OC LEVO CAT SCHOOL
HVAC REPLACEMENT
Bid Documents

FOR
ORANGE COUNTY
FACILITIES MANAGEMENT
2010 EAST MICHIGAN STREET
ORLANDO, FLORIDA 32806

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

JUNE 1, 2012

HVAC REPLACEMENT
OC LEVO CAT SCHOOL
BID DOCUMENTS
JUNE 1, 2012

Division 16	**Electrical**
16010	Basic Electrical Requirements
16012	Submittals
16014	Reference Standards and Regulatory Requirements
16015	Electrical Symbols and Abbreviations
16090	Tests and Performance Verification of Electrical System
16095	Demonstration of Completed Electrical Systems
16098	Operation and Maintenance Manuals
16111	Conduit
16123	Building Wire and Cable
16170	Grounding and Bonding

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

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

1.02 PROJECT DESCRIPTION

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

1.03 SCOPE OF WORK

A. The work consists of the following:

1. Replacement of the stand-alone split systems with new at OC LEVO CAT school facility. Systems shall be a one for one replacement of the existing split units with a building automation system.

2. Replace all existing grilles, registers and diffusers as shown on the contract documents with new.

3. Rebalance of existing exhaust fan.

4. Seal existing roof vents.

5. Remove all existing BATT insulation.

6. Spray icynene insulation on the underside of roof deck.

7. Replace existing Acoustical Ceiling Tiles with new.

B. General Contractor requirements:

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

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

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

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

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

5. The contractor shall coordinate with the Owner on the operation of the existing fire alarm system prior to the start of active construction. There shall be an action plan for the operation of the fire alarm system during construction submitted by the contractor to the Owner for acceptance. This action plan shall be in place prior to the start of active construction. Any false fire alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all costs incurred from the local fire department for responding to a false alarm.

6. The contractor is responsible for moving furniture and or equipment if necessary to perform the work included in the contract. The contractor is responsible for placing the furniture and or equipment back in its original location. The contractor is responsible for any damages to furniture, equipment, etc., which occur during construction. The contractor shall provide protection for floors, walls, furniture, equipment and any other items that may be subject to damage during the construction periods.

7. The contractor shall coordinate with the Owner on the operation of the security alarm system prior to the start of active construction. The contractor shall submit an action plan for operation of the security alarm system during construction to the Owner for acceptance prior to start of active construction. This active plan shall be in place prior to the start of active construction. Any false security alarms that occur during construction and deemed by the Owner to be the fault of the contractor, the contractor shall pay all cost incurred from the local police and or sheriff department for responding to a false alarm.

8. The contractor shall videotape or take pictures of pre-existing conditions of the interior and exterior of the building prior to the start of active construction. Failure to provide photographs or videotape prior to start of construction, places the responsibility on the Contractor to complete the necessary replacement, repairs, and or cleaning as determined by the Owner at no additional cost to the Owner. One set of photographs (in a three-ring binder) or videotape of the site existing conditions shall be submitted to the Owner.

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

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

1.04 WORK UNDER OTHER CONTRACTS

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

1.05 WORK SEQUENCE

A. The facility shall remain fully occupied and operational while work is in progress. All outdoor work shall be performed during normal business hours. Normal business hours

are defined as 8am to 5pm. Material and equipment deliveries will be during normal business hours. Indoor work may be performed during normal working hours; work in other phases shall be performed after hours, unless authorized by Owner for daytime work. After hours is defined as 6pm to 6am Monday through Friday.

B. The contractor may work on the weekends at his or her discretion. Weekend work shall not be an additional cost to the Owner. The contractor will coordinate with the Owner for access to the building on weekends and after hours work.

1.06 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 by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.

B. General: Limited use of the premises to construction activities in areas indicated within the limit of the premises. The Contractor may use any portion of the site for storage or work areas or any legal purpose.

1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owners' employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

3. Burial of Waste Materials: Do not dispose of organic and hazardous material on site, either by burial or by burning.

4. Where appropriate, maintain the existing building in a watertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and it's occupants during the construction period.

5. Confine construction operations to the areas permitted by the contract documents and other Owner directives.

6. Provide protection and safekeeping of material and equipment stored on premises.

7. Contractor will move any stored material and equipment, which interfere with operations of the Owner or other contractors.

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

9. Contractor to require all employees and subcontractors to wear non-objectionable clothing; prohibit revealing clothing and articles of clothing with offensive writings displayed. The contractor shall require offending personnel to leave the premises until such clothing is changed.

10. Contractor employees and subcontractors will not fraternize with County employees or the general public during the entire construction period.

11. Use of sound equipment (such as boom boxes, stereos, radios, etc.) during day times of construction is not allowed.

12. Smoking is not allowed inside the building.

13. Conduct that is disrespectful, abusive or otherwise objectionable to the Owners' employees or general public will not be allowed at any time during the construction period. Repetitive complaints and violations of the requirements listed above will be cause for dismissal and or permanent removal of offending personnel from the project.

14. Contractor to coordinate with the Owner the site location for storage of equipment, machinery, materials, tools and a construction waste dumpster.

15. Contractor shall at all times keep the premises free of all waste or surplus materials, rubbish and debris, which is caused by contractor employees or subcontractors resulting from their work. Contractor shall maintain a safe work environment to all building occupants during the construction period.

1.07 OWNER OCCUPANCY

A. Owner Occupancy: The Owner will be occupying the building during construction. Normal occupancy hours are 7 AM to 6 PM Monday through Friday. The contractor is to coordinate with the Owner's representative for areas in the building that work can be performed on during normal business hours. Work performed after normal business hours can be done provided the area where work is done is fully operational and back in original condition prior to beginning of the next business day. Such placing of equipment and partial occupancy shall not constitute acceptance of the total work.

1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.

2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.08 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.

1.09 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

2.10 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 in Section 01400, QUALITY CONTROL. Such statement shall be submitted with the final payment request. Final payment shall not be made until such statement is submitted. Contractor agrees that if materials containing asbestos are subsequently discovered at any future time to have been included in the construction, the Contractor shall be liable for all costs related to the redesign or modification of the construction of the project so that materials containing asbestos are removed from the facility. If construction has begun or has been completed pursuant to a design that includes asbestos containing materials, the Contractor shall also be liable for all costs related to the abatement of such asbestos.

PART 3 EXECUTION (Not applicable).

END OF SECTION 01010

SECTION 01027
APPLICATION FOR PAYMENT

PART I GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 01300 – "SUBMITTALS".

1.03 SCHEDULE OF VALUES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.04 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner's representative and paid for by the Owner.

   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements. See items G, I, J and K of this section.

B. Payment Application Times: The period of construction work covered by each Application of Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use the County's most updated form as the form for Application for Payment. Form given at the Preconstruction Conference.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor s Construction Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit six (6) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.

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

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

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

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

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

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

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

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

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

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

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01035
MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

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

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

1.03 MINOR CHANGES IN THE WORK

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

1.04 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
1. Proposal requests issued by the Project Manager are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.

2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owner's review, an estimate of cost necessary to execute the proposed change.
   a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
   b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
   d. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amount.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representatives findings require

modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

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

5. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amounts.

C. Proposal Request Form: Project Manager will transfer the information to the appropriate forms for approval. Use AIA Document G 709 for Change Order Proposal Requests.

D. Proposal Request Form: Use forms provided by the Owner for Change Order Proposals.

1.05 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.06 CHANGE ORDER PROCEDURES

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

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

END OF SECTION 01035

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

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

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

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

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

1.03 SUBMITTAL PROCEDURES

A. 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.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the 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. Number and title of appropriate Specification Section
I. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Project Manager using transmittal form as provided by the Project Manager. Submittals received from sources other than the Contractor will be returned without action.

1. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitation. Include Contractor’s certification that information complies with Contract Document requirements.

2. Transmittal Form: As provided by the Project Manager

D. 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.

E. 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.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the Schedule of Values.

2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.

3. Prepare the schedule on a sheet, series of sheets, stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.

5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.

6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

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

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

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

E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating precalculated and actual costs. On the line show dollar-volume of work performed as the dates used for preparation of payment requests.

1. Refer to Section Applications for Payment for cost reporting and payment procedures.

F. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the project meeting room and temporary field office.

1. When revision are made distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

G. Schedule Updating: Revise the schedule monthly or activity, where revisions have been recognized or made. Issue the updated schedule concurrently monthly pay request.

1.05 SUBMITTAL LOG

A. After development and acceptance of the Contractor's construction schedule, prepare a complete log of submittals.
   1. Coordinate submittals log with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.

   2. Prepare the log in chronological order; include all submittals required. Provide the following information:

      a. Scheduled date for the first submittal
      b. Related Section number
      c. Submittal category
      d. Name of subcontractor
      e. Description of the part of the work covered
      f. Scheduled date for resubmittal
      g. Scheduled date for the Engineer's final release or approval.

   3. All submittals must be received within the first 25% of contract time.

B. Distribution: Following response to initial submittal, print and distribute copies to the Project Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

   1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Log Updating: Revise the log after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.06 DAILY CONSTRUCTION REPORTS

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

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

1.07 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawings and will be rejected.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. All required dimensions
2. Identification of products and materials included
3. Compliance with specified standards
4. Notation of coordination requirements
5. Notation of dimensions established by field measurement
6. Sheet Size: Except for templates, patterns and similar full-size Drawings on sheets at least 8" x 11" but no larger than 24" x 36".
7. Initial Submittal: Submit one correctable translucent reproducible print and one blue-or black-line print for the Project Manager’s review; the reproducible print will be returned.
8. Initial Submittal: Submit 2 blue-or black-line prints for the Engineer's review; one will be returned.
9. Final Submittal: Submit 5 blue-or black-line prints; submit 7 prints where required for maintenance manuals. 3 prints will be retained; the remainder will be returned.
10. Final Submittal: Submit 3 blue-or black-line prints; submit 5 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
    a. One of the prints returned shall be marked-up and maintained as a Record Documents.
11. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.

C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.
2. Submit coordination Drawings for integration of different construction elements. Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.

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

1.08 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer’s installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as “Shop Drawing”.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required,

mark copies to indicate the applicable information. Include the following information:

a. Manufacturer's printed recommendations
b. Compliance with recognized trade association standards
c. Compliance with recognized testing agency standards
d. Application of testing agency labels and seals
e. Notation of dimensions verified by field measurement
f. Notation of coordination requirements
g. Manufacturers local representative and phone number.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.

4. Submittals: Submit six (6) copies of each required submittal. The Project Manager will return two (2) sets to the Contractor marked with action taken and corrections or modifications required.

a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
a. Do not proceed with installation until an applicable copy of Product Data applicable is in the Installer’s possession.
b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.

1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Engineer's/Owner's Sample. Include the following:

a. Generic description of the Sample
b Sample source
c. Product name or name of manufacturer
d. Compliance with recognized standards
e. Availability and delivery time

2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.

b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.

3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

a. Preliminary submittals will be reviewed and returned with the Engineer's/Owner's mark indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.

5. Maintain sets of Samples, as returned, at the project site, for quality comparisons throughout the course of construction.

a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field Samples specified in individual sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.

a. Comply with submittal requirements. Process transmittal forms to provide a record of activity.

1.10 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Project Manager will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Engineer/Project Manager will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:

1. Final Unrestricted Release: Where submittals are marked No Exceptions Taken, that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

2. Final-But-Restricted Release: When submittals are marked Made Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

    a. Do not permit submittals marked Revise and Resubmit to be used at the Project site, or elsewhere where work is in progress.

4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay.

PART 2 PRODUCTS (Not Applicable)

PART 3 Execution (Not Applicable)

END OF SECTION 01300

SECTION 01631
PRODUCTS SUBSTITUTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

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

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

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

1.03 DEFINITIONS

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

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

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

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

1.04 SUBMITTALS

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

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

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

   g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

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

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

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

1. Extensive revisions to Contract Documents are not required.

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

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

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

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

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

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

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

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

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

C. Substitution request constitutes a representation that the Contractor:

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

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

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

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

END OF SECTION 01631

SECTION 01700
PROJECT CLOSE-OUT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:

1. Inspection procedures
2. Project record document submittal. (substantial completion requirements)
3. Operating and Maintenance Manual Submittal (substantial completion requirements).
4. Submittal of warranties (substantial completion requirement).
5. Final cleaning

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

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

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following: List exceptions in the request.

1. In the Application for Payment that coincided with, or first follows, the date Substantial Completion in claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following

inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. Results of the completed inspection will form the basis of requirements for final acceptance.

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

1.04 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following list exceptions in the request:

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and complete operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Engineer or Owner’s final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager.

4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.

5. Submit consent of surety to final payment.

6. Submit a final liquidated damages settlement statement

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Engineer will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of reinspection, the Engineer will prepare a certification of final acceptance, or advise the contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.05 RECORD DOCUMENT SUBMITTALS

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

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation; where the installation varies substantially from the work as originally shown. Mark

whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the

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

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

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

3. Note related Change Order numbers where applicable.

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

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

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

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

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

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

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

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owner's records.

