART 2 - PRODUCTS

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

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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.

- G. 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.
- 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.

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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.
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. 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.
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.

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.

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 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. 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

- A. 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.

2.2 FABRICATION – MOTORS

- A. 3/4 HP and Larger Horsepower Motors:

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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.
10. Slide bases as required.
11. 60 Hz. terminal box large enough to accommodate the required conduit and wiring.

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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 1 Specification Sections, apply to this Section.
- B. Refer to Division 26 for electrical wiring requirements.

1.2 WORK INCLUDED

- A. Building Control System Wiring.
- B. Kitchen Exhaust Hood Interlock Wiring.
- C. Walk-In Cooler and Freezer Wiring
- D. Interior & Exterior Lighting Control 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.

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- 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 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. 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.

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- 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.

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 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Duct Hangers and Supports.
- B. Duct Sleeves.
- C. Fabricated Steel Support.

1.3 QUALITY ASSURANCE

- A. 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.
- B. 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.
- C. Welding of steel members shall be in accordance with AWS D1.1.
- D. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as applicable.
- E. Steel supports for ducts, 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)
 - 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)

1.5 SUBMITTALS

- A. Submit schedule indicating type of hanger to be used by system and pipe size. Include

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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. Duct Hangers and Supports: Fabricated per Specifications
- B. Duct Sleeves: Fabricated per Specifications
- C. Fabricated Steel Support: As Detailed on Drawings.

2.2 FABRICATION

- A. Duct Hangers and Supports: Fabrication and application of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.
- B. 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.
- C. 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 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

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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. 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.
- B. 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 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 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.
- C. 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 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 1 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. Equipment Identification:
 - 1. 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

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- 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.

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. Equipment Identification:

1. 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.
2. 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 1 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 flow (air and/or water) 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

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- with the cube of speed.
2. Determine air volume in ducts by use of pitot tube, and inclined manometer. 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, air flow, pressure loss values.
 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. Compare temperature of space (taken with test instrument) to temperature read by thermostat or temperature sensor. Tabulate results.
- B. In cooperation with the controls contractor, set adjustments of automatically operated dampers to operate as specified, indicated, and / or noted.
- C. 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 un-repaired 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:
 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.

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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 design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.

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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, 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.
 - b. CFM from pitot tube traverse.

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- 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).
- 6. Kitchen Exhaust Hoods:
 - a. Designation.
 - b. Nameplate data.
 - c. Exhaust air CFM, from pilot tube traverse.
 - d. CFM and velocity in capture area.
 - e. All final readings used to determine cfm.

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 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Duct Systems Insulation.
- B. Kitchen Hood Exhaust Duct Fireproofing.
- 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).
- D. Kitchen hood exhaust duct fireproofing system shall have specific acceptance by ICBO, and SBCCI. Material shall be non-hazardous and contain no asbestos or toxic materials. Suitable for 2 hour fire rating.

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

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- 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.
- 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 AND PIPE INSULATION AND FIREPROOFING REQUIREMENTS – Refer to Construction Documents.

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

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- per 1" thickness of .23 at 75°F mean temperature. Based on Knauf Insulation Board or approved equal.
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" thickness of .28 at 75°F mean temperature. Based on Knauf Duct Wrap or approved equal.
- 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 and 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. Kitchen Hood Exhaust Duct Fireproofing:
1. Fire resistive duct wrap: Thermal Ceramics FireBarrier DuctWrap 15A, 1.5" thick, 24" or 48" wide x 240" long or FireBarrier DuctWrap 20A, 2" thick, 24" or 48" wide x 240" long rolls, foil encapsulated with logo identification or equal. Thermal Ceramics FireBarrier DuctWrap collar or equal, 6" wide for air duct butt joint optional wrap method.
 2. Tapes:
 - a. High performance filament tape
 - b. Aluminum foil tape: Minimum 3" wide to seal cut blanket edges.
 3. Banding material:
 - a. Carbon steel banding for ≤ 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.
 4. Insulation pins/washers: Pins: 10 or 12 gage, 4" to 5" long, copper coated steel; washers: 1.5" x 1.5" or 1.5" diameter galvanized steel speed clip.
 5. Through-penetration fire stop materials:
 - a. Packing material: Scrap pieces, Thermal Ceramics FireBarrier DuctWrap 15A, FireBarrier DuctWrap 20A, or 3 pcf mineral wool.
 - b. 3M 1000 N/S Silicone sealant or 3M 1003 S/L Silicone sealant.
 6. Grease duct access door:
 - a. Single angle opening frame.
 - b. Access cover, minimum 16 gage.

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- c. Insulation pins.
 - d. Speed clips, minimum 1.5" x 1.5" or 1.5" diameter galvanized steel.
7. Hardware:
- a. Threaded rods: 4" to 5" long, 3/8" diameter galvanized steel with 3/8" wing nuts and 1/4" metal washers.
 - b. 4" long steel hollow tubing to fit threaded rods.
8. Based on Thermal Ceramics FireMaster or approved equal
- E. 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 accord 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 equal to WB Armaflex or Foster 30-64 elastomeric finish.
 - 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 equal.
 - 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 equal.
 - 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 equal.
 - 13. Acrylic Finish and Vapor Barrier Coatings:
 - a. Elastomeric Insulations: acrylic coating, air drying flexible water based

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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 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 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.

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- 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 "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

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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 and 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.

B. Pipe Insulation:

1. General:

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- a. 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.
- b. 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.
- c. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
- d. Seal all raw edges of insulation with vapor barrier coating or lagging adhesive.
- e. For piping supported by hangers outdoors, apply a rainshield to prevent water entry.

2. 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. Kitchen Hood Exhaust Duct Fireproofing: Install in strict accordance with manufacturers written instructions based on the latest acceptance of the specified code officials.

D. 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.
5. Provide on all ducts exposed to the weather.

E. 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 or Childers CP-76 Chil Byl.

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F. 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.

G. 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.

H. Flexible Acrylic Latex:

1. Apply two coats to 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 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 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Single Wall Round Galvanized Steel Ductwork and Fittings.
- B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings.
- C. Double Wall Round Galvanized Steel Ductwork and Fittings.
- D. 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.

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

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- the contract drawings.
 2. Show duct sizes.
 3. Show fitting details.
 4. Show lighting and ceiling diffusers.
- B. 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 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. Double Wall Round 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
- D. Insulated Round Flexible Ductwork:
1. ATCO Rubber Products, Inc.
 2. Flexmaster USA, Inc.
 3. Flexible Technologies - Thermaflex®

2.2 FABRICATION

- A. Single Wall Round 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

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National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal 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

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 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.

Based on United McGill or approved equal

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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. Double Wall Round Ductwork and Fittings:

1. Materials:
 - a. Outer Duct: Hot rolled, continuously annealed hot dipped galvanized steel, minimum G- 90, 0.90 oz/sf (.001 inch thick/side) coating, conforms to ASTM A653.
 - b. Liner: 1" thickness flexible fibrous glass minimum density 1.5 lb/cf, maximum conductivity per 1" thickness of .27 at 75 F mean temperature.
 - c. Inner Duct: Hot rolled continuously annealed, perforated hot dipped, galvanized steel, minimum G-90, 0.90 oz/sf (.001 inch thick/side) coating, conforms to ASTM A653.
2. Metal Gauges:
 - a. Outer Duct: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) Duct Construction Standards, Metal 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:

Round Ducts:

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Spiral Pipe Inside Dia.	Shell	Perf. Liner	Longitudinal Shell	Fittings and Seam Pipe Perf. Liner
3" thru 8"	24	26 Non-Ribbed	24	24
9" thru 12"	24	28 Ribbed	24	24
13" thru 24"	22	28 Ribbed	22	24
25" thru 34"	20	28 Ribbed	20	24
35" thru 48"	20	28 Ribbed	20	22
49" thru 52"	18	28 Ribbed	18	22
53" thru 58"	18	26 Ribbed	18	22
59" thru 62"	16	26 Ribbed	16	22
63" thru 82"	16	22 Non-Ribbed	16	22

3. Duct Construction:

- a. Outer Duct: Spiral wound, lockseam construction, slip joint or flanged connections as noted below under couplings.
- b. Inner Duct: Spiral wound, lockseam construction, slip joint connections, mechanically bound to outer duct for vertical installation.

4. Fitting Construction:

- a. 90 Deg. and 45 Deg. Ells: Die formed or welded segmented construction, radiused ells to be full radiused unless otherwise noted, mitered ells to have single thickness turning vanes, liner and inner duct continuous.
- b. Tees or Crosses: Tangential unless otherwise noted, conical take off or reduction coupled ends, 180 Deg. or 45 Deg. as indicated.
- c. Bellmouth: Spun metal smooth converging bellmouth, round, single wall gauge equal to or greater than connecting duct.
- d. Access Section:
 - 1) 7" Diameter and Less: Flanged section, minimum four bolts per flange. Double wall section.
 - 2) 8" Diameter and Larger: Round or rectangular access cover, on welded raised sections, 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.

Based on United McGill or approved equal

D. 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

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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.

Based on Type 5M as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #036 or Omni Air 1200, or Flexible Technologies – Thermaflex M-KF.

- E. 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.
- F. 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 7 Firestopping. The sleeve shall be permanently affixed to the wall (Refer to Section 23 05 29 for Hangers and Supports for HVAC Piping and Equipment).