G. Maintenance Manuals: Organize operating and maintenance data into five (5) suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

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

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 CLOSE-OUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that required regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. All items to be provided or competed prior to Certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments
13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.

B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments

3.02 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide three (3) copies.

B. Bind in commercial quality 8 ½" x 11" three ring binder, indexed with hardback, cleanable, plastic covers.

C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.

D. Provide table of contents: Neatly typed, in the following sequence:

1. Final Certificate of Occupancy
2. Warranty Service Subcontractors Identification List
3. Final Lien Waivers and Releases
4. Warranties and Guarantees
5. Systems Operations and Maintenance Instruction
6. Manufacturer's Certificates and Certifications
7. Maintenance Service Contracts
8. Spare Parts Inventory List
9. Special Systems Operating Permits or Approvals
10. Asbestos free materials notarized statement

E. Provide all documents for each section listed. List individual documents in each section in the Table of Contents, in the sequence of the Table of Contents of the Project Manual.

F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the product or work item.

G. Separate each section with index to sheets that are keyed to the Table of Contents listing.

H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.

3.02 FINAL CLEANING

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

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

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

a. Remove labels that are not permanent labels.

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

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

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

e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove

stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.

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

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

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

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

END OF SECTION 01700

SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contractor Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General close-out requirements are included in Section "Project Close-Out".

3. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in this document.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.03 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

B. Reinstatement of Warranty. When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligation, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

E. The Owner reserves the right to refuse to accept work for the Project where a special warranty, certification, or similar commitment is required on such work or part of the

Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 WARRANTY PERIOD

A. The Contractor shall participate with the County and the Engineer's representative, at the beginning of the tenth month of the warranty period, in conducting an on site review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Engineer/Owner during on the site review.

B. All warranties and guarantees shall commence on the date of Substantial Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the County's acceptance of that work.

C. Warranty period shall be manufacturer's standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

1.05 SUBMITTALS

A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Engineer's Certificate of substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the work, submit written warranties upon request of the Project Manager.

1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen days of completion of that designated portion of the work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for executing by the required parties. Submit a draft to the Engineer for approval prior to final execution.

1. Refer to individual Sections of Division 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 1/2“ by 11" paper.

1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title “WARRANTIES AND BONDS’, the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01740

SECTION 02070 - DEMOLITION AND ALTERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF SECTION

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

1.3 REFERENCE STANDARDS

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

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

C. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

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

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

1. Do not cut or drill existing Steel structure, existing roof metal panels and concrete structure.

1.4 PROTECTION

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

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

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

D. Portable Coverings: For minor interior alterations, where acceptable to Architect, flame-proofed drop cloths may be used. Plastic sheet or film shall not be used for any purpose for interior work.

E. Air filters: During Demolition provide portable air filters as part of dust control.

F. Wet mop concrete floors slab to control dust.

G. Vacuum space every day at the completion of the work.

1.5 SECURITY

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

1.6 HOUSEKEEPING

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

1.7 OCCUPIED FACILITY

A. Since the facility is in operation, coordination will be required with staff to coordinate time of demolition to minimize disturbance of occupants.

PART 2 - MATERIALS

2.1 LUMBER

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

2.2 TAPE

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

2.3 TEMPORARY CLOSURES

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

PART 3 - EXECUTION

3.1 RELOCATION AND REMOVAL

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

3.2 PORTABLE COVERINGS

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

3.3 DEMOLITION

A. Plan of Operations: Establish procedures for safe removal of parts by methods that will not transmit excessive vibrations to or eccentric loads on building structure, create a nuisance, damage existing work that will remain, nor endanger either workmen, public, occupants nor adjacent work.

B. Supervision: Cut and demolish under supervision of a competent foreman, capable of identifying hazardous conditions and authorized to promptly take corrective action to eliminate them.

C. Precaution: Exercise care to avoid unnecessary damage to work that shall remain.

D. Hole Cutting: Neatly cut holes where necessary. Keep area and debris covered to minimize creation of dust. Use care and adjust hole locations as required to minimize necessary cutting.

E. Finishes and Exposed Work: Cut to true and straight lines to permit satisfactory refinishing or connection to new work. Remove items to nearest full piece that is to remain.

3.4 OWNERSHIP OF MATERIALS

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

3.5 SALVAGE OPERATIONS

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

3.6 REMOVAL

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

3.7 DISPOSAL

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

3.8 CLEANING

A. Clean surfaces as described in specifications.

3.9 CONCRETE

A. Exercise due caution in cutting and patching, chipping or general concreting so as not to deface that portion of the existing structure which is to remain. Should any such impairment occur, immediately clean or restore to original condition at no cost to Owner.

B. Do not cut or core existing precast concrete slabs, columns, joist and beams.

C. Patch all existing slab penetrations caused by demolition of mechanical and plumbing.

3.10 UTILITIES AND RELATED EQUIPMENT, PLUMBING, AND ELECTRICAL WORK

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

B. Temporary support of all lighting, low voltage wiring other devices on, below, and in the ceiling system will be required will require temporary support until new ceiling system is installed.

3.11 Drywall

A. Within the limits of the work, should any portion of existing drywall surfaces be deemed broken, scratched or unfastened, spackle with drywall compound, refasten or refinishing as necessary to complete repairs. Where indicated on the drawings for drywall to be removed remove the covering, base, drywall board, vapor barrier, insulation, metal furring and all fasteners.

B. Within the limits of the work make repairs to drywall partitions. Match adjacent surfaces or as indicated on the drawing.

C. Within the limits of tile work remove drywall ceiling and ceiling suspension system and supports, fasteners complete.

3.12 PATCHING

A. Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish.

B. Where patching occurs on rated partition or fireproofed structure repair to match existing UL rated system to match code required hourly rating for assembly.

3.13 FIRESTOPPING AND DRAFT STOPPING

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

END OF SECTION 02070

SECTION 07218 – POLYURETHANE SPRAY INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions of the Contract, including General and Supplemental Conditions and the General Requirements of Division 1, apply to the work of this Section.

1.2 SECTION INCLUDES

A. Polyurethane spray foam insulation at intersection of walls, sills, around openings, and roof surfaces with accessory intumescent thermal barrier coating.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM), latest approved edition:

1. ASTM C518, Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
2. ASTM D2863, Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-like Combustion of Plastics (Oxygen Index)
3. ASTM E84, Test Method for Surface Burning Characteristics of Building Materials
4. ASTM E90, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
5. ASTM E96, Test Methods for Water Vapor Transmission Rate of Building Materials
6. ASTM E283, Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Differences across the Specimen

1.4 SUBMITTALS

A. Product Data: Provide data on materials, describing insulation properties, surface burning characteristics.

B. Manufacturer’s Installation Instructions: Indicate special procedures, perimeter conditions requiring special treatment.

C. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three (3) years experience.

B. Applicator: Company specializing in performing the work of this section with minimum two (2) years documented experience and certified by the manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Conform to Florida Building Code 2010 for flame and smoke ratings.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Toxicity/Hazardous Materials:

1. Outgassing/Reactivity:

a. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
b. Chlorofluorocarbons (CFCs)/HCFCs: Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.

B. Airtightness: Meet specific standards of the Energy Star Program of 1.5 Air Changes/Hour at 50 Pa.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Store materials in an area protected from freezing and overheating damage and in accordance with manufacturer’s instructions.

C. Protect materials during handling and application to prevent damage and contamination.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Icynene Inc., 6747 Campobello Road, Mississauga, Ontario L5N 2L7 Canada, (800) 758-7325, fax (905) 363-0102, www.icynene.com, or approved equal by architect.

2.2 MATERIALS

A. Polyurethane Spray Insulation: Icynene; hydrophobic, Light density, open celled, flexible, 100 percent water blown polyurethane foam insulation; conforming to the following:

B. Thermal Resistance (R-Value/inch): ASTM C518; 3.7 hr/sq ft/degree F/BTU in.

C. Air Permeance (for 5.5 inches of material): ASTM E 2178; < 0.02 L/s.m^2 @ 75 Pa

D. Water Vapor Transmission (for 5.5" of material): ASTM E96; 11 perms

E. Sound Transmission Class (STC): ASTM E90; STC 37 in wood stud wall

F. Noise Reduction Coefficient (NRC): ASTM E90; NRC-0.7 in wood stud wall

G. Corrosion: No significant corrosion when in contact with steel under 85% relative humidity.

H. Bacterial or Fungal Growth: No growth; no material deterioration.

I. Flame Spread and Smoke Developed Rating: ASTM E84; <20/<400

J. Fuel Contribution: ASTM E84; 0

K. Oxygen Index: ASTM D2863; average value 23.1%

L. Vapor Retarder: Vapor retarder paint or vapor diffusion retarder recommended by insulation manufacturer.

2.3 ACCESSORIES

A. Intumescent Coating: DC-315, International Fireproofing Technology, Inc. or approved equal

B. Coating Thickness: 20 wet mills.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate is free of any foreign material that will impede application.

C. Verify that other work on and within spaces to be insulated is complete prior to application.

D. Notify Architect of conditions that would adversely affect the application.

E. Beginning of installation means applicator accepts existing conditions.

3.2 PREPARATION

A. Comply with manufacturer's written installation instructions for preparing substrates indicated to receive insulation.

B. Mask and protect adjacent surfaces from overspray or damage.

C. Remove foreign materials, dirt, grease, oil, paint, laitance, efflorescence, and other substances that will affect application.

3.3 APPLICATION

A. Apply insulation in accordance with manufacturer’s written application instructions.

B. Apply insulation to a reasonably uniform monolithic density without voids.

C. Apply to minimum cured thickness, filling cavity and joints between vertical walls and metal roof.

D. Apply insulation to fill voids around doors and windows.

E. Seal plumbing stacks, electrical wiring and other penetrations into attic to control air leakage.

3.4 FIELD QUALITY CONTROL

A. Inspect application for insulation thickness.

3.5 PROTECTION OF FINISHED WORK

A. Do not permit subsequent work to disturb applied insulation.

END OF SECTION 07218

SECTION 07613 - STANDING SEAM METAL ROOFING

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 SECTION INCLUDES

A. Standing seam metal roofing, including self-adhesive waterproof underlayment, ridge, hips, valleys, gutters, downspout, expansion and accessory sheet metal work for the system, all as indicated on Drawings and specified, complete.

1.3 QUALITY ASSURANCE

A. Requirements of regulatory agencies:
   1. In addition to complying with other legal requirements, comply with:

      a. UL: Class A fire rated.
      b. FM: 125 mph wind uplift, per Florida Building Code 2010 edition.
      c. The roof system shall meet FM requirements for all components and assemblies for coastal wind zone.
      d. See structural drawing for additional requirements.

B. Reference specifications and standards:
   1. SMACNA: "Architectural Sheet Metal Manual", Sheet Metal and Air Conditioning Contractors National Association, Inc.
   2. ASTM: B32 Solder Metal.
   3. ASTM: B370 Copper Sheet and Strip for Building Construction.
   4. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermosplastic Rubbers and Thermoplastic Elastomers in Tension.
   5. ASTM D461 Standard Test Methods for Felt
   6. ASTM D903 Standard Test Method for Peel or Stripping of Adhesive Bonds
   7. ASTM D1970 Standard Specification for Self-Adhering Polymer-Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   8. ASTM D3767 Standard Practice for Rubber-Measurement of Dimensions
   9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
   10. AISC: "Steel Construction Manual", American Institute of Steel Construction.
   11. AISI: "Cold Form Steel Design Manual", American Iron and Steel Institute.
   12. UL: "Tests for Uplift Resistance of Roof Assemblies", Underwriters Laboratories, Inc.
   13. UL: "Test Standard For Impact Resistance", Underwriters Laboratories, Inc.

14. UL: Flame Spread Classification Test – UL790
15. FM: "Test requirements for Class 1 panel roofs", Factory Mutual Research Corporation.
16. ICBO: Evaluation Report No, ER-3997, ICBO Evaluation Service, Inc.
17. ASTM E 1592-95: "Standard Test method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure difference", American Society for Testing and Materials. #16 wide, 22 gauge only.
18. ASTM E 1680-95: " Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems", American Society for Testing and Materials.
19. ASTM E 1646-95: " Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference", American Society for Testing and Materials.
20. ASTM A 792-83-AZ50: "Specifications for Steel Sheet, Aluminum-Zinc Alloy Coated (Galvanized) by the Hot Dip Process, General Requirements (Galvalume*)", American Society for Testing and Materials.
21. ASTM E 1514-93: "Standard Specification for Structural Standing Seam Steel Roof Panel Systems", American Society for Testing and Materials.
22. Florida Building Code 2001 Edition

1.4 WARRANTY

A. Submit manufacturer’s written 10 year warranty covering durability of roof and wall panels against rupture, structural failure or perforating, and panel finish against blistering, peeling, cracking, flaking, chipping, excessive color change, and chalking.

1.5 SUBMITTALS

A. Samples:

1. 12 in. square made-up sample of typical roof section with standing seam and accessories.
2. 12 in. square color samples of manufacturer's standard colors for selection of finish colors by Owner.

B. Shop drawings: Plans of roof showing layout of pans, larger scale details showing pan sections, standing seam, methods of attachment, and flashing.

1. Indicate materials, gauges, dimensions, fabrication, roof layout and erection details.
2. Fastener details and spacing.
3. Field verify roof dimensions.

C. Product data: Manufacturer's detailed specifications, literature and catalog cuts for each manufactured item.

D. Certificates:
1. Fabricator's certification that materials meet specified requirements.
2. Installer certification by the roof manufacturer as an accepted installer of the product.

3. Fabricator certification that the materials and assemblies include UL Fire Class and FM wind requirements.
4. Pull out test results.

E. Submit certified test results from FM lab for assemblies and components.

F. Submit signed and sealed engineering calculation confirmation of compliance of cladding loads for all roof areas based on specified wind load condition or other specified requirements, allowable clip loads, type of clip, clip fastener and spacing required number of fasteners to secure the panel clips to the roof deck.

1. Provide valley capacities for the applicable rainfall intensity in accordance with FM requirements and building code.

1.6 PRODUCT HANDLING

A. Procedures: follow manufacturer's instructions for storage & handling of all materials.

B. Protect metal roofing components from damage.

1.7 PRE-ROOFING CONFERENCE

A. Prior to commencement of roofing and associated work, meet at project site or other mutually agreed upon location, with installer, manufacturer's representative, installers of related work, and other entities concerned with roofing performance, including (where applicable) Owner's insurer, test agencies, governing authorities, and Owner. Record results of pertinent discussions and agreements, and furnish copy to each participant. Provide at least 72 hours advance notice to participants prior to convening pre-roofing conference.

1.8 TESTING

A. Conduct clip fastener pull out test to confirm minimum requirements. All testing will be witnessed by FM Global Representative and performed by the contractor. Coordinate all testing with FM. A copy of the Test results will be provided to the Architect.

B. Testing to be provided by G.C. and included in the contract.

1.9 WARRANTY

A. 20 year warranty for:

1. Materials and workmanship
2. Watertight
3. Paint finish

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type: 22 gauge minimum, aluminum-zinc alloy coated steel, precision roll-formed panels in design configuration as selected by Owner.

1. Coating: Approximately 55% aluminum and 45% zinc, applied by continuous hot-dip process to achieve 0.5 oz., total both sides, of aluminum-zinc alloy per square foot of coated sheet.

B. Finish: Thermosetting silicone-type to dry film thickness of 1 mils to provide 10-year warranty. (Kynar 500 Coating)

C. Waterproof underlayment: “Vycor Ultra” rubberized asphalt and polyethylene membrane as manufactured by W.R. Grace Co.

D. Dry sheet: Rosin sized paper, weighing 7 lb. per square.

E. NOTE: The purpose of this dry sheet is to protect the ice and watershield from prolonged exposure to UV rays from the sun until the standing seam metal roofing is installed. Keep covered, even on cloudy days.

F. Sealant: In accord with Section 07900.

G. Gutter and Rain Leader: 22 GA. S.S. metal gutter with combination hanger with flat bar. 22 GA, galvanized S.S., gutter, rain leader with bends and elbows. Both will be field painted to match the roof color selected.

2.2 MANUFACTURER

A. IMETCO, Innovative Metals Company, Inc.2070 Steel Drive, Tucker, GA 30084-5832 (770) 908-1030, FAX (770) 908-2264 (800) M-IMETCO

B. Original Roofing Manufacturer

C. Or accepted substitution

2.3 PRODUCT

A. Series 300 standing seam by IMETCO: Metal roof system in accordance with FM standards or accepted equal. Metal roof system in accordance with FM Standards. or approved substitution.

1. Panels, FM Class 1-135, test 4471, ASTM E-1592 to match existing, meet 125 m.p.h. wind load, 22 Ga., smooth, standing seam.
2. Resist the roof design pressures calculated in accordance with reference S-201, structural design criteria B3.
3. Panels: Galvalume Plus Steel Sheet, minimum yield 50,000 p.s.i.
4. Clip: FM accepted I-135, Test 4471, ASTM E-1592.
5. Fasteners: All fasteners type spacing, sizes to comply with FM assembly requirements. For 125 MPH winds per the Florida Building Code. All fasteners will be stainless steel.
6. Finish: Premium Fluorocarbon Coating produced with Kynar 500 resin. Color to be selected by Architect.
7. Prefab Roof Jack:

    a. Construction Fasteners, Wyomissing, PA
    b. ITW Buildex, Itasca, IL
    c. Supplied by manufacturer

8. Roof System compliance with ASTM E1592
9. Air infiltration test in accordance with ASTM E283 and E1680.
10. Water penetration test in accordance with ASTM E331 and E1646
11. Class A fire rating in accordance with UL 790
12. Dynamic pressure water infiltration test in accordance with NNMA 501.1

2.4 MISCELLANEOUS MATERIALS

A. Fasteners:

1. All roof fasteners shall be stainless steel.
2. All self-tapping/self-drilling fasteners, bolts, nuts, self-locking rivets and other suitable fasteners shall be provided and installed to withstand loads required to meet FM Class 1-135 and 125 MPH wind requirements.
3. Provide neoprene washers under heads of exposed fasteners as accepted by or if required by roof manufacturer to maintain a watertight roof.
4. Locate and space all exposed fasteners in a true vertical and horizontal alignment. Use proper torque settings to obtain controlled uniform compression for positive seal.

B. Accessories:

1. Provide all components required per the metal roof system manufacturer's accepted shop drawings for a complete metal roof system to include panels, panel clips, trim/flashing, fascias, ridge, closures, sealants, fillers underlayment and other required components.
2. All outside closures will be fabricated from Galvalume Plus sheet steel of the same gauge, finish and color as the panels.
3. All tape seal is to be pressure sensitive, 100 percent solids, polyisobutylene compound sealing tape with a release paper backing. Provide permanently elastic, non-sagging, non-toxic, non-staining tape seal accepted by the metal roof system manufacturer.

4. All joint sealant is to be a one-part elastomeric polyurethane sealant accepted by the metal roof system manufacturer.

2.5 SHOP FABRICATION

A. General:

1. Make allowance for expansion and contraction of metal components. Provide for 1/8 in. change per 10 ft. of pan length per 100°F.
2. Fabricate components in accord with referenced SMACNA manual.
3. Fabricate components with lines, rises and angles sharp and true, and free from wave, warp and buckle.

B. Pans: Custom form from prefinished 22 gauge sheet steel. Provide one-piece continuous formed sections from ridge to eave without transverse seams.

1. Pan width: See roof drawings for custom triangular pan size.
2. Seam height: 2-3/8 in.

C. Clips: Fabricate to conform to FM accepted assembly requirements. Provide quantity required for spacing to meet class 1-135 Roof. Heavy 16 gauge clip. Seamed with an electric seamer.

D. Fabricate trim, flashing and accessories to meet FM 1-135 assembly.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces for conditions that will adversely affect execution, permanence and quality of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

C. Conduct pull out tests for support clips.

3.2 PREPARATION

A. Cover insulation deck/sheathing with membrane sheet laid shingle fashion. Lap edges 2 in., and ends 6 in.

B. Apply dry rosin sheet over membrane shingle fashion. Lap edges 2 in., and ends 4 in. for temporary protection of underlayment from the sun.

3.3 INSTALLATION OF WATERPROOFING UNDERLAYMENT

A. Install shingle fashion free of wrinkles over substrate to achieve 100% adhesion in accord with manufacturer's written installation instructions.

B. Apply second layer of underlayment strips in areas of ridges and valleys extending a minimum of 6 in. to each side of centerline of ridges and valleys, and 6 in. beyond edges of metal flashings.

C. Immediately after applying waterproofing underlayment and as work progresses, to prevent UV and conductive heat degradation to greatest extent possible, install protection sheet over waterproofing underlayment. Sprinkle nail to the minimum extent practical to maintain in place until installation of metal roofing.

3.4 INSTALLATION OF METAL ROOFING

A. Secure clips to decking at spacing o.c. per FM class 1-135 requirements.

B. Install pans and close seams with a double lock in accord with SMACNA and FM assembly requirements.

C. Solder terminations and joint intersections of standing seams if bare metal is exposed.

D. Completed roof shall be free from water leakage under all rain and wind conditions.

E. Clean roof in accordance with manufacturer's recommendation prior to theme painting.

F. Touch up minor scratches and abrasions with touch-up paint supplied by the manufacturer.

G. Do not allow panels or trim to come in contact with dissimilar metals such as copper, lead, or graphite. Provide isolating material to separate dissimilar materials from contact.

H. Clean all Portland cement dripping from surfaces immediately clear per manufacturers instructions.

I. Install metal roof system so that it is water tight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.

J. Install metal roof system in accordance with manufacturer's instructions and shop drawings.

K. Provide concealed anchors at all panel attachment locations.

L. Install panels plumb, level and straight with seams and ribs in radial pattern shown on drawings parallel, conforming to design as indicated.

3.5 PREFABRICATED ROOF JACK

A. Comply with metal roof system manufacturer's shop drawings, instructions and recommendations for installation of roof jacks. Refer to metal roof system manufacturer's standard installation details. Anchor jacks securely in place with provisions for thermal and structural movement.

B. Do not penetrate roof with any other kind of penetrations.

END SECTION 07613

SECTION 07620 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Metal flashing

2. Self-adhering flashing

1.3 PERFORMANCE REQUIREMENTS

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

1.4 SUBMITTALS

A. Product Data: Include manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

B. Shop Drawings: Of each item specified showing layout, profiles, methods of joining, and anchorage details.

C. Samples: Of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of two (2) or more units showing the full range of variations expected.

1. 8" square Samples of specified sheet materials to be exposed as finished surfaces.

2. 12" long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Owners, and other information specified.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.

2. Notify Architect one (1) week in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Construct mockups for the following type of sheet metal flashing:

a. Valley flashing

b. Shingle roof to metal wall flashing

5. Obtain Architect's approval of mockups before start of final unit of Work.

6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

a. When directed, demolish and remove mockups from Project site.

b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.6 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 10 years from date of Substantial Completion.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 METALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:

1. Factory-Painted Aluminum Sheet: ASTM B209, 3003-H14, with a minimum thickness of 0.040", unless otherwise indicated.

2. Extruded Aluminum: ASTM B221, alloy 6063-T52, with a minimum thickness of 0.080" for primary legs of extrusions that are anodized, unless otherwise indicated.

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance; minimum 0.0187" thick, unless otherwise indicated.

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

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

B. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

C. Self-Adhering Flashing/Weather Barrier: Self-adhering rubberized asphalt membrane integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 40 mils thick.

1. Product and Manufacturer - Basis of Design: SVYCOR 40 Wall Flashing; Grace Construction Products.

a. Surface Conditioner: Type as recommended by the manufacturer for substrates indicated.

D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

2.3 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

E. Expansion Provisions: Space movement joints at maximum of 10' with no joints allowed within 24" of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).

F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

G. Separate metal from noncompatible metal or corrosive substrates with self-adhering flashing material.

H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.4 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:

1. Aluminum: 0.050" thick.

C. Copings: Fabricate from the following material:

1. Aluminum: 0.050" thick.

D. Base Flashing: Fabricate from the following material:

1. Stainless Steel: 0.01" minimum thickness.

E. Counterflashing: Fabricate from the following material:

1. Stainless Steel: 0.01" minimum thickness.

F. Flashing Receivers: Fabricate from the following material:

1. Stainless Steel: 0.01" minimum thickness.

G. Equipment Support Flashing: Fabricate from the following material:

1. Stainless Steel: 0.0187" thick.

H. Concealed Flashing and Thru-Wall Flashing: Fabricate from the following material:

1. Stainless Steel: 0.0187" thick; mill finish.

I. Break Metal Closure: Fabricate from the following material:

1. Stainless Steel: 0.0187" thick; mill finish.

2. Galvanized Steel: 0.040” thick; mill finish.

2.5 ALUMINUM FINISHES

A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.

B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; complying with AAMA standards.

    a. Colors: Custom to be selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

1. Install exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

B. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10' with no joints allowed within 24" of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).

C. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant. Use joint adhesive for nonmoving joints specified not to be soldered.

D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

E. Separations: Separate metal from noncompatible metal or corrosive substrates using self-adhering flashing material.

F. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2" and bed with sealant.

G. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Seal flashing to equipment support member.

3.3 CLEANING AND PROTECTION

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

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

END OF SECTION 07620

SECTION 07842 - FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes firestopping and smokesealing for the following:

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

1.3 REFERENCES

A. ASTM E814 - “Test Method for Fire Tests of Through-Penetration Fire Stops”

B. UL 2079 - “Standard for Tests for Fire Resistance of Building Joint Systems”

C. FM 4991 - “Standard for Approval of Firestop Contractors”

1.4 DEFINITIONS

A. Firestopping: The combination of materials utilized to restore the integrity of an assembly identified with an hourly rating.