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- 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, 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

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- 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 ductwork as follows:
 - a. Use slip joints, couplings, etc. sealed with adhesive pre-applied to couplings or duct mate spiralmate 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. Double Wall Round Ductwork and Fittings:

- 1. Coordinate the liner and/or exterior insulation requirements to assure a continuous vapor barrier and uniform thermal resistance. See Para. 3.5 Schedules for liner/insulation thickness requirements.
- 2. In unconditioned, non-accessible areas such as chases and dry wall ceiling the lined ducts shall also have an additional layer of duct wrap (Refer to Section 23 07 00 for Insulation) at all joints to assure condensation control, wrap will extend a minimum of 6" on either side of joint.

C. Insulated Round Flexible Ductwork:

- 1. Provide where indicated or required on supply air ducts.
- 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 Insulation)

3.5 SCHEDULES

A. System Pressure Classification and Duct Material Schedule:

System I.D. No.	System	Section	Maximum Pressure	Duct Material
1.	Supply	AHU to Terminal	3" pos.	A

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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 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Galvanized Steel Rectangular Ductwork.
- B. Stainless Steel 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.

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. Stainless Steel Ductwork:
 - 1. Interior Concealed or Exterior: Type 304, finish No. 2D conforming to ASTM A 240 and Federal Specification QQ-S-766.
 - 2. Interior Exposed: Type 304, finish No. 4, conforming to ASTM A 240 and Federal Specification QQ-S-766.
- C. 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

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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 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. Stainless Steel Duct:

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. All elbows shall be full radiused whenever possible.
- b. All elbows required to be mitered shall have single thickness turning vanes. Vanes shall be welded in place. No protruding screws will be

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permitted.

3. All seams shall be welded with interior weld ground smooth and all slag and/or splatter removed.
 4. All joints shall be constructed using Ductmate DM35 or equal stainless steel flange connections of the same grade as the duct material. All joints shall be sealed completely (externally or internally) with United Duct Sealer or an approved equal. No duct leakage will be allowed.
 5. Unless otherwise noted all material shall be 18 gauge.
 6. Provide welded tabs for hanging. Spacing as required.
- C. 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 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

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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.
 - 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.

3.5 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.)

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B. Stainless Steel Ductwork:

1. Connect to equipment served with a solid connection.
2. Slope horizontal runs to inlet at a minimum of 1/4 inch per one (1) linear foot.
3. All joints shall be sealed air and water tight.

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.	Supply To Terminal	A.C Unit	3" pos.	A
2.	Supply	Terminal to Diffuser	1" pos.	A
3.	Supply	AHU to grille	3 pos.	A
4.	Return	Inlet Grille to Terminal	2" neg.	A
5.	Return	Terminal to Return Air Fan	4" neg.	A
6.	Return	All AHU Return	1" neg.	A
7.	Gen. Exh.	Inlet to Unit	1" neg.	A
8.	Kit. Hood Exh.	All 3" neg.		C

Schedule Legend:

Duct Material

- A Galvanized Steel
 C Stainless Steel - Type 304

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 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Duct access doors.
- B. Volume dampers.
- C. Flexible duct connectors.
- D. Insulating duct coating.
- E. Louver (Outside Air Intake)
- F. Hardware cloth.
- G. 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.

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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Duct Access Doors:
 - 1. Air Balance, Inc.
 - 2. Cesco Products
 - 3. Greenheck, Inc.
 - 4. Nailor Industries, Inc.

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5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

B. Volume Dampers:

1. Air Balance, Inc.
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

C. Flexible Duct Connectors:

1. Ductmate Industries, Inc.
2. Duro-Dyne
3. Elgen
4. Ventfabric

D. Insulating Duct Coating:

1. Insulated Coating Corp. (No Substitute)
956 US Highway 42 South
Inverness, Florida 32650

E. Louvers (Outside Air Intake):

1. Air Balance, Inc.
2. Cesco Products.
3. Construction Specialties, Inc.
4. Greenheck, Inc.
5. Miami Dade
6. Penn Ventilator
7. Prefco.
8. Ruskin Manufacturing Company
9. Pottorff

F. Hardware Cloth:

1. McNichols Co.
2. or equal

G. Aluminum Louver:

1. Greenheck, Inc.
2. Construction Specialties, Inc.
3. Ruskin Manufacturing Company
4. Sunvent
5. T.M. Products Company

2.2 FABRICATION

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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 equal.

2. High Pressure Ductwork:

- a. Rating: Up to 10" wg positive pressure.
- b. Frame: Minimum 16 gauge galvanized steel with "Z" shaped reinforced corners, polyurethane gasket between frame and duct and frame and door.
- c. Door: Minimum 16 gauge galvanized steel or aluminum, minimum 2 spring latches, double wall construction, fiberglass insulated with thickness to match ductwork.
- d. Based on Ruskin Manufacturing Co. ADHP-3 or approved equal.

B. 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 equal
- i. Based on Ruskin Manufacturing, Co. CD30AF1 for rectangular ducts (CDR82 for round ducts) with velocities over 1501 feet per minute or approved equal.

C. 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

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.

D. Insulating Duct Coating:

- 1. ASTEC #100 ceramic filled insulating coating, white, suitable for fluid application.
- 2. ASTEC #WPM#8 waterproof membrane undercoat.

E. Louvers (Outside Air Intake):

- 1. Extruded aluminum, 6" frame depth with .125 wall thickness.
- 2. Blades: Extruded aluminum, .091 wall thickness, mounted vertically on approximately 1" centers.
- 3. Provide birdscreen at all outside air intake louvers. See hardware cloth requirements.
- 4. Minimum size to be 12"x12", this supersedes any dimension on the drawing less than 12"x12". No louver shall have a dimension in width or length smaller than 12".
- 5. Louvers are to be clear anodized.

Based on Ruskin Manufacturing, Co. EME520MD – Wind-driven rain resistant stationary louver. (Horizontal Blade) or approved equal.

Based on Ruskin Manufacturing, Co. EME6325D - Wind-driven rain resistant stationary louver. (Vertical Blade) or approved equal.

F. 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

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- 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. 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.
- C. 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.
- D. Insulating Duct Coating:
1. Apply to exposed supply and return air ducts located above roof.
 2. Clean sheet metal surface by pressure washing or other approved method.
 3. Caulk all joints with urethane caulk. After caulking has skinned over, apply ASTEC WPM#8 at the rate of 1 gal. per sq. ft. over the caulking and at least 4 inches on either side of the caulking.
 4. A 4" wide polyester cloth is then embedded into the wet strip of ASTEC WPM#8, centered over all joints. A second wet strip of ASTEC WPM#8 is then applied over the top of the cloth and 2" on each side of the cloth edge. An extra coat of ASTEC #100 coating shall be applied over the WPM#8 coat on all joints at the minimum rate of 1.33 gal. per 100 sq. ft.
 5. Top coat shall be ASTEC #100 applied to the entire surface of the duct at a minimum rate of 1.33 gal. per 100 sq. ft.
- E. Louvers (Outside Air Intake):
1. Receive and unload louvers and deliver to general contractor at jobsite for storage and installation by general contractor.
 2. All duct connections to louvers shall have their bottom sloped towards the louver for drainage and shall be sealed water tight.
- F. Hardware Cloth: Install over all open ended ducts. Provide sheetmetal pocket over raw edges and secure with sheetmetal screws through the metal edge cover.
- G. Install Miscellaneous Control Devices:

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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 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Centrifugal wall exhaust fans.
- B. In-line centrifugal fans.
- C. Ceiling 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 –Motor Requirements for HVAC Equipment.
- H. 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.
- I. Provide shaft grounding rings on all motors driven by a VFD. Typically to an AEGIS –

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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. Submit construction details and dimensional data including weights.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Centrifugal Wall Exhaust Fans:
 - 1. Acme Engineering and Manufacturing Corp.
 - 2. Barry Blower
 - 3. Greenheck Fan Corp.
 - 4. Loren Cook Co.
 - 5. Penn Ventilator Co., Inc.
- B. In-line Centrifugal Fans:
 - 1. Acme Engineering and Manufacturing Corp.
 - 2. Barry Blower
 - 3. Greenheck Fan Corp.
 - 4. Loren Cook Co.
 - 5. Penn Ventilator Co., Inc.
- C. Ceiling 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 Wall Exhaust Fans:
 - 1. Direct or belt drive as scheduled.
 - 2. Housing heavy gauge aluminum weatherproof.
 - 3. Wheels centrifugal type.
 - 4. Motor outside air steam in isolated motor compartment with forced outside air cooling for 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.

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7. Tip speed and motor horsepower shall not exceed catalog ratings.
8. Accessories: Grease trough, UL listed for grease duct use, hinged sub-base for damper access.
9. Based on Loren Cook Wall Exhauster or Greenheck CW/CWB or approved equal

B. In-line Centrifugal Fans:

1. Heavy gauge aluminum housing with integral aluminum motor mounting base and straightening vanes heliarc mounted to housing at discharge end. Inlet and outlet flanges.
2. Non-overloading, backwardly inclined aluminum air foil blower wheel with blades heliarc welded to the hub. Dynamically balanced. All wheels keyed to shaft.
3. Belt drive or direct drive as scheduled with motor out of the airstream.
4. Aluminum support bracket. Belt drive units to have locking strap and bolt to permit universal motor position. All motor shall be installed on the bottom of the unit for ease of maintenance.
5. Grease lubricated anti-friction, self-aligning bearings having a minimum average life of L10-40,000 hours. Extended lubrication tubes.
6. Belt drive units to have adjustable pitch belt drive designed for 140% of motor horsepower with a minimum of two oil resistant non-static belts. OSHA approved motor cover listed below.
7. Direct drive units to be provided with adequate motor cooling passages.
8. Motor Cover: The motor cover completely encloses the motor and drive assembly and also serves as an OSHA belt guard. The cover is constructed of 18 gauge galvanized steel & insulated. This shall be included on all fans with exterior mounted motors and will be factory mounted.
9. Removable filter as noted in schedule and on drawings.
10. Based on Loren Cook Type SQND/SQNB or Greenheck SQ/BSQ or approved equal

C. Ceiling Exhaust Fans:

1. Direct or belt driven as scheduled.
2. Housing heavy gauge metal with sound attenuating duct liner.
3. Wheels shall be forward curved centrifugal type with permanently lubricated ball bearings.
4. Provide integral or matched inlet grille provided by the fan manufacturer.
5. Motors continuous duty permanent split capacitor type permanently lubricated bearings. Factory wired to junction box with cord and plug or disconnect switch.
6. Provide integral fan speed controller.
7. Based on Greenheck SP or approved equal

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.