B. Smokesealing: The combination of materials utilized to restore the integrity of an assembly identified as a smoke barrier.

C. Through-Penetration: The incident in which a penetrating item passes entirely through any assembly identified either with an hourly rating or as a smoke barrier; i.e., breaching both sides of the assembly.

D. Membrane-Penetration: The incident in which a penetrating item passes into or exits from any assembly identified either with an hourly rating or as a smoke barrier; i.e., entering into or exiting from only one side of the assembly.

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

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases according to requirements indicated, and to restore integrity of assembly.

1. For systems subject to movement, provide products that will remain flexible to allow for such movement without affecting the integrity of the system when exposed to movement.
2. For systems exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
3. For systems for items subject to binding, e.g., fire or smoke dampers, provide non-intumescent type products.

B. F-Rated Penetration Firestop Systems: Provide penetration firestop systems with F ratings determined per ASTM E814, not less than that of the construction penetrated.

C. T-Rated Penetration Firestop Systems: Provide penetration firestop systems with T ratings, in addition to F ratings, determined per ASTM E814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.

D. Joint Firestop Systems: Provide joint firestop systems with fire-resistance ratings determined per UL 2079, not less than that of the construction in which the joint occurs. Where movement is required or can be anticipated, joint firestopping system must be listed as a dynamic joint, with movement capabilities equal to those of the in-service conditions.

E. Materials offered for horizontal applications shall be capable of self-supporting any penetrating item and shall maintain their integrity when tested in horizontal applications.

1.6 SUBMITTALS

A. Schedule identifying conditions to be firestopped and smokesealed. Include type of construction, orientation, type and size of penetrant, type and size of joint, and methods to

accomplish firestopping and smokesealing. One axis of schedule shall identify each assembly to be firestopped or smokesealed and its rating (i.e., 1-hour cmu wall). Second axis of schedule shall identify each penetrant or joint to be firestopped or smokesealed (i.e., 4" cast iron pipe – insulated). Intersection point between both axes of schedule shall identify design designations from qualified testing and inspecting agency proposed to accomplish firestopping and smokesealing (i.e., C-AJ-5102).

B. Product data and copies of listings or test reports. Cross-reference each to schedule. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular condition, submit illustration approved by manufacturer's fire protection engineer with modifications marked and signed engineering opinion letter stating basis for modifications.

C. Qualification data for firm and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, and dates (month/year); names and phone numbers of Architects and Owners; products installed at each listed project; and other information specified.

1. Include letter from manufacturers of products specified, wherein manufacturer recognizes as trained or approved, or certifies, firm and persons for installation of that manufacturer’s products.
2. Copy of Factory Mutual’s Approved Firestop Contractor certificate, if applicable.

D. Identification label.

E. Certification affidavit.

1.7 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics:

1. Firestopping tests performed by a qualified nationally recognized independent testing and inspecting agency performing testing and follow-up inspection services for firestopping that is recognized by the Council of American Building Officials and is acceptable to authorities having jurisdiction.
2. Penetration firestopping identical to that tested per ASTM E814 under conditions where positive furnace pressure differential of at least 0.01" of water is maintained at a distance of 0.78" below the firestopping surrounding the penetrating items in the test assembly.
3. Joint firestopping identical to that tested per UL 2079 under conditions where all components of each joint system, including splices, are exposed to a positive furnace pressure differential. For tests of floor-to-floor, floor-to-wall and head-of-wall joint systems, the average furnace pressure shall be measured at 12" below the exposed horizontal surface of the test assembly. For tests of wall-to-wall joint systems, the average furnace pressure shall be measured at the elevation of the midheight of the exposed vertical surface of the test assembly. After the initial ten (10) minutes of fire exposure, the furnace pressure for the respective joint systems shall not be less than

0.01" of water for an aggregate time period exceeding 10% of the fire exposure for fire tests of one (1) hour or less duration, 7.5% of the fire exposure for fire tests longer than one (1) hour but not longer than two (2) hours and 5% of the fire exposure for fire tests exceeding two (2) hours.

B. References to specific design designations of firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed alternate systems equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

C. Installer Qualifications: A single-experienced Installer who is trained, certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements and who has specialized in installing firestopping systems similar in material, design, and extent to those indicated for this Project. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer. All firestopping and smokesealing products, regardless of the Section in which their use is specified or drawing on which their use is indicated, are to be installed by a single installer.

D. Technical Advice: Provide technical advice from material manufacturer’s lab and technical department on materials and assemblies as required. For through- or membrane-penetrations and assemblies proposed but not yet tested provide an Engineering Opinion, in writing on manufacturer’s letterhead signed by a qualified person and bearing his title, with copies to the Architect. Engineering Opinions shall be based on approval tests from recognized independent testing agency.

E. Pre-Installation Conference: Prior to preparation for and installation of materials to be used as firestops and smokeseals convene a pre-installation conference at project site with the Contractor, installer, affected subcontractor(s), material supplier(s), and Architect. Review Contract Document requirements, submittals, status of coordinating work, availability of materials and installation facilities, proposed installation schedule, safety and handling requirements, requirements for inspections and testing or certifications, proposed installation procedures and protection requirements for construction period extending beyond installation. Record discussion; furnish copy of recorded discussions to each participant.

F. Field-Constructed Mockup: Prior to installing firestopping and smokesealing, erect mockups for each different system to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.

1. Locate mockups on site in locations indicated or, if not indicated, as directed by Architect.
2. Identify mockups as specified under the "Field Quality Control" article.
3. Notify Architect one (1) week in advance of the dates and times when mockups will be erected.

4. Obtain Architect's acceptance of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.

    a. When directed, demolish and remove mockups from Project site.
    b. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

G. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that systems are installed per specified requirements. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate systems.

1.8 CERTIFICATIONS

A. Contractor shall provide the following notarized affidavit jointly signed by corporate officers, with titles noted, of both the Contractor and installer:

> "We the undersigned certify that firestops and smokeseals have been installed in accordance with Contract Document requirements and manufacturer's instructions, and that materials used meet firestopping and smokesealing requirements of the Contract Documents".

B. Manufacturer shall provide the following certification, executed by the appropriate person, with title and department noted:

> "Products provided by (manufacturer) for the (name of project) are composed of the same ingredients and formulation or are of the same components and identical construction as products that have been tested by (the testing agency) for various fire resistive and other performance ratings, and when properly applied or installed in accordance with (manufacturer) instructions will perform in a manner consistent with results obtained in the tests conducted by (the testing agency)".

1.9 SEQUENCING AND SCHEDULING

A. Schedule installation of penetration firestopping and smokesealing after completion of penetrant installation but prior to covering or concealing of openings. Schedule installation of joint firestopping and smokesealing after completion of adjacent assemblies, but prior to covering or concealing of joints.

B. Do not cover up those firestopping and smokesealing installations that will become concealed behind other construction until authorities having jurisdiction have examined each installation.

1.10 PRECEDENCE

A. Order of precedences: Firestopping, smokesealing, acoustical/sound rating, other requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A/D Fire Protection Systems, Inc.
2. Bio Fireshield / The Rectorseal Corp.
3. Hilti, Inc.
4. Grace / International Protective Coatings Corp.
5. Isolatek International
6. Nelson Firestop Products / O - Z Gedney
7. NMP Corp.
8. Specified Technologies, Inc.
9. Thermal Ceramics
10. 3M Fire Protection Products
11. Tremco, Inc.
12. Unifrax

2.2 MATERIALS

A. Firestopping and Smokesealing: Provide systems composed of components that are compatible with each other, the substrates forming openings or joints, and the items, if any, penetrating the system under conditions of service and application, as demonstrated by system manufacturer based on testing and field experience. Provide systems of one or more of the following types:

1. Ceramic-Fiber Mastic Coating and Sealant: Single-component formulation of ceramic fibers and inorganic binders.
2. Collar: Factory-manufactured device consisting of a metal-restricting collar housing a molded intumescent insert.
3. Endothermic Latex Compound Sealant: Single-component, endothermic, latex formulation.
4. Intumescent Latex Mastic Sealant: Single-component, intumescent, latex formulation.
5. Intumescent Polyurethane Foam Block: Pliable softfoam-shaped block, intumescent formulation.
6. Intumescent Putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

7. Intumescent Wrap Strip: Flexible elastomeric strip, intumescent. May be used in conjunction with a surface-mounted restricting collar.
8. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogenous mortar.
9. Pillow/Bag: Re-usable, heat-expanding pillow/bag composed of a glass-fiber cloth or plastic case filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
10. Silicone Sealant: Single-component, moisture-curing, silicone-based, neutral-curing elastomeric sealant, self-leveling and non-sag as appropriate.

B. Identification: Provide pressure-sensitive, self-adhesive, preprinted vinyl identification labels for firestopping and smokesealing systems, minimum 2" by 3". Identification shall include:

1. Condition:

   a. For penetration firestops, “Rated Penetration Firestop System - Do Not Disturb.”
   b. For joint firestops, “Rated Joint Firestop System - Do Not Disturb.”
   c. For smokeseals, “Smokeseal System - Do Not Disturb.”
   d. For all, “Notify Building Management of any damage.”

2. System designation issued by the qualified testing and inspecting agency, and the name of the qualified testing and inspecting agency.
3. System manufacturer’s name.
4. Contractor’s name, address, and phone number.
5. Installer’s name, address, and phone number.
6. Date of installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordination: Sequence work to avoid need for removal of firestopping and smokesealing by work of other trades.

B. Preparation: Clean out openings and joints immediately prior to installing firestopping and smokesealing. Prime substrates where recommended by manufacturer.

C. Install forming/damming materials and other accessories of types required to support firestopping during application and in the position needed to produce the cross-sectional shapes and depths required to restore fire-resistance-rated construction. After installing firestopping and smokesealing, remove combustible forming materials and other accessories not listed as permanent components of system.

D. Install firestopping by proven techniques to restore fire-resistance-rated construction.

E. Install materials in both fire-rated and smoke barrier assemblies with sufficient pressure to properly fill and seal openings to ensure an effective cold smokeseal.

3.2 FIELD QUALITY CONTROL

A. After installation, identify firestopping and smokesealing systems at locations where each is installed. Attach labels permanently to surfaces of adjacent construction on both sides of each system installation where labels will be visible to anyone seeking to disturb the installation or adjacent construction.

B. Inspect completed firestopping and smokesealing for compliance with requirements, and issue written letter to Architect and Owner stating such.

C. Do not proceed to cover or enclose firestopping and smokesealing with other construction until reports of examinations are issued.

D. Where deficiencies are found, repair or replace firestopping and smokesealing so that it complies with requirements.

3.3 CLEANING AND PROTECTION

A. Clean off excess materials adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of systems and of products in which opening and joint occurs.

B. Protect firestopping and smokesealing during and after installation from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping and smokesealing immediately and install new materials to produce systems complying with specified requirements.

3.4 PENETRATION AND JOINT FIRESTOP SCHEDULE

A. A combination of multiple details may be necessary to address a specific job condition, such as multiple or differing penetrants through a single opening or a head-of-wall joint with a penetration of the wall or horizontal assembly.

B. The following basic system references are not intended to be exhaustive or exclusive. System numbers are from UL for convenience only.

C. Blank Opening:

1. CMU: CAJ0004, CAJ0009, CAJ0011, CAJ0012, CAJ0014, CAJ0015, CAJ0033, CAJ0040, CAJ0041, CAJ0043, CAJ0050, CAJ0051, CAJ0053, CAJ0054, CAJ0055, CBJ0009
2. GWB: WL0001, WL0005

D. Metallic Pipe, Conduit, or Tubing:

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

E. Flexible Metal Conduit:

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

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

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

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

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

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

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

I. Electrical Cables – No Sleeve:

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

J. Electrical Cables – Metal Sleeve:

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

K. Electrical Cables – Non-Metallic Sleeve:
1. CMU: CAJ2162, CAJ2163, CAJ3030, CBJ3003
2. GWB: Submit

L. Insulated Metallic Pipe, Conduit, or Tubing:

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

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

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

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

1. CMU: CAJ5103
2. GWB: WL5051

O. Miscellaneous Electrical Penetrants:

1. CMU: CAJ6011, CAJ8001, CAJ8055
2. GWB: WL8002, WL8003, CLIV, UL Report 94NK15324

P. Miscellaneous Mechanical Penetrants:

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

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

R. Head-of-Wall Joints, Dynamic:

1. Concrete/Masonry – Concrete: HWD0006, HWD0007, HWD0008, HWD0017, HWD0022, HWD1001
2. Frame – Concrete: HWD0003, HWD0010, HWD0011, HWD0015, HWD0016, HWD0019, HWD0020

END OF SECTION 07842

SECTION 07921 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required, provide samples with joint sealants in 1/2"-wide joints formed between two (2) 6"-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

G. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

1.4 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

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

1.5 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

C. Multi-Component, Non-Sag, Neutral-Curing Silicone Sealant:

1. Products:

   a. Dow Corning Corporation; 756 H.P.

   b. Other approved equivalent.