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- 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
GRILLES, REGISTERS AND DIFFUSERS

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 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.

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.
 - 4. Metal Aire Division of Metal Industries, Inc.

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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 38 10
KITCHEN EXHAUST 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 WORK INCLUDED

- A. Short circuit type kitchen exhaust canopy.
- B. Make-up air unit.
- C. Exhaust air fan.
- D. Ductwork.

1.3 QUALITY ASSURANCE

- A. Underwriters' Laboratories, Inc. regulation UL 710.
- B. National Sanitation Foundation Seal of Approval (NSF).

1.4 SUBMITTALS

- A. Submit dimension drawings, performance and product data for acceptance. Include fan curves with the system design point plotted, with fan efficiency and horsepower clearly indicated and include computer coil selection clearly indicating system design conditions.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Provide Florida Product Approval Numbers for all products required by Florida Building Code (FAC 9N-3).
- D. Refer to Division 1 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Short Circuit Type Kitchen Exhaust Canopy:
 - 1. Greenheck
 - 2. Captive-Aire
 - 3. Owner approved equal.
- B. Make-up Air Unit:
 - 1. Refer to Section 23 34 00.
- C. Exhaust Air Fan:

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1. Refer to Section 23 34 00.

D. Ductwork: Field Fabricated

2.2 GENERAL

- A. The system shall be a complete packaged system.
- B. All components shall be furnished by one manufacturer regularly engaged in supplying kitchen exhaust systems equipment.

2.3 CONSTRUCTION

A. Short Circuit Type Kitchen Exhaust Canopy:

1. Canopy shall be short circuit type including both exhaust and integral short circuit supply plenum.
2. Canopy inner liner, outer shell and filter housing, 18 ga. 304 stainless steel. Internal supports to reinforce inner and outer shell.
3. Integral exhaust duct collar or collars.
4. Joints and seams of inner liner, full liquid tight, externally welded and ground smooth. Inside top surface with collecting device to prevent grease accumulation in supply plenum.
5. Supply air nozzle to provide 80% of make-up air. Supply air outer shell insulated to prevent condensation. Supply air plenum with baffle type diffuser panel.
6. Filter housing with integral pitched drip tray, full length of canopy, grease cup. U.L. classified aluminum grease filters. Extra set of filters.
7. Vaporproof lights with plastic coated glass lens, completely wired to junction box, on 3 ft. centers.
8. Remote control station with light switch, fan switch and indicating light.
9. Canopy to be UL listed as a range hood and balancing fire damper assembly.
10. Accessible nozzles for wet chemical fire suppression system.

B. Make-up Air Unit:

1. Fan shall be in-line centrifugal fan. Refer to schedule and Section 23 34 00 for requirements.

C. Exhaust Air Unit:

1. Fan shall be centrifugal wall exhaust fan. Refer to schedule and Section 23 34 00 for requirements.

D. Ductwork:

1. Exhaust Ductwork:

- a. Constructed of 16 ga. 304 stainless steel.
- b. All welded construction.
- c. Access door at offsets for cleaning.
- d. Refer to Section 23 31 01, Shop Fabricated Ductwork for additional requirements.

2. Supply Ductwork:

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- a. Constructed of galvanized steel in accordance with SMACNA requirements.
- b. Refer to Section 23 31 01, Shop Fabricated Ductwork for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install items in accordance with manufacturers printed instructions.

END OF SECTION 23 38 10

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SECTION 23 77 00
PACKAGED GROUND-MOUNTED AIR CONDITIONING UNITS (3 - 10 TON)

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 WORK INCLUDED

- A. Packaged Ground-Mounted Air Conditioning Units (3 - 10 TON)

1.3 QUALITY ASSURANCE

- A. Each unit shall be approved by the Underwriters Laboratory and shall include the official UL label.
- B. ANSI/ASHRAE/IESNA 90.1-2007 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.
- C. Unit cooling capacities shall be rated in accordance with ARI Industry Standards.
- D. Unit insulation shall meet the requirements of NFPA 90A.
- E. 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 WARRANTY

- A. Provide parts warranty (excluding refrigerant) for one year from start-up or 18 months from shipment, whichever occurs first. The following extended warranties shall be provided:
 - 1. Compressor - Full five years extended warranty
 - 2. Heat Exchanger - Full five years extended warranty

1.5 SUBMITTALS

- A. Submit unit performance data including: capacity, nominal and operating performance.
- B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
- D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

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- E. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Packaged Ground-Mounted Air Conditioning Units (3 - 10 TON) :
1. Addison
 2. Carrier
 3. Daikin Applied
 4. Trane

2.2 FABRICATION

- A. Packaged Ground-Mounted Air Conditioning Units (3 - 10 TON):
1. General:
 - a. Furnish and install where shown on plans, single-zone electric heating and cooling units.
 - b. Units shall perform as indicated on the schedule.
 - c. Units shall be completely factory assembled, piped, wired, tested and shipped in one piece with a single point power connection.
 - d. Outside air system, return air system, filters, switches and supply air fan system shall be furnished factory installed.
 - e. Units shall be specifically designed for outdoor applications and include a weatherproof cabinet and curb.
 - f. Units shall have direct expansion cooling with electric heat.
 - g. Units shall be shipped fully charged with Refrigerant 410A.
 - h. Units shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.
 2. Cabinet:
 - a. The frame and unit base shall be 14 gauge galvanized steel. The unit base shall overhang the curb for water run-off and shall have a formed recess that sets on curb gasket to provide a positive weathertight seal. Exterior panels shall be constructed of 18 gauge galvanized steel. Access doors downstream of the supply air fan section shall include 20 gauge galvanized steel door liners. All side access doors shall seal to vinyl, dual durometer gasketing. Water and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.
 - b. Unit cabinetry shall incorporate a standing top seam and channelled surfaces at all joining sections. Top panels shall be cross broken for water drainage. Unit cabinet shall be designed to operate at external static pressures up to 5 inches, W.G.
 - c. Units cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.
 - d. Exterior surfaces shall be phosphatized and coated baked-on, light gray enamel. Hinged side panels with flush-mounted, single lever latching mechanism shall provide access to each cabinet section from both sides

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- of the unit.
- e. Units base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
 - f. Provide 1/2 inch thick fiberglass insulation with foil face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air stream.
 - g. Lifting brackets with lifting holes shall be provided on the unit so as to accept cable or chain hooks. The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.
 - h. Provide 115-volt convenience outlet, factory-installed and per NEC requirements.
 - i. Contractor shall provide factory supplied curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.
 - j. The curb shall be a minimum of 18" above the grade surface. Provide curb extensions if this is required on new and existing applications.
 - k. Units shall be secured to the curbs by tie-downs per the drawing details or local requirements. Contractor to verify and provide tie-downs as required.

3. Condensing Section:

- a. Condenser coils shall be multi-row type fabricated from seamless copper tubing mechanically bonded to ripped and corrugated aluminum fins. Condenser coil for each refrigerant circuit shall be provided with an additional circuit for a minimum of 15 deg. of sub-cooling. Each condenser coil shall be factory leak tested at 450 psig under water.
- b. Condenser fans shall be direct drive, aluminum propeller type designed for low tip speed and vertical air discharge. Condenser fan motors shall be heavy-duty, inherently protected, 3-phase, non reversing type with permanently lubricated ball bearings and integral rain shield.
- c. Provide on all projects East of I-95 and West of I-75 a complete, flexible epoxy dip and bake coating of condenser coils. Coil with coating shall be able to handle 5000-hour salt spray test. All coil surfaces shall be coated with epoxy material giving uniform coverage (minimum of 0.8 mils), without bridging between fins. Any coating showing bridging will degrade performance and be deemed unacceptable. Coatings not covering any part of the fin and/or parts of condenser frame will be unacceptable. Baked phenolic coatings are unacceptable because of their brittle nature. The heat transfer decrease due to the coating shall be less than 1% so that design capacity and efficiency are maintained. Baked phenolic coatings are also unacceptable due to performance losses of up to 5%. If baked phenolic is allowed, unit provided must account for performance degradation. Coating shall be able to withstand corrosive environments in the pH range of 3-12. Coating shall be flexible so that bare surfaces will not form. The coating shall be able to handle temperatures ranging from -50 to 150F without degrading. UV protection shall be applied on surface of coating to prevent degradation from sunlight.