2. Type and Grade: M (multi-component) and P (pourable)

3. Class: 50

4. Use Related to Exposure: NT (non-traffic)

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O

   a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, and ceramic tile.

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

1. Products:

   a. Dow Corning Corporation; 799

b. GE Silicones; UltraGlaze SSG4000
c. GE Silicones; UltraGlaze SSG4000AC
d. Polymeric Systems, Inc.; PSI-631
e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus
f. Tremco; Proglaze SG
g. Tremco; Spectrem 2
h. Tremco; Tremsil 600

2. Type and Grade: S (single-component) and NS (non-sag)
3. Class: 25
4. Use Related to Exposure: NT (non-traffic)
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O

a. Use O Joint Substrates: Color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and ceramic tile.

2.3 JOINT-SEALANT BACKING

A. Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330. Provide any type approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, non-absorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 °F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Non-Porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean non-porous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Non-porous joint substrates include the following:

    a. Metal.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or joint-sealant-

substrate tests prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-Sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

G. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

H. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8". Hold edge of sealant bead 1/4" inside masking tape.

3. Within ten (10) minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.

4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. EXAMINATION / INSPECTION

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
2. Inspect tested joints and report on the following:

a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each

type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

b. Whether sealants-filled joint cavities and are free from voids.

c. Whether sealant dimensions and configurations comply with specified requirements.

3. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

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

3.5 CLEANING

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

3.6 PROTECTION

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

END OF SECTION 07921

SECTION 09250 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

1. The extent of the gypsum drywall and support framing work specified here in and shown on the drawings and in schedules, and is hereby defined to include gypsum board work with a tape and compound joint treatment system and other applied finishes know as "drywall finishing" work.

1.3 REFERENCES AND STANDARDS

A. Gypsum association

1. GA 216-00
2. GA252

B. ASTM

1. ASTM -C79
2. ASTM – E96
3. ASTM – C1177
4. ASTM – C973
5. ASTM – C518

C. FM and UL Laboratories Tests and Ratings

1.4 QUALITY ASSURANCE

A. Fire-Resistant Rating: Where work is indicated for fire-resistant ratings, including those required to comply with governing regulations provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including U.L. and F.M. Comply with F.M. "Approval Guide" where applicable.

B. Installer: Use a manufacturer accepted installer with experience in this trade.

C. Industry Standard: Comply with applicable requirements of GA-216-00 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.

D. Allowable Tolerances: With 1/8" offsets between planes of board faces and 1/4” in 8’ -0" for plumb, level, warp and bow.

E. Manufacturer: Obtain gypsum boards, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturers of gypsum boards.

F. Obtain metal support materials and fastener from a single manufacturer.

G. Standard building code requirements for firestop/ draftstopping of walls.

1.5 SUBMITTALS

A. Manufacturer's Data: Submit (6) copies of manufacturer's product specifications and installation instructions for each gypsum drywall, metal support component, or accepted equal, including other data as may be required to show compliance with these specifications.

1.6 PRODUCT HANDLING

A. Deliver materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

1.7 JOB CONDITIONS

A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Maintain ambient temperatures at not less than 55 degrees F. for the period of 24-hours before drywall finishing, during installation and until compounds are dry.

1.8 HAZARDOUS MATERIAL

A. Do not use asbestos materials, additives and reinforcement in any products, materials, or accessories required for the project.

PART 2 - PRODUCTS

2.1 METAL SUPPORT MATERIALS

A. General: To the extent not otherwise indicated, comply with Gypsum Association Specification GA-203 "Installation of Screw-Type Steel Framing Members to Receive Gypsum board" (as specified and recommended) for metal system supporting gypsum drywall work.

B. Studs: ASTM C 645; 20 gauge x 3-5/8" deep.

C. Studs: 16GA, 18GA, x 5/8” deep, 18GA x 6” deep and 20 GA x 2½“ spaced as indicated on the drawing except as otherwise indicated.

D. Studs for Durock Walls: 20 gauge x 3-5/8" deep, G60 hot-dipped galvanized.

E. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

F. Stud System Accessories: Provide stud manufacturer's standard clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system.

G. Furring Members: ASTM C-645; 20- gauge, hat-shaped.

H. Furring members: 20 guage “Z” Furring.

I. Fasteners: Type and size recommended by furring manufacturer for the substrate and application indicated.

J. Rated assemblies as noted on drawings

K. Hanger wire: ASTM A641, soft, Class 1 galvanized, pre-stretched; sized in accordance with GA-203.

L. Hanger Anchorage Devices: Size for 3 x calculated loads, except size direct-pull concrete inserts for 5x calculated loads.

2.2 GYPSUM BOARD PRODUCTS

A. GENERAL: To the extent not otherwise indicated, comply with GA-216, as specified and recommended.

1. Gypsum Board:

a. Sheet Size: 4’x8'.

b. Thickness: 5/8” except where otherwise indicated.
c. Type "X": Provide where indicated (fire resistant).

2.3 TRIM ACCESSORIES

A. GENERAL:

1. Manufacturer's standard galvanized steel beaded units with flanges for concealment in joint compound, including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.

2.4 JOINT TREATMENT MATERIALS

A. GENERAL:

1. C-475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

a. Joint Tape: Perforated type.
b. Joint Compound: Ready-mixed vinyl-type for interior use.
c. Grade: Two separate grades, one specifically for bedding tapes and filling depressions, and one for topping and sanding.

2.5 MISCELLANEOUS MATERIALS

A. GENERAL:

1. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.
2. Lamination Adhesives: Special adhesive for joint compound specifically recommended for laminating gypsum boards.
3. Gypsum Board Fasteners: Comply with GA-216-00.
4. Concealed Acoustical Sealant: Latex, acrylic, or acrylic-latex type; permanently elastic and paintable.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL SUPPORT SYSTEMS

A. General:

1. To the extent not otherwise indicated, comply with GA-203, and manufacturer's instructions.

2. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

3. Isolate stud system from transfer to structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

4. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work.

5. Space studs 16" O.C., except as otherwise indicated.

6. At all intersections use solid plate and sill members to provide firestop and draftstop as required by the building code.

3.2 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Pre-Installation Conference: Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed.

B. General Standards: In addition to compliance with GA-216, comply with manufacturer's instructions and requirements for fire-resistance UL rating.

C. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

D. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

E. Cover both faces of steel studs with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls, which are properly braced internally.

F. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft. and limited not less than 75% of full coverage.

G. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.

3.3 INSTALL EXTERIOR GYPSUM BACKER BOARD

A. Preparation: Examine subframing; verifying that surface of framing and furring members to receive sheathing does not vary more than ¼" from the place of faces of adjacent members.

B. Tape Application:

1. Apply fiberglass joint tape to all joints overlapping at intersections by the width of the tape. Apply approximately a 3/8" bead of caulk along the joint. Embed the caulk into the entire surface of the tape with a trowel. Apply enough caulk to each exposed fastener to cover completely when troweled smooth. Approximate rate of usage is 48 sq. ft. per 10.5 oz tube. This may vary depending upon the number of joints, penetrations and openings.

3.4 FLOATING CONSTRUCTION

A. Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.

B. Where sound-rated drywall work is indicated (STC rating), including double-layer work and work on resilient furring, seal the work at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with manufacturer's recommendations for location of beads, and close off sound-flanking paths around or through the work, including sealing of partitions above acoustical ceilings.

C. Space fasteners in gypsum boards in accordance with GA-216 and manufacturer's recommendations, except as otherwise indicated.

3.5 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. GENERAL: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

1. Install metal corner beads at external corners of drywall work. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install "L" type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of "L" type trim. Install "U"type trim where edge is exposed, revealed, gasketed, or sealant filled (including expansion joints).
2. Install "J" type semi-finishing trim where indicated, and where exterior gypsum board edges are not covered by applied moldings. Install plastic edge trim where indicated on wall panels at juncture with ceilings. Install metal control joint (beaded-type) where

indicated. Install "H" molding in exterior gypsum drywall work where control joints are indicated.

3.6 INSTALLATION OF DRYWALL FINISHING

A. GENERAL: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fasteners, heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, using type of compound recommended by manufacturer. Apply joint compound in two coats (not including prefill of openings in base), and sand after last coat.

1. Surface Wall Texture: Texture shall be in accordance with design specifications (e.g., Orange Peel), and shall be such that all irregularities in the drywall surface are imperceptible.
2. Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing, including sound, fire, air and smoke-rated work.
3. Installer shall advise Contractor of required procedures for protection of the gypsum drywall work from damage and deterioration during the remainder of the construction period.
4. Surface Wall Texture at Existing Wall or Within Rooms to be remodeled: Texture shall be to match existing adjacent walls at renovated and remodeled rooms.

END SECTION 09250

SECTION 09510 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCOPE

A. Install a new acoustical ceiling tile and suspension system as indicated on the drawings and as specified herein.

B. Repair and replace components damaged by G.C. during the work.

C. Replace components as required by the work.

1.3 SUBMITTALS

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

1.4 JOB CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 CEILING UNITS

A. Acoustical Panels:

1. Provide lay-in panels with fine fissured textured to match existing 24” x 48”. Material Fiber Acoustical Panels:

2. Products/Manufacturer:

    a. Armstrong
    b. US Gypsum
    c. CertainTeed

2.2 CEILING SUSPENSION MATERIALS

A. General:

1. Comply with ASTM C-635 for dimensional tolerances, coatings and finishes as applicable to type of suspension system required for type of ceiling units indicated. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, soffits, fans and partition system (if any).
2. Structural Class: Intermediate-duty system. Individual component deflection shall not exceed 1/360 of the span.
3. Hanger Wires: Galvanized carbon steel, ASTM A-641, soft temper, prestretched, yield-stress load of at least 3 times design load, but not less than 9-gauge. Install wire hangar at each corner of grid at light fixtures.
4. Type of System: Indirect-hung suspension system. Provide under the work of this Section, supplemental framing as required for proper spacing of hanger wires and other items suspended such as fans, and electric fixtures.

B. System Manufacturer: One of the following to match existing:

1. Armstrong “Prelude ML” color white.
2. US Gypsum
3. CertainTeed

C. Edge Moldings: Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish unless otherwise indicated.

D. Exposed Suspension System: Manufacturer's standard exposed runners, cross-runners and accessories, of types and profiles indicated, with exposed cross runners coped to lay flush with main runners.

E. Finish of Exposed Members: Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system, including moldings, trim, and accessories.

F. Finish: Provide hot-dipped galvanized finish (G-30 minimum on all ceiling suspension components. Exposed surfaces of suspension system component will receive a white baked on enamel paint. Color to be selected by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

3.2 INSTALLATION

A. General

1. Install materials in accordance with manufacturer's printed instructions, and comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.
2. Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.
3. Install tile with pattern running in one direction.
4. Install suspension systems to comply with ASTM C-636, with hangers supported only from building structural members or supplemental framing supported by building structural members. Locate hangers near each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".
5. Secure wire hangers by looping and wire-tying, either directly to structures or supplemental framing.
6. Install edge moldings to type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
7. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.
8. Install acoustical panels in coordination with suspension system instructions, with edges concealed by support of suspension members.
9. Scribe and cut panels to fit accurately at borders and at penetrations.
10. Do not use or install pop rivets in tracks.
11. Do not staple tracks to wall.
12. During demolition store ceiling panels & track to be re-used.
13. Replace all panels & track damaged during the demolition process or construction complete.

3.3 ADJUST AND CLEAN

A. Clean exposed surfaces of acoustical ceilings including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

B. Replace damaged tiles or suspension system.

END SECTION - 09510

SECTION 09912 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:

1. Exposed interior items and surfaces.
2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available or will direct to match existing color.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

2. GWB partitions

3. GWB ceilings

4. Other misc. surfaces affected by the work.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work

areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 degrees F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 degrees F.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

A. Manufacturer – Basis of Design: Benjamin Moore or approved equal.

B. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

D. Colors: To be selected by the Architect, as noted on the drawings or to match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINT SCHEDULE

A. Gypsum Drywall:

a. Paint System, Application and Finish: Vinyl acrylic; two coats over primer.

B. Concrete and Masonry: Walls

1. Paint System, Application and Finish: Acrylic; two coats over filler.

C. Ferrous Metal: Steel doors and frames, stairs, and miscellaneous exposed steel.

1. Paint System, Application and Finish: Alkyd/Latex; two finish coats over prime coat; semi-gloss finish. Pre-primed requires top finish only; prime coat damaged surfaces.

a. Primer: B50Z Kem Kromik Primer

b. Finish Coat: B54Z Industrial Alkyd Gloss Enamel

END OF SECTION 09912

SECTION 15010
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Each Section within Division 15, Mechanical, shall conform to the requirements of the General Conditions of the Contract, including Supplementary General Conditions, Special Conditions, and all requirements of Division 1.