4. Compressors:

- a. Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with

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- winding temperature limits and compressor overloads.
- b. Each compressor shall have its own completely independent refrigeration circuit including sight-glass, filter drier, manual shut-off valve, and spring type high pressure relief valve. Compressor shall be spring isolated. Compressor capacity reduction shall be accomplished with cylinder unloading and hot gas bypass.
 - c. Units shall have cooling capabilities down to 0 degree F as standard and for field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
 - d. Provide each unit with schedule specified amount of refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.
 - e. For heat pump units, provide reversing valve, discharge muffler, flow control check valve, and electronic adaptive demand defrost control on all units.
5. Evaporator Coil Section:
- a. Evaporator coils shall be multi-row type fabricated from 5/8 inch O.D. seamless copper tubing mechanically bonded to rippled and corrugated aluminum fins. Coils shall be factory leak tested at 315 psig under water. The evaporator coil circuiting shall be fed with an adjustable thermal expansion valve (one per refrigerant circuit) with an external equalizer. The evaporator coil shall be circuiting for a combination row/face split.
 - b. A mastic coated primary drain pan shall be provided with the evaporator coil and extend beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall be connected to a threaded drain connection extended through the unit base. Units shall be provided with a secondary mastic coated drain pan connected to the primary drain pan.
 - c. Provide factory installed thermal expansion valve (TXV) for each refrigerant circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.
6. Electric Heater Section:
- a. Electric heating coils shall be constructed with low watt density 80/20 nickel chromium elements. Safety controls shall include automatic reset high limit control for each heater element, a linear heat limiter in the discharge airstream of each heater bank, and line break protection in each heater circuit. Heating element branch circuits shall be individually fused to a maximum of 48 amps to meet NEC requirements.
 - b. A solid-state control system with full magnetic line breaker contactors shall provide multiple stages of control. The electric heating section shall contain a single point electrical connection with a factory mounted non-fused disconnect switch to provide power to the unit as well as the electric heat section. Heaters shall be provided with set control in 10 kw increments.
 - c. Heater shall be UL and CSA listed and approved and provide single point power connection.
7. Supply Fan:
- a. Supply fans shall be double width, double inlet, centrifugal type airfoil.

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- All fans shall be statically and dynamically balanced for quiet operation.
- b. The airfoil fan wheel shall be Class II type, and fabricated from aluminum with fan blades continuously welded to the back plate and end rim. Units shall have solid steel fan shafts mounted in heavy-duty, 200,000 hour relubricative ball bearings.
 - c. Fan motors shall be heavy duty, 1800 RPM, open drip-proof type with greaseable ball bearings. The motor shall have a variable pitch sheave and an adjustable base for proper alignment and belt tension adjustment. The entire fan assembly shall be completely isolated from the unit bulkhead with neoprene gasketing and mounted on double deflection, spring isolators.
 - d. Provide units 5 tons and below with direct drive, multiple speed, dynamically balanced supply fans.
 - e. Provide units 7.5 – 10 tons high efficiency products utilize direct drive plenum fan design. Fan is backward incline design.
8. Filter:
- a. The filter section shall be supplied complete with galvanized steel filter racks as an integral part of the unit. Filters shall be accessible from both sides of the unit. The filter section shall be provided with panel or bag filters. Panel filters shall be 2 inch thick, 35% efficiency pleated type mounted in a galvanized steel filter frame.
9. Outdoor Air Section & Economizer:
- a. Provide motorized outside air damper with 0-50% outside air operating range, manually set.
 - b. Outside air arrangement shall be 0 to 100% outside air with economizer control.
 - c. Provide spring return motor for outside air damper closure during unit shutdown or power interruption.
 - d. 0 to 100% outside air economizer control shall consist of outside, return air and exhaust air dampers, adjustable potentiometer, damper motor, and an adjustable enthalpy control mounted in the outside air stream. The adjustable potentiometer shall control the minimum outside air damper position for fresh air requirements (unit mounted on unit without optional remote monitoring panel). An enthalpy control shall be provided to sense the dry bulb temperature and relative humidity of the outside air for use in cooling. The damper motor shall be of the modulating spring return type.
10. Electrical:
- a. Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with NEC requirements and shall conform with all applicable UL standards. All wiring shall be number coded per the electrical wiring diagrams. All electrical components shall be labeled according to the electrical diagram and be UL recognized where applicable. Each unit shall have 115 volt control circuit transformer, 115 volt receptacle, return air firestat, supply air firestat, system service switch, and control circuit fuse. Unit shall have a single source power connection.
 - b. The supply and return air fan, compressor and condenser fan motor branch circuits, and electric heat shall be individually fused. Contactors

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and inherent thermal overload protection shall be furnished for each compressor and condenser fan motor. The supply and return air fan motors shall have contactors and external overload protection.

- c. A terminal block shall be provided for the main power connection and a terminal board shall be provided for the low voltage control wiring. Knockouts shall be provided in the bottom of the main control panel for field wiring entrance. A separate keylocked control panel shall house all controls for the condensing section.
- d. Any electrical changes required as a result of a deviation from the scheduled equipment shall be at no cost to the Owner.
- e. Units shall include a phase monitor as standard that protects equipment from phase loss, phase reversal, and low voltage. Any fault condition shall produce a Failure Indicator LED, and send the unit into an emergency stop condition. The entire unit with this option shall be cULus approved. If not, a field UL inspection is required.

11. Controls:

- a. Each compressor circuit shall include a liquid line solenoid valve, oil pressure switch, high pressure switch, low pressure switch, compressor control circuit switch and pumpdown switch. Each refrigeration circuit shall have at least one condenser fan controlled from an ambient thermostat for positive heat pressure control. An ambient thermostat shall prevent the refrigeration system from operating below 50°F.
- b. Microprocessor based discharge air controls shall be provided. The discharge air control system shall be completely factory installed to control the discharge air temperature from a single sensor. The sensor shall be located at the discharge air opening. The discharge air controller shall have an adjustable temperature setting (40°F to 90°F) and an adjustable cycling rate (3 to 6 CPH).
- c. The discharge air controller shall operate the economizer, electric heater and mechanical cooling stages. On multiple compressor units, the discharge air controller shall alternate circuit unloading between compressors. The economizer cycle shall include enthalpy control of the economizer dampers. The mechanical refrigeration system shall be locked out below 50°F ambient (adjustable).
- d. A fully factory mounted variable air volume control system shall be provided on each unit.
- e. Units with supply and return air fans shall include a solid state electronic pressure control system, inlet vane actuators and a duct mounted high limit safety device.
- f. The electronic pressure controller shall control the position of the supply and return fan inlet vanes from the static pressure control signals, from up to six remote sensor locations, automatically selecting the lowest pressure signal, comparing it to the setpoint and providing the necessary proportional signal to drive the actuators. The return fan vane position relative to supply fan vane position shall be automatically controlled by the electronic pressure controller to maintain a constant building pressure. This relationship between supply and return fan vane position shall be field adjustable by dials on the control to facilitate air balancing.
- g. The electronic pressure controller shall have an adjustable (0 to 3") operating range for each sensor. Meters shall display either the sensed or command (setpoint) pressure and the actuator position (0 to 100% for both supply and return fans). Indicator lights shall show when drive commands have been issued by displaying the actuator mode (opening

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- or closing) independently for supply and return fans.
- h. The electronic pressure controller shall automatically shift to a low sensitivity mode after system balance to eliminate system hunting and prevent the actuators from responding to short term minor pressure variations. A separate sensor assembly shall house the pressure sensors which monitor pressure from the remote sensing points.
 - i. Variable inlet vanes shall be of the center controlled type for complete accessibility. A peripheral type linkage inside the inlet funnel shall not be acceptable.
 - j. The inlet vane actuation mechanisms shall be permanently lubricated and interconnected by a solid steel shaft through two lubricated table pillow block bearing assemblies mounted on the fan housing.
 - k. The inlet vane actuators shall be completely factory mounted, wired and adjusted. A manual reset pressure switch shall be factory mounted in the unit discharge air stream to shut down the supply and return air fans on an excessive buildup of pressure on units with airfoil wheels and inlet vanes.
 - l. A remote monitoring panel shall be provided with system operation switches and signal lights for remote control and monitoring of unit functions. The panel shall include "Heat-Auto-Cool" system switch, "On-OFF" fan switch, minimum outside air damper potentiometer and four signal lights to indicate supply fan operation, mechanical cooling malfunction, electric heat malfunction, and clogged filters. Two additional lights are available on the remote monitor panel for field hook up and monitoring of other system functions.
 - m. An adjustable 0 to 8 minute timer lockout shall be provided on each compressor to prevent short cycling on safety control or power interruption.
 - n. Hot gas bypass control shall be factory installed on each compressor circuit to provide capacity control by artificially loading the evaporator. Hot gas bypass control includes a solenoid valve, hot gas bypass valve shall be sized to modulate the full load.
 - o. A disconnect shall be provided with night heating setback and cooling shutdown. Initiation of setback shall be provided by a time clock. The system shall perform the following:
 - 1) Setback the heating setpoint to 55°F.
 - 2) Shut down the cooling system.
 - 3) Close the outside air damper.
 - 4) Switch fan to intermittent operation to automatically cycle the fan with a call for heating.
 - p. Morning warm-up: After unoccupied periods, the outdoor air damper shall be held closed by a return air thermostat until space temperature approaches the occupied setpoint.
 - q. Smoke detector shall be supplied in the supply and return of the unit to stop the fan systems whenever products of combustion are sensed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Assemble and install in accordance with manufacturers written installation instructions and details on drawings.

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- B. Coordinate duct, piping and electrical work so as to provide access to unit for maintenance and filter replacement and coil removal with minimum disturbance of piping.
- C. Arrange condensate trap for proper drainage at design pressure differential.
- D. Prior to unit start-up all controls shall be installed and tested.
- E. Prior to initial start-up and for system testing install temporary air filters to protect the unit and ductwork from dirt and debris. After the system has been tested and prior to turning the system over to the Owner, replace the temporary filters with new, clean filters as specified.
- F. All joints or assembled seams of the assembled unit shall be caulked or gasketed air tight to 10" positive or 7" negative.
- G. Prior to turning the system over to the Owner, all damages incurred during shipping, storing and installing shall be repaired. These repairs shall be sufficient to bring the equipment back to the quality standards equal to the original manufacturing standards. These repairs shall include but are not limited to repairing painted surfaces, dent removal, combing coil fins, repairing or replacing wet, sagging or torn insulation, etc.
- H. Furnish a complete set of fan motor drive belts.
- I. The contractor shall furnish manufacturer complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END OF SECTION 23 77 00

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SECTION 26 01 00 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 OPERATION AND MAINTENANCE MANUALS

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

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

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- (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) Surge Suppression:
 - 1. Product data and/or catalog sheets on equipment applicable to this project.
 - 2. Parts list.
 - 3. Recommended testing and replacement procedures.

1.4 SUBMITTALS

- A. 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.
- B. Provide additional copies if additional copies are required in other Divisions and/or sections of these specifications.

1.5 DELAYS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

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PROJECT INFORMATION SHEET

Project Name: _____

Project Number: _____

Substantial Completion Date: _____

Certificate of final Completion Date: _____

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

Brief Description of Project Scope:

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CHECK OUT MEMO

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

Project Name _____

Type of Equipment Checked _____

Equipment Number _____

Manufacturer of Equipment _____

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

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

MANUFACTURER'S REPRESENTATIVE – PRINT NAME

ADDRESS

TELEPHONE, FAX, E-MAIL

MANUFACTURER'S REPRESENTATIVE – SIGNATURE AND TITLE

DATE CHECKED

WITNESSED BY:

CONTRACTOR'S REPRESENTATIVE – SIGNATURE AND TITLE

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

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CONDUCTOR INSULATION RESISTANCE TEST

PROJECT NAME _____

CONDUCTOR FROM _____ TO

SIZE _____

INSULATION TYPE _____

INSULATION VOLTAGE RATING _____

DATE _____ TIME _____

WEATHER CONDITIONS _____

TEST VOLTAGE (DC) _____

RANGE _____

MEGGER INSTRUMENT/SERIAL NUMBER _____

TESTING METHODOLOGY _____

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

PHASE A TO GROUND _____

PHASE B TO GROUND _____

PHASE C TO GROUND _____

NEUTRAL TO GROUND _____

ISOLATED GROUND TO GROUND _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

OWNER'S REPRESENTATIVE _____

DATE: _____

ENGINEER'S REPRESENTATIVE: _____

DATE: _____

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DC HIGH VOLTAGE CABLE TEST

Project Name _____

Location _____

Description _____

Rated Voltage _____

TEST DATA

Set Leakage @ Test Voltage _____ ma Variac _____

Pri. Voltage _____

Sphere Gap _____ Inches

Duct Temp. _____ Ambient Temp. _____ Weather _____

Cable Status _____ 1 hour prior to test

Phase or Conductor	<u>A</u>	<u>B</u>	<u>C</u>	Remarks
Starting Time	<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 _____ Number of Terminals _____

Joints _____

Witnessed By: _____ Performed By: _____

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GROUND TEST INFORMATION

PROJECT NAME: _____

GROUND TYPE: _____

TEST BY: _____

DATE OF TEST: _____

GROUND LOCATION: _____

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM

GROUND _____ (OHMS)

AFTER CONNECTION TO SYSTEM

GROUND _____ (OHMS)

WEATHER CONDITIONS (Wet/Dry) _____

SOIL CONDITIONS (Wet/Dry) _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

ENGINEER'S REPRESENTATIVE _____

DATE: _____

OWNER'S REPRESENTATIVE _____

DATE _____

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MOTOR TEST INFORMATION

PROJECT NAME: _____

DESCRIPTION OF MOTOR: _____

NAME OF CHECKER: _____

DATE CHECKED: _____

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

Manufacturer _____

Model Number _____

Serial Number _____

RPM _____

Frame Size _____

Code Letter _____

Horsepower _____

Nameplate Voltage and Phase _____

Nameplate Amps _____

Actual Voltage _____

Actual Amps _____

Starter Manufacturer _____

Starter Size _____

Heater Size, Catalog No. and Amp Rating _____

Manufacturer of Dual-Element Fuse _____

Amp Rating of Fuse _____

Power Factor _____

CONTRACTOR'S REPRESENTATIVE: _____

DATE: _____

SIGNATURE OF CHECKER: _____

DATE: _____

OWNER'S AUTHORIZED REPRESENTATIVE: _____

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VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME _____

SWITCHGEAR/PANELBOARD _____

FULL LOAD AMPERAGE READINGS:

DATE _____

TIME _____

PHASE A _____
 B _____
 C _____
 N _____
 GROUND _____

FULL LOAD VOLTAGE READINGS:

DATE _____

TIME _____

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

VOLTAGE AT THE END OF THE LONGEST BRANCH _____

TYPE OF LOAD _____

NO LOAD VOLTAGE READINGS:

DATE _____

TIME _____

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

ENGINEER'S REPRESENTATIVE _____

DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE _____

DATE _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

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PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT: _____

DIVISION NUMBER AND NAME: _____

This is to certify that the attached marked-up design prints were marked as the items were installed at the site during construction, and that these prints represent as accurate "As-Builts" record of the work as actually installed. One copy will be turned over to the Owner at the instruction in Operation Conference. The duplicate copy is for the Engineer's files.

General Contractor

: _____
By: Authorized Signature And Title

Date

Subcontractor

By: Authorized Signature And Title

Date

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SPARE PARTS / MAINTENANCE STOCK CERTIFICATION

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

Project Name: _____

Type/Name of Spare Parts/Attic Stock: _____

Specification Reference: _____

Quantity of Spare Parts/Attic Stock: _____

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

Contractor/CM

Authorized Signature, Title

Date: _____

Subcontractor

Authorized Signature, Title

Date: _____

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

Department

Authorized Signature, Title

Date: _____

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

MANUAL COVER (face)

OC CLARCONA HORSEMAN'S PARK KITCHEN AND RECREATION BUILDING HVAC REPLACEMENT
MPE NO. 2013-079
ELECTRICAL OPERATION AND MAINTENANCE MANUAL
DATE (substantial completion date)

MANUAL COVER (Spine)

OC CLARCONA HORSEMAN'S PARK KITCHEN AND RECREATION BUILDING HVAC REPLACEMENT
MPE NO 2013-079
E L E C T R I C A L
OPERATION AND MAINTENANCE MANUAL
DATE

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SECTION 26 01 03 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for minor electrical demolition for remodeling.

1.3 REFERENCES

- A. NFPA 70 National Electrical Code
- B. Underwriters Laboratories

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work as specified in individual sections.
- B. Provide all materials necessary for work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. 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.
- C. Existing Electrical Service: Maintain existing system in service until new items are 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.
- D. 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.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

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- 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 luminaires. Remove brackets, stems, hangers, and other accessories.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Seal openings in walls, floors, etc. and fire stop in accordance with the accepted UL detail to maintain integrity of assembly.
- H. 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.
- I. Extend existing installations using materials and methods compatible with existing electrical installations. Extension must meet or exceed the materials/methods specified in the contract documents.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused, including but not limited to:
 - 1. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
 - 2. Luminaires: Remove existing luminaires within the kitchen for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

END OF SECTION

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SECTION 26 01 05 - INVESTIGATION OF EXISTING ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes testing and documentation of existing electrical systems.
- B. Test the essential features of the following existing electrical systems:
 - 1. Fire detection devices, smoke detection devices.
 - 2. Controls and alarms.
 - 3. Outlets: Convenience.
 - 4. Switches: Regular, time.
 - 5. 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 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.
 - b) Test each smoke detector with canned smoke. Record location of each tested device; note either operational or non-operational.
 - c) 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

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an automatic signal.

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

2. Ground System:

- a) Test ground system at each permanent building and at each modular unit/building.
 - b) Submit Ground Test Information Form (included at the end of this section), for every grounding system in the project. This includes, but is not limited to:
 - 1. Ground rod installation.
 - 2. Water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment).
 - 3. Building steel ground connection (test building steel to ground and test building steel to building service equipment).
 - c) Testing shall be 3-point method in accordance with IEEE recommended practice.
 - d) Where grounding resistance is greater than the value required by this Specification, Contractor is to bring this to the attention of both the Engineer and Owner in writing along with the Ground Test Information Form.
- B. The Electrical Contractor shall investigate all existing systems as called out in this performance verification prior to the beginning of any work which could affect these systems.
- C. Each system shall be retested after completion of remodel and/or renovation to ensure proper operation is maintained. Demonstrate operation per Section 26 08 03 Demonstration of Completed Electrical Systems.

3.2 INVESTIGATION/TESTING FORMS

- A. Submit Existing Facilities Investigation Form (included at the end of this Section) and advise Owner/Engineer of all deficiencies in system(s) prior to work. All systems will be assumed to be fully operational if Form is not received by Engineer prior to work on system.
- B. Submit five copies of Existing Facilities Investigation Form for each device tested, signed by the Contractor, Subcontractor and Owner and submit each test result to the Owner's Authorized Representative.

Attachments:
Existing Facilities Investigation
Ground Test Information

END OF SECTION

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EXISTING FACILITIES INVESTIGATION

PROJECT: _____

The existing systems on the above project have been investigated and checked to determine the existing condition of all existing electrical systems within the area(s) affected by the scope of work of this project. The investigation consisted of testing all electrical systems/devices as required by Section 26 01 05 Investigation of Existing Electrical Systems.