C. Each Section within Division 15, Mechanical, shall conform to the additional requirements of this Section, Mechanical General Provisions.

1.2 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. Guarantee of Work.

S. System Testing.

1.3 ARTICLES

A. Definitions:

1. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "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 15.
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 15 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 HVAC, plumbing and fire protection 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. 2006 Life Safety Code - NFPA 101
2. 2010 The Florida Building Code
3. 2010 The Florida Accessibility Code for Building Construction
4. 2008 National Electric Code (NEC
5. 2010 The Florida Building Code – Mechanical
6. 2009 NFPA Standards

E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all HEATING, VENTILATING, AIR CONDITIONING, as indicated in the Contract Documents.

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:

1. In addition to all other submittal requirements elsewhere in the contract documents, the contractor shall comply with the following.
2. Submittal for acceptance is required only on those items specifically requested in the specification section that applies.
3. For products and equipment that do not require a submittal for acceptance, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the contract documents.
4. Provide submittal data in accordance with the General Conditions and/or as listed below.
5. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed in order to meet construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer’s discretion.
6. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.

    a. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.

7. Prepare performance and product data as follows:

   a. Clearly mark each copy to identify pertinent products or models, delete non-pertinent data.
   b. Show performance characteristic and capacities.
   c. Show dimensions and clearances required.
   d. Show wiring or piping diagrams and controls.
   e. Clearly list any deviation in the submittals from the requirements of the contract documents.
   f. Include installation requirements.

8. Manufacturer's standard schematic drawings and diagrams:

   a. Modify drawings and diagrams to delete information not applicable to the work of this project.
   b. Supplement standard information to provide information specifically applicable to the work of this project.

9. 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 mechanical systems shall be met without the use of asbestos or PCB.
   b. Prior to the Final Review field visit the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 15 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.

10. Letter of Certification: Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance of the specified requirements. In the event the contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.

11. Schedules: Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.

12. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:

   a. Functional characteristics of the product, with integral related parts

and attachment devices.

b. Full range of color, texture and pattern.

c. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.

d. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.

13. The Contractor shall:

a. Review Shop Drawings, Product Data and Samples prior to submission.

b. Determine and verify:

1) Field measurements.
2) Field construction criteria.
3) Catalog numbers and similar data.
4) Conformance with specifications.
5) All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the contract documents.

c. Coordinate each submittal with requirements of the work and of the Contract Documents.

d. Clearly identify any deviations in the submittals from requirements of the Contract Documents. Any deviations not specifically disclosed in the submittal shall be solely at the risk of the Contractor, and shall be subject to discovery at any time. Any undisclosed deviations shall be corrected by the Contractor to comply with the requirements of the Contract Documents at no cost to the Owner regardless of the action code accorded the submittal by the Owner's Representative.

e. Do not release equipment for shipment, begin fabrication or work on any items requiring submittals for acceptance until all submittals are returned with the Owner's Representative acceptance.

f. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other contractor.

14. Number of Submittals: Comply with the General Conditions.

15. Submittals shall contain:

a. The date of submission and the dates of any previous submissions.

b. The Project title and number.

c. Contract identification.

d. The names and phone numbers including personal contact of:
   1) Contractor.
   2) Supplier.
   3) Manufacturer.

e. Identification of the product, with the specification section number and contract document description clearly indicated.
f. Field dimensions, clearly identified as such.
g. Relation to adjacent or critical features of the work or materials.
h. Applicable standards.
i. Identification of deviations from Contract Documents.
j. Identification of revisions on re-submittals.
k. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
l. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets except as defined in paragraph m. below. Each submittal shall have a cover/control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the general contractors, engineers and architects review stamp.
m. The first group of submittals shall be sent in a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2” x 11” sheets:

   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. Description sheets are to be white with black letters, minimum of 11” high and full width of pocket. Description is to describe project and match project drawing/project manual description.

n. Submittals not complying with these requirements may be returned with no action taken at the reviewer’s discretion.

16. Re-submittals shall contain:

a. The date of re-submission and the dates of all previous submissions.
b. A copy of the Engineer's comments from the previous submittal.
c. An itemized response to each of the Engineer's comments specifically outlining the changes or corrections being made. As an example; this could be either noting the page(s) of the previous

submission that are affected and what changes have been made or noting specific additional information being provided.

d. Submittals not complying with these requirements may be returned with no action taken at the reviewers discretion.

17. The Owner's Representative will:

a. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.

b. Review the submittal for general compliance with the contract documents. The contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function and compliance with the written installation instructions.

c. Determine the appropriate action for the submittal. Action codes will be as follows:

Action	Description
No exceptions noted.	No exceptions taken.
Make corrections noted.	Resubmittal not required. Make corrections to exceptions noted.
Revise and resubmit.	Make corrections to exceptions noted and resubmit.
Rejected	Not in compliance with contract documents. Resubmit
Submit Specific Item	Resubmit item as specified.
Review not required	Not required for review. No action taken. Copy retained for reference.

d. Turn around time will generally be within 14 calendar days on properly prepared submittals unless otherwise noted in Division 1.

e. Review comments will generally be on a separate attached sheet.

18. Resubmission requirements for "as specified" products.

a. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until accepted.

b. A submittal shall only be reviewed a maximum of 3 times. If upon the second resubmission an accepted action cannot be rendered (No Exceptions Noted or Make Corrections as Noted), the contractor shall supply the basis of design product and bear all costs incurred by the Owner's Representative during the review process until an accepted submittal is achieved.

19. The Contractor shall maintain one copy of all accepted submittal data including letters of compliance in a job site file.

J. Product Requirements, Equals and Substitutions:

1. In addition to all other requirements for submittals, equals and substitutions elsewhere in the contract documents, the contractor shall comply with the following.
2. Product Requirements:

    a. The specifications sections under Article 2.1 "ACCEPTABLE MANUFACTURER", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified.
    b. In certain cases, foundations and/or structural supports or electrical requirements for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this contractor shall coordinate the revised requirements and include an allowance for any cost differential.
    c. If the list, under Article 2.1 "ACCEPTABLE MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall be supplied.

3. Substitutions.

    a. A substitution is defined as any product not meeting the requirements as outlined in PART 2 - PRODUCTS. A different design accomplishing the same result will be considered a substitution. The same design requiring a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If a manufacturer who is not listed as an "ACCEPTABLE MANUFACTURER" wants to have his product considered as an equal or as a substitution, he shall submit details to the Owner's Representative 10 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. No substitution requests shall be considered after the Bid.
    b. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.

        1) Comparison of the qualities of the proposed substitution with that specified in tabulated format.

2) Changes required in other elements of the work because of the substitution.
3) Effect on the construction schedule.
4) Cost, extra credit or statement of no change in contract price.
5) Any required license fees or royalties.
6) Availability of maintenance service, and source of replacement materials.

c. The Owner's Representative shall be the judge of the acceptability of the proposed substitution.
d. A request for a substitution constitutes that the Contractor:

1) Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
2) Will provide the same warranties for the substitution as for the product specified.
3) Will coordinate the installation of the substitution into the work, and make such other changes as may be required to make the work complete in all respects.
4) Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
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 Owner's Representative 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.

4. Owner's Representative will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.
5. The Owner's Representative will review substitution submittals for compliance a maximum of two times. If the submittal or substituted product does not comply with the contract documents on the second submittal, the submittal and product will be rejected and the specified product will be required.
6. The contractor may request further review of the substitution after the second submittal rejection if the contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Owner's Representative.

7. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.

K. Manufacturer's Instructions:

1. Installation of work shall comply with manufacturer's printed instructions.
2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.

L. Transportation and Handling: Comply with 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:

1. Quantity: Four (4) sets
2. Format: Adequately sized for contents, minimum 1" and maximum 3" spline size, hard cover, view type, 8-1/2" x 11 loose leaf binders. Binder covers to have outer clear vinyl pocket on front cover and spline. Provide correct project designation and contents description in each pocket. Use as many as required. Do not overload binders.
3. Content:

    a. Cover sheet.
    b. Table of contents (as follows):

        1) Description of systems.
        2) Design parameters.
        3) Section 15010 - 15950

    c. Point by Point System Check-out: Provide tabulated results indicating compliance with contract document requirements.

5. Detailed Preparation Requirements:

    a. The cover sheet shall list: project name, location, architect, structure engineer, mechanical engineer and electrical engineering firm name with address, telephone number and project managers name for this project.
    b. Each major heading in the table of contents shall have a large distinctive, clearly marked, non-erasable, plastic encased tab.
    c. The description of systems will be provided by the design engineer for insertion at the time of review and turn-over to owner. This description of systems will be an updated version of the narrative included in Section 15010 - Mechanical General Provisions and will be an overview of the entire system. It will be the basis for the starting of the owners instruction program.
    d. Each section shall have the following sub-tabs. Sub-tabs shall be similar to the main tabs but of a different color.

        1) Specifications: The specification shall be copied and inserted complete with all addenda.
        2) Submittal: This section shall include all accepted submittal data. If submittal was not required, include technical data as specified.

3) Installation Instructions: If the product, such as pipe, etc., does not have any written installation instructions, include a statement "Manufacturer's Written Installation Instructions not Available - Product Installed in Accordance with Specifications and Good Practice".
4) Operation and Maintenance Instructions: These shall be the written manufacturer's data edited to omit reference to products or data not applicable to this installation.
5) Parts List: These shall be edited to omit reference to items not applying to this installation.
6) Equipment Supplier: This section shall include the name, address and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.
7) System Description: This section shall include that portion of the overall description included in the beginning of the manual as it applies to each sub-section. In sections such as pipe, valves and fittings, a statement shall be included "Not Applicable to this Section." Data for this section will be added by the design engineer when the manuals are submitted for review and forwarded to the owner.
8) Controls Description: This will be included in each section covering controlled equipment. It will include the description from the approved temperature control submission, complete with schematic diagram showing piping arrangement and control location on 8-1/2" x 11" or 11" x 17" sheet. This data shall be provided by the temperature controls contractor in a form suitable for insertion by the mechanical contractor and for review by the design engineer.
9) Special Operating Instructions: This section shall include condensed instructions for start-up, shut-down, emergency operation, safety precautions and troubleshooting suggestions. Where control is clearly covered in controls description, it is not to be duplicated here.
10) Preventative Maintenance Instructions: This section shall include excerpts from the manufacturer's written instructions on weekly, monthly, quarterly, annually, etc. This summary shall be prepared by the mechanical contractor with help from the equipment supplier. It will be reviewed by the engineer prior to turning over to the owner.

e. Section 15051 - Adjusting, Balancing and System Testing shall contain the following sections:

1) Specifications.
2) Submittal.
3) TAB Data.

This shall be the final TAB data. It will probably have to be added after the owner has received his training and the O&M manuals. Payment for TAB work will be withheld until the data is received and accepted. and the TAB instructed session is complete. The contractor shall provide a separate binder complete as detailed in this article as part of the set. The engineer will be responsible for incorporating this data into the O&M manuals.

6. Submittal Requirement:

   a. The O&M manuals shall be submitted at the 30% completion stage, which shall be defined as that time in the project when the major pieces of equipment have been set in place ready for connection to piping and duct systems.
   b. In order to ensure that this is done and to give a reasonable time for compliance, any progress payments for mechanical work past the 60% completion stage, defined as piping and ductwork installed and tested but not insulated, will be held up until this submittal requirement is met.

R. 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 15 specifications specify a longer period.

S. System Testing:

1. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
2. Provide all necessary labor, materials and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 15 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 15010

SECTION 15020
DEMOLITION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Heating, Ventilation and Air Conditioning: Remove all existing heating, ventilating and air conditioning equipment 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 15 of the specifications.

I. The Contractor shall exercise care during the progress of the work under this section so as not to damage or displace the work of the other trades performed under other sections. He shall coordinate work under this section with work under other sections, as necessary for the proper execution of the entire work.

J. When the contract documents indicate the removal of existing equipment to be 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.

END OF SECTION 15020

SECTION 15050
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Access doors.

B. Equipment identification.

C. Fire and smoke stopping.

D. Electrical requirements.

E. Painting.

F. 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. Where submittals are required, comply with Section 15010 Mechanical General Provisions.

B. 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. Piping and equipment identification.
3. Fire and smoke stopping material.

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. 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

C. Fire and Smoke Stopping Material:

1. General Electric Company.
2. Hilti, Inc.
3. International Protective Coatings Corp. (IPC) Division of Grace Construction Prod.
4. Johns Manville
5. Rectorseal
6. Tremco, Inc. Sealant/Weatherproofing Division
7. 3M Fire Protection Products.

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.

B. 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 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.

C. Fire and Smoke Stopping: Fire and smoke stopping material: A one-part silicone elastomer, or a one-part intumescent elastomer caulk or putty, UL classified and FM approved with flame spread of 0 and smoke development not to exceed 50 in accord with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in accord with ASTM E814 under positive pressure. 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.

D. Electrical Requirements: Product description not applicable to this Section.

E. 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. 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.

C. Fire and Smoke Stopping:

1. Fire and smoke stopping shall be provided as required to meet all code requirements and at a minimum is required in the following locations:

    a. Where exposed and concealed horizontal pipes, tubes, wires and ducts which are part of an active smoke control system that are not provided with fire dampers penetrate fire rated walls, shaft walls, and smoke barriers.
    b. Where exposed and concealed vertical pipes, tubes, and wires ducts which are part of an active smoke control system that are not provided with fire dampers penetrate rated and non-rated floors.

3. Provide pipe or duct sleeve for all penetrations. Space between pipe or duct and sleeve shall not exceed the UL listing of the penetration.
4. Fill annular space between pipe and sleeve, or between duct and sleeve on non- dampered penetrations, with approved material.
5. Depth of material shall be in accord with laboratory tests for 1, 2, or 3 hour rated assemblies.
6. Damming material may be temporary non-fire approved, or permanent fire-approved. Where permanent fire-approved damming material is used depth of fire and smoke stopping material may be decreased in accord with manufacturer's recommendations. Temporary damming material shall be removed after installation of fire and smoke stopping material.
7. Seal all gaps or voids in cured foam with material to match the fire and

smoke stopping material.

8. Trim excess cured foam from around all openings and leave smooth, flush surface.

D. Electrical Requirements:

1. Electrical apparatus, devices, controls, etc., required but not specified in detail in this Division shall conform to Division 16 - ELECTRICAL.
2. Except as otherwise detailed or specified, all power wiring required to operate electrical devices and equipment furnished in this Division will be provided under Division 16 - ELECTRICAL.
3. Control and interlock wiring required for all electrical devices and equipment furnished in this Division is specified under Section 15058 - CONTROL WIRING.

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. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
5. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
6. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
7. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

F. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
3. Exercise caution during equipment placing operations to insure that structure is not overloaded.
4. 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 15050

SECTION 15051
ADJUSTING, BALANCING AND SYSTEM TESTING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of 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 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 in accordance with Section 15010 - Mechanical General Provisions.

B. 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.

C. Submit schedules of test data readings in organized, schematic, tabulated format. Include schematic drawing showing location of all readings.

D. 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.

B. Test and balance personnel shall be qualified to perform testing and balancing in accordance with AABC or NEBB procedures.

1.6 TOLERANCES

A. Balance final airflow to within plus or minus 5 percent of specified quantities. Caution is urged on systems where diversity has been taken and the total flow exceeds the equipment capacity. In this case, the system must be sectioned as necessary to get proper terminal flow.

1.7 GENERAL COMMENTS

A. Air Balance: Readings from a pitot tube traverse will be given highest priority as to accuracy. Terminal flow shall be as taken from the terminal DDC flow readings. Outlet flow as established by flow hood will be used to pro-rate air flow. Pressure readings as well as voltage and ampere readings will be used for check purposes only. Temperature readings will be used as a check against performance.

B. All readings shall be cross-checked for accuracy. These cross-checks shall be tabulated within the report.

PART 2 – PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 INTENT OF DRAWINGS AND SPECIFICATIONS

A. Review drawings and specifications with regard to adjusting and balancing.

B. Additional balancing devices which, in the opinion of the TAB sub-contractor, would aid in the adjusting and balancing of the systems shall be brought to the attention of the contractor prior to bid time so that the contractor may make allowances to cover the provision of these additional devices in the original bid.

C. Minor modifications in system design which, in the opinion of the Contractor, would aid in the adjusting and balancing of the systems may be provided subject to approval of the Owner's Representative at no additional cost to the Owner. Design modifications shall not lessen the operating efficiency of the systems.

3.2 AIR BALANCE

A. Check system visually and audibly for leakage and proceed with balancing as outlined by AABC or NEBB.

B. Balance for full flow shall be based on dirty friction loss across the filters. Artificially blank-off sections on a uniform pattern as required to simulate this condition.

D. Constant Volume Systems:

1. Adjust each fan to deliver the specified quantity of air at the specified temperatures to all areas of the building served by the air system. Where the installed drive cannot be adjusted to obtain the required flow, advise the contractor so that the necessary drive change can be made. Adjust speed, in direct proportion to actual vs. required cfm. Exercise caution because amps vary with the cube of speed.
2. Determine air volume in ducts by use of pitot tube, and inclined manometer. 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.

3.4 CONTROLS ADJUSTMENT

A. Check the automatic temperature controls to ascertain that the specified sequence of operation is occurring. Record thermostat set point and room conditions in each space.

B. Compare temperature of space (taken with test instrument) to temperature read by thermostat or temperature sensor. Tabulate results.

3.5 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. 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.
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.

3.6 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 16 hours, two working days, 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 15051

SECTION 15058
CONTROL WIRING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010 - Mechanical General Provisions, shall be made an integral part of this section.

C. Provisions of Section 16010 - Electrical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Building Control System Wiring.

1.3 DEFINITIONS

A. Control Wiring: All wiring, high or low voltage other than power wiring, required for the proper operation of the mechanical systems.

B. Power Wiring: All line voltage wiring to the mechanical equipment. Line voltage which also serves as a control circuit, such as a line voltage thermostat, or involves interlocking with a damper, shall be considered control wiring.

1.4 QUALITY ASSURANCE

A. All work will be in accordance with the requirements of the National Electrical Code.

1.5 SUBMITTALS

A. Submittals are not required.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All material used in the completion of the wiring under this section will comply with the requirements of Division 16 Electrical and Section 15900 - Building Management Systems.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cooperate completely with the contractor for Division 16.

B. Provide all conduit, wire and accessories necessary to complete the control wiring as specified under WORK INCLUDED.

C. Because of variations in requirements from manufacturer to manufacturer, all details may not be included in the Contract Documents. This sub-contractor must obtain approved coordinated wiring diagrams before proceeding with the control wiring.

D. All control wiring shall be properly installed in an approved raceway system or when allowed, run exposed in concealed spaces. All control wiring run in exposed areas shall 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 encloses. 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.

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 15058

SECTION 15060
PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this Section.

1.2 WORK INCLUDED

A. Refrigerant (RS/RL/RHG) Piping.

B. A/C Unit Condensate Drain (CD) Piping.

1.3 DEFINITIONS

A. Pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.

B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:

1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
2. Refrigeration Piping - ASME/ANSI B31.5
3. All other metallic piping - ASME/ANSI B31.1

C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.

D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

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

B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.

1.6 SUBMITTALS

A. All submittals shall be made in accordance with Section 15010 - Mechanical General Provisions.

B. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, fittings, valves, hangers and supports. Include the designation of the publication applicable for each type of material and method.

C. Submit a letter from the refrigeration equipment manufacturer stating that the refrigeration piping system, as shown on the contract documents, is acceptable for the equipment the manufacturer proposes to furnish, or submit drawings prepared by an authorized representative of the refrigeration equipment manufacturer.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Refrigerant (RS/RL/RHG) Piping.
System Design Pressure: 300 psig.

1. Piping carrying Refrigerants shall be either ACR copper, or carbon steel.
2. ACR Copper Refrigerant Piping:

a. Piping, 3" and smaller: Type ACR hard-drawn copper tubing, ASTM B88, ANSI H23.1.
b. Fittings, 3" and smaller, all types, wrought copper: ASTM B16.22, ANSI B16.22. All 90° elbows shall be the long radius type.
c. Brazing: Contractors Option:

(1) 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
(2) 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
(3) 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal

d. Unions used shall be specifically designed for refrigeration piping.

B. A/C Unit Condensate Drain (D) Piping.
System Design Pressure: 10 psig.
(Where two materials are listed, either may be used.)

1. Drains in Return Air Plenums or other areas - Copper:

a. Piping, 1/2" thru 4: Type L Hard-drawn Copper Tubing: ASTM B88.
b. Pipe Fittings, 1/2" thru 4": Contractor's Options:

(1) Wrought Copper, ANSI B16.22.
(2) Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation.

c. Solder: Lead-free per code.
d. Brazing for Mechanically formed tee fittings: Brazing: Contractors Option:

(1) 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
(2) 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
(3) 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal

e. Unions: 1/4" thru 4": Wrought Copper, Pressure Class 150, w/solder ends. Note: Dielectric unions shall be used to connect copper to steel pipe, and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.

2. Drains, Indoor, not in Return Air Plenums - PVC:

a. Schedule 40 Polyvinyl Chloride (PVC), ASTM D1785.
b. Schedule 40 PVC, socket-type, ASTM D2466. Joints shall be made with solvent cement, ASTM D2564.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to

complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.

2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.

11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
13. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
14. Avoid bushings. Reducing fittings shall be used wherever practical.
15. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
16. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
17. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
18. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
19. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
20. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
21. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
22. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Hydronic HVAC Systems Additional Requirements:

1. Provide water seal in the condensate drain from each air handling or air conditioning unit. The depth of each seal shall be equal to the total static pressure rating of the unit to which the seal is connected. Water seals

shall be constructed of two tees and an appropriate U bends with the open end of each tee plugged.

2. Slope piping 1 inch per 40 ft, in the direction of flow.

C. Plastic Pipe Systems Additional Requirements:

1. Joints between plastic pipe and other materials shall be subject to the following requirements:

   a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
   b. Joints between the hub of cast-iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
   c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.

2. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
3. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

3.2 BRAZING AND SOLDERING

A. Operator and Procedure Qualifications: All brazing operators and all brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

C. Soldering: Joints in copper tubing shall be made with solder- type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self- cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

D. Piping Identification: All piping shall be marked in accordance with the provisions of Section 15050 - BASIC MATERIALS AND METHODS.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:

1. General: Furnish everything required for the tests. Notify Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Engineer. Testing shall be performed at the completion of each phase of the project.
2. Refrigerant Piping Systems shall be tested with dry carbon dioxide, or nitrogen, at 315 psig for the high side, and at 245 psig for the low side. If leaks are to be detected by use of an electronic halogen detector, or a halide torch, the system shall be pressurized with refrigerant gas prior to introduction of dry carbon dioxide or nitrogen into the system. Pre-charging of system with refrigerant gas is not necessary for soap bubble leak detection method.

B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.

C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.

D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.

F. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.

G. Disconnect pressure boosting apparatus, and vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.

H. During tests, isolate system components that have test pressures less than pressures specified for system tests.

I. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION 15060

SECTION 15090
SUPPORTS, HANGERS, ANCHORS AND SLEEVES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Pipe Hangers, Rods, Supports and Accessories.

1.3 QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.

B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.

1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
2. SP-69 Pipe Hangers and Supports: Selection and Application.
3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.

C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.

D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.

E. Welding of steel members shall be in accordance with AWS D1.1.

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. National Fire Protection Association (NFPA)
7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

1.5 SUBMITTALS

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

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 15010, Mechanical General Provisions for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe Hangers, Rods, Supports and Accessories:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line®, Inc.
4. Elcen Metal Products
5. Hilti
6. Michigan Hanger Company
7. PHD Manufacturing, Inc.
8. Unistrut®

2.2 FABRICATION

A. Pipe Hangers, Rods, Supports and Accessories:

1. Pipe Hangers:

a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300.
b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe.
c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181.

2. Rods:

a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic Fiberglass Reinforced Pipe Size	Steel, Cast Iron or Glass Pipe Size	Rod Size	Max Equip. Load
¼" to 2"	¼" to 2"	3/8"	730 lbs.
2-1/2" to 5"	2-1/2" to 3"	½"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs
8" to 12"	6"	¾"	3230 lbs.
14"	8" to 12"	7/8"	4480 lbs.
16"	14" to 16"	1"	5900 lbs.
18" to 20"	18" to 20"	1-1/4"	9500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" in maintained. Based on Anvil Fig. 146.

3. Supports:

a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange.

b. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where applicable install in accordance with the manufacturers written installation instructions.

B. Where supports are in contact with copper pipe provide copper plated support, or wrap pipe with sheet lead.

C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.

D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed and painted black within one week of installation. At substantial completion all supports shall be free of rust and in a "like new condition".

E. Hangers and supports, including attachments & pipe supports, exposed to

weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a “like new condition”.

3.2 INSTALLATION

A. Pipe Hanger, Rods, Supports and Accessories:

1. Select proper hanger for piping systems.
2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
6. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
7. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
8. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT
SPACING TABLE

a. Steel Pipe (Schedule 40 & 80):

Up to 1":	7 ft. on center
1-1/4" and greater:	10 ft. on center

b. Copper Pipe (Types L, K and M):

Up to 1-1/4" size:	5 ft. on center
1-1/2" to 2-1/2":	6 ft. on center
3" and larger:	10 ft. on center

c. Ductile Iron and Cast Iron: Two hangers per section length.

d. Polyvinyl Chloride (PVC):

Up to 1-1/2":	3 ft. on center
2" and larger:	4 ft. on center

9. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
10. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.