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

PRIME CONTRACTOR

AUTHORIZED SIGNATURE AND TITLE

DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE

AUTHORIZED SIGNATURE AND TITLE

DATE _____

Note To Contractor: Upon completion of investigation and one week prior to the commencement of work, submit five copies of the completed Existing Facilities Investigation Form to the Owner's Authorized Representative, signed and dated by the Contractor. The Owner's Authorized Representative's signature and date is required to verify receipt of Form. Retain copy(ies) and submit copy of Form in each Operation and Maintenance Manual. Contractor shall submit quantities of Forms as required to present required information.

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GROUND TEST INFORMATION

PROJECT NAME: _____

GROUND TYPE: _____

TEST BY: _____

DATE OF TEST: _____

GROUND LOCATION: _____

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

AFTER CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

WEATHER CONDITIONS (Wet/Dry):

SOIL CONDITIONS (Wet/Dry):

CONTRACTOR'S REPRESENTATIVE

DATE _____

ENGINEER'S REPRESENTATIVE

DATE _____

OWNER'S REPRESENTATIVE

DATE _____

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SECTION 26 05 00 - COMMON WORK RESULTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes Basic Electrical Requirements specifically applicable to Division 26 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.

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- C. Pay for all required licenses, fees, and inspections.
- D. 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. 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-operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.
- H. Bid shall include all removal and relocation of all piping, fixtures or other items required for

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completion of alterations and new construction.

- I. See Section Minor Electrical Demolition for Remodeling for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

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

1.9 MATERIALS AND EQUIPMENT

- A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.
- B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with Section Substitutions and requirements.
- C. When a product is specified to be in accordance with a trade association or government

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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.

1.10 MISCELLANEOUS CIRCUITS REQUIRED

- A. 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.
- B. 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

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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. Fire Shutters
 - 2. Mechanical Division of the Specifications
- 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.

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- 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 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.

1.15 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.

1.16 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

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complete.

- D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.
- E. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.
- F. The Contractor shall keep the construction site clean of waste materials and rubbish at all times. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.
- G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and a layout made prior to the setting or embedment thereof, so as to cause no delay to the project schedule.

1.17 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

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a set of "as-built" drawings to the Architect/Owner satisfaction.

1.18 "OBSERVATION OF WORK" REPORT

- A. Reference the General Conditions.
- B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item to the A/E. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected, and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.
- C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

1.19 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.

1.20 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.

1.21 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.

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1.22 PROHIBITION OF ASBESTOS AND PCB

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

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SECTION 26 05 07 - SUBMITTALS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 26 Sections.
- B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.
- C. Submittals may be submitted electronically in PDF format as long as they meet the requirements below including organization and nomenclature.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

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

1.4 SUBMITTALS

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

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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.

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. U.L. 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.

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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 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:

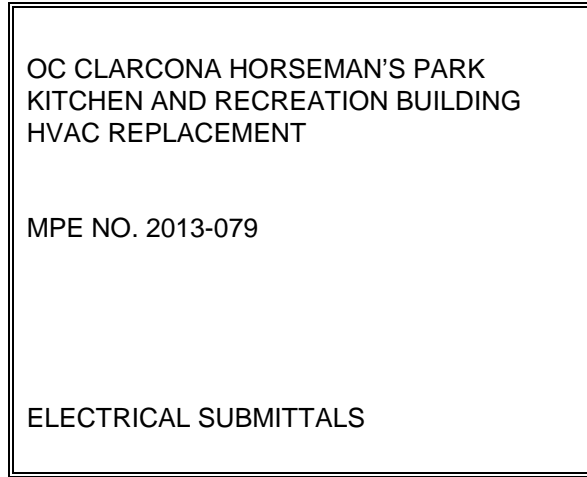
Matern Professional Engineering, Inc.
130 Candace Drive
Maitland, Florida 32751
Telephone No.: (407) 740-5020
Fax No.: (407) 740-0365

GENERAL CONTRACTOR:

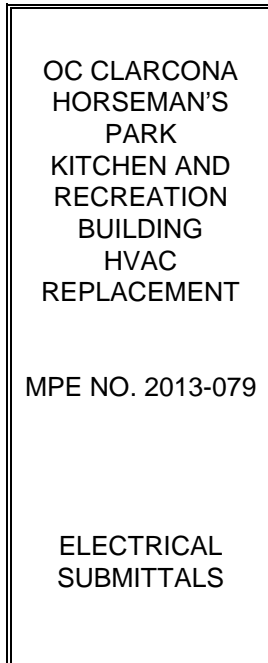
SUBCONTRACTOR:

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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 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 Division 26 sections.

1.3 REFERENCES

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

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	ASME International American Society of Mechanical Engineers International
ASTM	ASTM International American Society for Testing and Materials International
BOR	Board of Regents
BICSI	BICSI, Inc.
CRSI	Concrete Reinforcing Steel Institute
DCA-ADAIA	Department of Community Affairs - Florida Americans with Disabilities Accessibility Implementation Act
DCA-ADAAG	Department of Community Affairs - Florida Americans with Disabilities Act Accessibility Guidelines
DCA-ARM	Department of Community Affairs - Accessibility Requirements Manual
DOCA or DCA	State of Florida Department of Community Affairs
EIA/TIA	Electronics Industries Alliance/Telecommunications Industry Association

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EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council
FAC	Florida Administrative Code
FBC	Florida Building Code
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFPC	Florida Fire Prevention Code
FLA	State of Florida
FMC	Florida Building Code (Mechanical)
FMG	FM Global (formerly Factory Mutual System)
FPC	Florida Building Code (Plumbing)
FS	Florida Statutes
IEEE	Institute of Electrical and Electronics Engineers, Inc
IES	Illumination Engineering Society of North America
LPCR	Local Power Company Requirements
NEC	National Electrical Code
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
SBE	State Board of Education
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.
FAC	Florida Administrative Codes, Chapter 33-8, Rules of the Department of Corrections, County and Municipal Detention Facilities.

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1.4 REGULATORY REQUIREMENTS

- A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc.. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.
1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority Having Jurisdiction):
 - a) Americans with Disabilities Act of 1990, as amended
 - b) ADA Standards for Accessible Design, 2010
 - c) American National Standards Institute
 - d) American Society of Heating, Refrigerating and Air Conditioning Engineers
 - e) American Society of Mechanical Engineers
 - f) American Society for Testing and Materials
 - g) Concrete Reinforcing Steel Institute
 - h) Department of Community Affairs
 - i) Electronics Industries Association/Telecommunications Industry Association
 - j) Florida Building Code, 2010
 - k) Florida Fire Prevention Code, 2010
 - l) Institute of Electrical and Electronics Engineers
 - m) Illumination Engineering Society
 - n) Local Power Company Requirements
 - o) Lightning Protection Institute
 - p) Local Telephone Company Requirements
 - q) National Electrical Code, 2008
 - r) National Energy Conservation Policy Act
 - s) National Electrical Safety Code
 - t) National Electrical Manufacturers Association
 - u) NFPA 1 Fire Code, 2009
 - v) NFPA 101 Life Safety Code, 2009
 - w) Occupational Safety and Health Act
 - x) Safety Code for Elevators and Escalators
A17.1a, 2008 and A17.1b, 2009 Addenda
 - y) Safety Code for Existing Elevators and Escalators
A17.3, 1996
 - z) Sheet Metal and Air Conditioning Contractors
 - aa) Underwriters Laboratories, Inc.
 - bb) Applicable Federal, State, Local Codes, Laws and Ordinances, Florida Statutes and Referenced Codes/Standards

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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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 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

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KWH	Kilowatt Hour
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
∅	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

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Sec.	Secondary
SHT	Sheet
S/N	Solid Neutral
SPST	Single Pole Single Throw
SF	Square Foot
SW.	Switch
SWBD	Switchboard
Sys.	System
THHN; THWN	Nylon Jacketed Wire
TSP	Twisted Shielded Pair
TTB	Telephone Terminal Board
TTC	Telephone Terminal Cabinet
TV	Television
TVTC	Television Terminal Cabinet
TVEC	Television Equip. Cabinet
TYP	Typical
Temp.	Temperature
U.L.	Underwriters' Laboratories
UTP	Unshielded Twisted Pair
VFD	Variable Frequency Drive
VHF	Very High Frequency
VHO	Very High Output
V	Volt
VA	Volt Amperes
Vol.	Volume
W	Wire
W.P.	Weatherproof
XFMR	Transformer
Y	Wye
Yd.	Yard
Yr.	Year
3R	Rainproof
4X	Stainless Steel Dusttight, Watertight

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY – CLARCONA HORSEMAN'S PARK
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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.

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PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

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

PART 3 - EXECUTION

3.1 GENERAL

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

3.2 EXAMINATION

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

3.3 PREPARATION

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

3.4 WIRING METHODS

- A. Use only building wire type (THHN/THWN for #10 and #12 and THHN/THWN-2 for #8 and larger) insulation in raceway, unless noted otherwise.
- B. Wiring in vicinity of heat producing equipment: Use only XHHW insulation in raceway.
- C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required

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to meet the UL listing of the fixture; however, in no case shall the temperature rating be less than 90 degrees Centigrade. Remove incorrect insulation types in new work.

3.5 INTERFACE WITH OTHER PRODUCTS

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

3.6 FIELD QUALITY CONTROL

- A. Inspect wire for physical damage and proper connection.
- B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- C. 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

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conductor insulation within the box or panel.

- B. Unless otherwise accepted or required by Architect/Engineer to match existing, color-code shall be as follows:
Neutrals: 120/208V system white; 277/480V system natural grey
Ground Wire: green, bare
120/208V: Phase A black, Phase B red, Phase C blue
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.
- 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. Testing equipment and procedures
- B. Product data shall prove compliance with specifications, National Electrical Code, manufacturers' specifications, and written installation data.

1.6 PROJECT RECORD DOCUMENTS

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

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- B. Submit test results of each ground rod. See Section Tests and Performance Verification of Electrical System.

PART 2 - PRODUCTS

2.1 MECHANICAL CONNECTORS

- A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.
- B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. Specified items of designated manufacturers indicate required criteria and equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:
 - 1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.
 - 2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.
 - 3. Piping Clamps: Burndy GAR-TC Series with two hole compression terminal or T&B equal.
 - 4. Grounding Screw and Pigtail: Raco No. 983 or equal.
 - 5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.
- C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

2.2 WIRE

- A. Material: Stranded copper.
- B. Size: Size to meet NFPA 70 requirements as a minimum, increase size if called for on drawings, in these specifications, or as required for voltage drop.
- C. Insulated THWN (or bare as noted elsewhere).

PART 3- EXECUTION

3.1 GENERAL

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

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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 5 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
 - 3. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two or more rods connected together but not connected to the grounding electrode conductor.
- E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc. of ground rod locations it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80' or more in length.
- F. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.
- G. Verify that final backfill and compaction has been completed before driving rod electrodes.
- H. Install ground rods not less than 1' below grade level and not less than 2' from structure foundation.

3.3 EQUIPMENT GROUNDING CONDUCTOR

- A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.
- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet

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(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.
- B. Complete installation shall meet and exceed the requirements of the NEC 250.
- C. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.
- D. Provide and bond to all of the following:
 - 1. Building metal frame, structural steel and/or reinforced structural concrete.
 - 2. All piping entering or leaving all buildings (including chilled water piping).

3.5 ROOF MOUNTED EQUIPMENT

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

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3.6 LIGHTING FIXTURES

- A. All new and removed/reinstalled fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.
- B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.

3.7 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

- A. One 30' ground rod electrode shall be driven vertically to a minimum depth of 30' plus 1' below grade in each manhole, handhole or pullbox (in ground).
- B. The complete installation shall exceed the minimum requirements of the NEC.
- C. Provide additional ground rod electrodes as required to provide resistance called for herein.
- D. Where more than one ground rod electrode is required bond the two or more ground rod electrodes together with a copper ground conductor.
- E. Bond to counterpoise system (whenever counterpoise system is provided.)
- F. Bond grounding electrode to all exposed metal parts of manhole, handhole, and pullbox (including metal cover) with #6 copper ground conductor. Connect to ground rod electrode with exothermic weld. Connect to metal cover with exothermic weld. Connect to other metal parts with exothermic weld or UL accepted grounding clamp. Provide 3' or more slack ground cable on cover connection as required to facilitate removal of cover.

3.8 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

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control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.

- G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
- I. Grounding provisions shall include double locknuts on all heavywall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.

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-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 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. Flexible Metal Conduit (FMC) NEC 348
 - 2. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
 - 3. Electrical Metallic Tubing (EMT) NEC 358
 - 4. Fittings and Conduit Bodies

1.3 REFERENCES

- A. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated
- B. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- C. ANSI/NFPA 70 National Electrical Code
- D. NECA Standard Practice of Good Workmanship in Electrical Contracting

1.4 REGULATORY REQUIREMENTS

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

1.5 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70. (See Drawings and this and other sections of these Specifications for additional requirements).
- B. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.
- C. A raceway shall be provided for all electrical power and lighting, and electrical systems unless specifically specified otherwise.

1.6 SUBMITTALS

- A. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.
- B. Submit catalog cut sheet on all types of conduit bodies and fittings.
- C. Product data shall be submitted for acceptance on:
 - 1. Conduits.
 - 2. Conduit straps, hangers and fittings.
 - 3. Fitting entering and leaving the ground or pavement
- D. Submit UL listed fire and smoke stopping assemblies for each applicable application.

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- 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.

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

2.3 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.

2.4 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Comply with:
 - 1. NEC 350.
 - 2. ANSI/UL 360.
- B. Conduit material:

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

C. Fittings:

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

2.5 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. Compression Type.
3. Zinc plated malleable iron or steel.
4. Concrete tight.

2.6 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.

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. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.

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:

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- 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) 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.
 - c) 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.)
 - d) Exterior conduits from grade level to 6' above grade may be rigid non-metallic Schedule 40 PVC for low voltage Class II wiring provided rigid metal conduit is used at transition from below grade to 12" above grade (due to weed eater damage, etc.).
 - 2. Metal Canopies:
 - a) Conduit runs except for canopy lighting raceways are not to be run on (top or bottom) of metal canopies roof systems. All new conduit shown on or at these areas shall be run underground.
 - 3. Roofs:
 - a) Conduit is not to be installed on roofs, without written authorization by A/E for specific conditions.
 - b) When accepted by written authorization conduit shall comply with the following:
 - 1. Be PVC coated rigid galvanized metal conduit.
 - 2. All fittings, etc. are to be PVC coated.
 - 3. Conduit shall be supported above roof at least 6" using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
 - 4. Supports to be fastened to roof using roofing adhesive or means as accepted by roofing contractor.
- E. Interior Dry Locations:
- 1. Concealed: Use electrical metallic tubing.
 - 2. Exposed: Use 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

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conduit as required elsewhere in these specifications).

3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

- A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.
 - 1. Accepted pipe vise.
 - 2. Roller/bade type cutter or band saw.
 - 3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.
- B. Hangers shall be installed 8' apart.
- C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.

3.3 ADDITIONAL REQUIREMENTS FOR EMT

- A. Electrical metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.
- B. All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted reamer.

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

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

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

- A. Rigid non-metallic PVC conduit is not allowed anywhere inside building(s) except underground, in slab, in poured in place concrete, and in block wall up to first outlet box (if not over 40" AFF) if allowed by codes. Rigid non-metallic PVC conduit may be used exterior to building as stated elsewhere in these specifications.
- B. Join rigid non-metallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- C. Threads will not be permitted on rigid non-metallic PVC conduit and fittings, except for rigid steel to rigid non-metallic PVC couplings.
- D. Installation of rigid non-metallic PVC conduit shall be in accordance with manufacturer's recommendations.
- E. Rigid non-metallic PVC conduit shall not be used to support fixture or equipment.
- F. Field bends shall be made with accepted hotbox. Heating with flame and hand held dryers are prohibited.

3.6 SUPPORTS

- A. Arrange supports to prevent misalignment during wiring installation.
- B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24", increase distance as required) provide space on each for 25 percent additional

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conduits.

- D. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29 Hangers and Supports.
- E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach conduit to ceiling support wires.
- G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.
- H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.7 EXPANSION FITTINGS

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

3.8 GROUNDING

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

3.9 FIRE AND SMOKE STOPPING

- A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.
- B. Install conduit to preserve fire resistance rating of partitions and other elements.
- C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.
- D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in compliance with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and

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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).
- 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. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- P. Ground and bond conduit under provisions of Section 26 05 26 Grounding and Bonding.
- Q. Identify conduit under provisions of Section 26 05 53 Identification for Electrical Systems.
- R. Install all conduits concealed from view unless specifically shown otherwise on drawings
- S. Rigid steel box connections shall be made with double locknuts and bushings.
- T. 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.
- U. 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.
- V. 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.
- W. 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

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into top to indicate use. Also, tag conduits in panels where originating.

- X. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."
- Y. 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.
- Z. Provide conduit seal-offs wherever conduit crosses obvious temperature changes (i.e. from inside to outside of coolers, freezers, etc.).
- AA. Route conduit through roof openings for piping and ductwork or through suitable roof flashing or boot. Coordinate location with roofing installation specified under other Sections of these specifications.
- BB. All raceways shall be run in neat and workmanlike manner and shall be properly in accordance with latest edition of NEC with accepted conduit clamps, hanger rods and structural fasteners.
- CC. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.
- DD. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.

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,

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type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.

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

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

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

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.

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- N. Use gang box where more than one device is mounted together. Do not use sectional box.
- O. Use gang box with plaster ring for single device outlets.
- P. Use cast outlet box in exterior locations and wet locations.
- Q. Comply with applicable portions of the NECA National Electrical Installation Standards.
- R. Install outlets in the locations shown on the Drawings; however prior to rough-in, the Owner shall have the right to make slight changes in locations to reflect room furniture layouts.
- S. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.
- T. The Contractor shall relocate electrical boxes as required so that once installed, electrical devices will be symmetrically located with respect to the room layout.
- U. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.
- V. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.
- W. As a minimum, provide pull boxes in all raceways over 150' long. The pull box shall be located near the midpoint of the raceway length.
- X. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
- Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
- Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
- AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
- BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.
- CC. Outlet boxes mounted in metal stud walls are to be supported to studs with two screws inside of outlet box to a horizontal stud brace between vertical studs, or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall is finished.
- DD. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.
- EE. Mount Height.
 - 1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify

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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

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 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:

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1. All motors, motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches, transformers, panelboards, circuit breakers (i.e., all 2-pole, 3-pole circuit breakers), contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical, and electrical systems (Systems Divisions 27, 28), junction and pull boxes (larger than 4-11/16"), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number, if applicable.

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	Popsicle Orange K02410
Normal Power 277/480 volt	Leather Brown K02501
Normal Power 120/208 volt	Glossy Black K01601
Fiber Optics	Plum Purple K01929
BAS	Cameo White K04129
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.

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 conduit, junction boxes, and outlet boxes using field painting.
- F. 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. Miscellaneous Electrical Equipment
 - a) Kitchen exhaust hood shut down
 - b) Electrical systems controls and equipment
 - c) Electrical power equipment
 - d) Motor control devices
 - e) Surge suppression equipment
 - 3. Lighting Fixtures (include relamping and replacing lenses)
 - a) Exit and safety fixtures
 - b) Fixtures, indoor and outdoor
 - c) Low-voltage controls
 - d) 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.
- 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 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 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, etc.) and its respective motor(s), shall have auxiliary break before break (open) interlock control

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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 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. Ballasts
 - 3. Lamps
 - 4. Luminaire accessories
- 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 ceiling, wall/slot fixtures, special fixtures).
 - 2. Shop drawings shall be complete showing all dimensions and installation instructions

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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.

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
1. Sylvania, G.E., Phillips.
- B. Fluorescent:
1. Fluorescent lamps to be Octron type T8 bulb with medium bi-pin base.

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2. Correlated color temperature shall be 4100K with color rendering index of 80.

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:

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.

PART 3 - EXECUTION

3.1 EXAMINATION

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- A. Examine substrate and supporting grids for luminaires.
- B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

- 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. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. 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.
- O. 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.
- P. 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.
- Q. Miscellaneous (provide and install complete):
 - 1. Tents as required for fixtures in fire rated ceilings as per applicable codes.
 - 2. Thermal protection for all fixtures with tents or fixtures surrounded by insulation as per

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applicable codes.

3. Zero degree ballast for outdoor lighting fixtures.
 4. Heat removal or air supply slot covers for all fixtures requiring them as determined by Mechanical Engineer.
- R. 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.
- S. Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.
- T. 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.
- U. Voltage for all fixtures shall match the voltage of the lighting circuit fixture is connected to. Coordinate with electrical drawings.
- V. 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.
- W. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect.

3.3 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.

3.4 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.

3.5 DEMONSTRATION

- A. Provide demonstration of luminaire operation.

3.6 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.7 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

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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 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 32 31 12
CHAIN LINK SLATTED FENCING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide galvanized chain link fencing with vertical PVC slats, gates and accessories as specified and indicated on drawings.
 - 1. Provide six foot high fence with gates as shown on plan.

1.2 REFERENCE STANDARDS

- A. ASTM INTERNATIONAL (ASTM)
 - 1. ASTM A 36, Steel Components.
 - 2. ASTM A 120, Pipe, Hot Dipped Zinc-Coated, Welded and Seamless, for Ordinary Uses.
 - 3. ASTM A 123, Zinc Coatings on Products, Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
 - 4. ASTM A392, Standard specification for zinc-coated steel chain-link fence fabric.
 - 5. ASTM A641, Standard specification for zinc-coated (galvanized) carbon steel wire.
 - 6. ASTM A817, Standard specification for metallic-coated steel wire for chain-link fence fabric and marcelled tension wire.
 - 7. ASTM F3000/F3000M-13, Standard specification for polymer privacy insert slats for chain link fabric and privacy chain link fabric manufactured containing pre-installed privacy slats.
 - 8. ASTM F567, Standard practice for installation of chain-link fence.
- B. Chain Link Fence Manufacturers Institute (CLFMI)
 - 1. WLG2445 Wind Load Guide.

1.3 QUALITY ASSURANCE

- A. Installation shall be by a contractor approved by the product manufacturer.
- B. All materials shall be installed in strict compliance with the manufacturer's recommendations.

1.4 SUBMITTALS

- A. Manufacturer's Product Data: Submit for each material and product. Include installation instructions and maintenance procedures.

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- B. Shop Drawings: Provide dimensions, fabrication details, anchorage details, size of components, details of gate components and accessories, indicate finish, and show layout of fencing.
- C. Sample: 2 - six inch slats. Owner to select from standard colors. .

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Armstrong Fence Company.
- B. Anchor Fence, Inc.
- C. Hoover Fence Company.
- D. Southwestern Wire, Inc.

2.2 MATERIALS

- A. Posts and Rails: ASTM A 120, Type I, Schedule 40 steel tubular members, galvanized.

2.3 COMPONENTS

- A. Line Posts: 1.90-inch o.d.
- B. Rails and Braces: 1.66-inch o.d.
- C. End, Corner and Pull Posts: 2.375-inch o.d.
- D. Gate Posts: 2.875-inch o.d.
- E. Gate Frames: 1.66 inch o.d.
- F. Chain Link Fabric: Fabricated of 9 -gage steel woven wire, 2 -inch mesh, galvanized. Fabric salvage shall be twisted and knuckled top and bottom.
- G. Slats: Extruded high density polyethylene with UV inhibitors. Slats shall be flat tubular shaped, 2 to 2.4 inches wide with fins for privacy screening.
 - 1. Color: White.
- H. Accessories:
 - 1. All metal accessories shall be hot dipped galvanized.
 - 2. Stretcher Bars: Provide in one piece lengths equal to full height of fabric and have minimum cross section of $\frac{3}{16}$ -inch by $\frac{3}{4}$ -inch.
 - 3. Stretcher Bar Bands: Heavy pressed steel, spaced not over 15-inches o.c. to secure stretcher bars to tubular posts and rails.

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4. Tension Wire: Provide 7-gage galvanized wire between each line post.
5. Wire Ties: Tie fabric to rails, braces and line posts with 9-gage steel wire. Tie fabric to tension wire with 11 gage hog rings.
6. Post Tops: Provide pressed steel or malleable iron. Top shall be designed to allow passage of top rail.

2.4 GATES

- A. Type: Manually operated, 48" wide swing type as shown on drawings.
- B. Frame: Fabricate gate perimeter frame of minimum 2-inch o.d. steel tubular members. Assemble gate frame by welding of fittings and rivets for rigid connections. Attach hardware with rivets or by other means which will provide security against removal or breakage.
- C. Chain Link Fabric: Same fabric as fence. Install fabric with stretcher bars at vertical edges, and ties at top and bottom edges. Privacy PVC fins may be preinstalled or inserted after the fabric is installed.
- D. Gate Stops: Mushroom type or flush plate type with anchors. Stops shall be galvanized. Set in concrete to engage center drop rod.
- E. Gate Locking Device: Provide with padlock eyes as an integral part of the latch requiring one padlock per leaf. Device shall permit operation of gate from either side.
- F. Wire Ties: Provide for tying fabric to rails, minimum 9-gage steel galvanized, space in accordance with manufacturer's directions.
- G. Hinges: Pressed steel or malleable iron non-lift-off type offset to permit 180° gate opening. Provide one pair gate hinges minimum per leaf.

2.5 GALVANIZING REPAIR COMPOUND

- A. Galvicon by Kenco Division, Southern Coatings or ZRC by ZRC Chemical Products.

2.6 CONCRETE

- A. ASTM C 94, 2500 psi at 28 days. Conform to Section 03 30 34 CONCRETE WORK for post foundations.

2.7 PIPE SLEEVES

- A. ASTM A 120, Type 1, Schedule 40 galvanized steel pipe with I.D. ½-inch larger than the o.d. of post to be inserted. Close bottom of pipe with cap or welded plate.
- B. Grout: Hartline Products Company, Inc., Kwikset; Thoro System Products, Thorite; or Master Builders, Embecco 167 Mortar.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: No fencing installation operations shall begin prior to completion of concrete placement and painting in location where fence is to be installed.
1. Install chain link fence fabric in accordance with ASTM F 567 Practice for Installation.
 2. Refer to CLFMI Wind Load Guide for line post size, spacing and imbedment depth. Use specified sizes unless otherwise recommended by this Guide.
- B. Post:
1. Gate, Corner, End and Pull Posts: Set in concrete footing four times the diameter of post minimum and 6-inches deeper than bottom of post. Bottom of footing 3'-6" below surrounding grade, minimum.

Line Posts: Set in concrete footing 12-inches in diameter minimum and 6 inches deeper than bottom of post. Bottom of footing 3'-6" below surrounding grade, minimum.
- C. Placing Concrete: Specified in Section 03 30 34 CONCRETE WORK. Slope top of footing away from posts.
- D. Fabric: Stretch taut and tie to posts and rails on security side of fence. Anchor to line post so that fabric remains in tension after pulling force is released. Provide tension wire at bottom. Provide tension wire at top when no top rail is used. Attach tension wire to fabric with hog rings 24-inches o.c.
- E. Bracing:
1. Install bracing at mid-height for fabric taller than 6-feet.
 2. Brace each side of corner posts, end, gate, and pull posts. Posts shall remain plumb when diagonal rod is under proper tension. Install diagonal tension rods at all braces.
- F. Stretcher Bars: thread through fabric and secure to posts with metal bands spaced not over 15-inches o.c.
- G. Gates: Install plumb, level and secure for full opening without interference. Install ground set accessories in concrete for anchorage as recommended by fence manufacturer. Adjust hardware for smooth operation.
1. Provide hardware for padlock securement.
- H. Fasteners: Install so nuts of stretcher bar bands and hardware bolts on side of fence opposite fabric side.

3.2 TOUCH-UP

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- A. All damage to galvanized finish shall be cleaned and touched up with a cold galvanizing compound.
- B. Replace broken or dented PVC slats.

3.3 CLEANING AND ADJUSTMENT

- A. Adjust rails and posts for rigid installation. Tighten hardware, fasteners and accessories. Remove excess and waste materials from project site.

END OF SECTION 32 31 12

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