END OF SECTION 15090

SECTION 15250
INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Duct Systems Insulation.

B. Piping Systems Insulation.

C. Accessories.

1.3 QUALITY ASSURANCE

A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.

B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.

C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.

D. Refer to Section 15010, Mechanical General Provisions for requirements.

1.5 GENERAL REQUIREMENTS

A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.

B. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.

B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.

C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass Insulation:

1. Owens-Corning Fiberglas
2. Knauf Fiberglass
3. CertainTeed
4. Johns Manville

B. Closed Cell Elastomeric Insulation:

1. Armacell LLC
2. Johns Manville
3. Rubatex

C. Jackets:

1. Southern Asbestos Company
2. John Mansville
3. Owens-Corning Fiberglas

2.2 DUCT, DUCT INSULATION AND FIREPROOFING REQUIREMENTS

A. Refer to the 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 per 1" thickness of .23 at 75°F mean temperature. Based on Knauf Insulation Board.

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. Accessories:

1. 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 appropriate mastic finish as recommended by the insulation manufacturer with the perm rating of the mastic equal to or less than that of the insulation it is sealing.
2. Corner angles shall be minimum 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch heavy kraft paper.
3. 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.
4. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated.
5. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
6. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex finish.
7. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
8. 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.
9. Vapor Barrier Mastic: Air drying flexible water based mastic used for applying a vapor barrier joint with glass cloth at insulation joints. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08. , Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard's Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.

10. Acrylic Latex Finish and Sealers:

a. Elastomeric Insulations: Air drying flexible water based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex 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. 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.

H. 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.

I. Insulation shall be protected from moisture and weather during storage and installation.

J. 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.

K. 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.

L. The insulation subcontractor is responsible for proper material storage at the work site.

M. Work performed prior to receipt of approved documents or submittals, later proving to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.

N. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns and walls have been provided.

O. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.

P. 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.

Q. 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.

R. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.

S. 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.

T. 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. Provide corner angles where insulation is subject to harm.
c. All fasteners shall be non corroding.
d. The insulation shall be applied by use of cup head weld pins. Such fasteners shall be spaced in accordance with NCIA recommendations, where NCIA standards do not address exact dimensions, cup head weld pins shall be spaced on 12" centers. Pin caps shall be covered with a round vapor seal patch that matches the jacket on the ASJ board. On cold ducts, these shall be coated so as to not cause condensation.
e. 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.
f. Insulation edges and joints shall be finished 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.
g. 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.
h. In finished areas, molded glass fiber insulation shall be used to insulate round ducts where commercially available sizes can be used.
i. 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.
j. On cold ducts, the fittings shall be finished 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.

B. Pipe Insulation:

1. General:

a. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping.
b. 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.

c. Cover fittings, flanges, unions, valves, anchors, and accessories with premolded or segmented insulation of the same thickness and material as the adjoining pipe insulation. 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.

d. Seal all raw edges of insulation.

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.

C. 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.

D. Glass Cloth Jacket:

1. Provide where specified.

2. Provide acrylic latex finish.

E. Flexible Acrylic Latex:

1. Apply two coats to glass cloth jacket, concealed closed cell elastomeric insulation.

2. 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 15250

SECTION 15776
PACKAGED 100% OUTSIDE AIR UNITS SELF CONTAINED

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Packaged 100% Outside Air Units, self contained.

1.3 QUALITY ASSURANCE

A. Units shall be listed and labeled by U.L., ETL or a Nationally Recognized Testing Laboratory (NRTL).

B. Units shall be ARI certified.

1.4 SUBMITTALS

A. Submit dimension drawings, performance and product data for acceptance. Include wiring diagrams.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 15010, Mechanical General Provisions for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Packaged 100% Outside Air Units, Self Contained:

1. Addison
2. Desert Aire
3. Owner Approved Equal

2.2 FABRICATION

A. Packaged 100% Outside Air Units, Self Contained:

1. Unit shall be design certified by UL and ARI specifically for outdoor installation, completely assembled on a rigid base for one-piece rigging,

suitable for mounting on a prefabricated roof curb, piped, wired, charged and tested by the manufacturer before shipment. Complete unit to have a 1-year limited parts warranty and compressor to have a 4-year extended parts warranty.

2. Cabinet shall be constructed of a minimum of 16 gauge commercial grade galvanized steel, primed, and painted to manufacturer's standard color. Indoor air section shall be completely insulated with fireproof, permanent, odorless 3/4" thick engineered polymer foam insulation. Neoprene gasketed access doors shall provide access to all components. All fasteners shall be stainless steel.
3. Evaporator Dehumidifier Coil Fins: Fins shall be die-formed, copper and shall be damage resistant. Fin spacing shall be a maximum of 10 FPI (fins per inch). Coil shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the fins to form a permanent metal-to-metal bond for maximum heat transfer and stability. The coil shall be a minimum of six (6) rows deep. Coils shall be leak tested with 420 psig nitrogen. After testing, coils shall be sealed.
4. Condenser and Reheat Coil Fins: Fins shall be die-formed, copper and shall be damage resistant. Fin spacing shall be a maximum of 12 FPI (fins per inch). Coil shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the fins to form a permanent metal-to-metal bond for maximum heat transfer and stability. The coil shall be a minimum of two (2) rows deep.
5. Electric Heating Coil: An internal electric heating coil shall be installed downstream from the hot gas reheat coil. The auxiliary heating coil shall be controlled by the systems controller. The binary control signal shall be a dry contact closure.
6. Compressor (<6 HP): The compressor shall be heavy-duty scroll type, single compressor complete with start kit on single-phase motors. The compressor shall be equipped with low and high pressure safety switches, with internal protection from overheating. The compressor shall be externally vibration isolated. A standard factory two-year compressor warranty shall be included. The unit shall be provided with hot has bypass for each system compressor. The use of semi-hermetic compressors is not acceptable.
7. Receiver: The unit shall be provided with a refrigerant receiver. The receiver shall assist the unit in operating at the highest efficiency over the full range of load conditions. Units 7.5 HP and larger shall have a full capacity receiver with service valves.
8. Electrical Control Panel: The electrical control panel shall be easily accessible on one side so that all service can be performed from the side of the unit. It shall be of adequate size so as to house all electrical controls and devices. The unit shall be provided with single point power connection factory wired to the power connection lug set. The electrical controls shall include low voltage transformers to supply 24 VDC control power, clearly labeled high and low voltage terminal strips, high and low pressure control (with manual reset of the high pressure cutout and automatic reset of low pressure cutout), and an anti-short cycling timer to protect against compressor cycling. Unit shall include factory-mounted temperature and humidity sensors in the filter section, pre-wired to controller in panel for actuation of compressor in ambient temperatures

above 55°F dewpoint. A factory-provided, field-installed discharge temperature sensor provides the feedback to the controller to automatically control the leaving air temperature to the desired set point. An adjustable potentiometer shall allow easy field changes in LAT set point. All units shall be provided with phase loss protection.

9. Condensate Drain Pan: The drain pan shall be 20-gauge stainless steel, sloped, and positioned under the dehumidifier coil. It shall be silver-solder welded and securely attached to the evaporator end plates to avoid shifting. The drain pan shall be fitted with a minimum 1" MPT non-corrosive plastic drain connection. The drain pain shall meet all the requirements of ASHRAE 62.
10. Blower Assembly: The blower housing shall be made of galvanized steel and mounted on permanently lubricated sealed ball bearings. The blower assembly shall be forward curved, centrifugal; it shall be dynamically and statically balanced. The blower housing shall be vibration isolated. The driver pulley and the blower pulley shall be made of cast iron. The motor sheave shall be a variable pitch type to allow for field adjustment of CFM and external static pressure, and shall be dynamically and statically balanced. The drive overload service factor shall be 1.4 minimum. The motor shall be ODP (indoor) or TEFC (outdoor), class B insulated, continuous duty, 40C ambient, three-phase overloads. The motor shall be UL listed.
11. Air Filters: Filters shall consist of 2" disposable pleated, 25 to 30% average atmospheric efficiency.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Packaged 100% Outside Air Units, Self Contained:

1. Install in accordance with manufacturers recommendations.
2. Condensate trap shall be minimum 4 inches deep and shall be field installed. Install plug in condensate drain on opposite side of unit from trap. Condensate drain connection shall not be less than 3/4".
3. All wiring shall comply with applicable local and national codes. Final connections shall be made with Greenfield type electrical conduit for ease of removal.
4. Ductwork shall be attached to the curb and sealed completely. Counterflashing shall be provided around the roof curb.
5. Thermostat and sub-base for wall mounting shall be as detailed on plans.
6. Maintain necessary access space for filter change and normal maintenance. Piping and electrical connections shall be so located to eliminate any interference with removal and replacement of filter.
7. After installation of unit, all interconnecting piping, controls and wiring, check each unit for satisfactory operation of fan on continuous and automatic control setting, unit operation on cooling, change over and heating and so indicate on tag pasted on unit indicating: "Checked for proper operation on __Date___ by __Name__."
8. Insert installation and maintenance instructions and parts lists in a one inch ring binder marked "OPERATION AND MAINTENANCE

INSTRUCTIONS" and furnish to Owner.

END OF SECTION 15776

SECTION 15780
PACKAGED SPLIT SYSTEM AIR CONDITIONING UNIT, AIR COOLED

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Packaged Split System Air Conditioning Unit, Air Cooled.

1.3 QUALITY ASSURANCE

A. All electrical components shall be UL listed or labeled.

B. All direct expansion coils shall be ARI certified.

C. All components in the air stream shall conform to the NFPA 90A Flame/Smoke/Fire contribution of 25/50/0.

D. All electrical devices shall conform to NEMA standards.

E. All wiring shall conform to the NEC.

F. After installation, the manufacturer's representative of all equipment provided in this section shall certify in writing to the Owner's representative that the equipment has been assembled and installed within the guidelines of the manufacturer's written installation instructions and that its performance meets or exceeds the operating characteristics specified and/or scheduled.

1.4 SUBMITTALS

A. Submit dimension drawings, performance and product data for acceptance. Include fan curves with the system design point plotted, and clearly indicate fan efficiency.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 15010, Mechanical General Provisions for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Packaged Split System Air Conditioning Unit, Air Cooled:

1. Carrier
2. McQuay
3. Rheem

2.2 EQUIPMENT

A. Packaged Split System Air Conditioning Unit, Air Cooled:

1. Provide an air-to-air electric condensing unit (outdoor unit) in combination with a direct expansion fan coil (indoor unit), fully piped, wired and operational. Condensing unit shall be designed, tested, and fully charged for use with R-410A refrigerant. Combination unit shall be designed certified by UL and ARI, and complete package to have one (1) year limited parts warranty and compressor to have a four (4) year extended parts warranty.
2. Outdoor Section:

a. Cabinet shall be constructed of commercial grade galvanized steel, primed and painted to manufacturer's standard color. Access doors with neoprene gaskets shall be provided to allow access to coil, fan, motor and controls. Mounting legs shall be provided.
b. Compressor shall be high efficiency hermetic reciprocating type or scroll type equipped with a crankcase heater, automatically reversible oil pump, internal high pressure protection, and internal vibration isolation. Compressor motor shall have both thermal and current sensitive overload protection.
c. Outdoor coil shall be constructed of copper tubing with mechanically bonded aluminum fins having all joints brazed, factory installed coil refrigerant metering device to be mounted on unit liquid service valve, with device internal components to be removable for cleaning or replacement. Coil to be protected by a vinyl coated grille.
d. Outdoor fan shall be propeller type, direct driven, balanced statically and dynamically, and arranged for vertical air discharge. Fan shall be weatherproofed and approved for outdoor use. Fan motor shall be factory lubricated and internally protected.
e. Controls shall provide compressor short cycle protection and shall prevent compressor restart for a minimum of five minutes after shutdown. Liquid line low pressure switch, suction line accumulator with positive oil return, pressure relief switch and a loss of pressure indicator shall be provided.
f. Unit shall be equipped with filter drier, schrader access valves, refrigerant check valves in the refrigerant line, hot gas piping connection and valving, and expansion devices with interconnecting tubing to provide proper refrigerant flow control.

g. Low refrigerant and high refrigerant cut-outs to be arranged in lock out circuit for manual reset. Control wiring terminal board and 24 volt control circuit transformer to be provided. Terminal board shall be designed to match indoor unit terminal board and furnished complete with factory wiring from board to all internal components and accessory thermostat terminals for standardized point-to-point connectors.
h. Units with multiple compressors shall have independent refrigerant circuiting.

3. Indoor Section:

a. Cabinet shall be constructed of commercial grade galvanized steel, primed and painted to manufacturer's standard color, and insulated with fireproof, permanent, odorless glass fiber material. Access to be all components shall be provided with neoprene gasketed access panel(s).
b. Indoor coil shall be constructed of copper tubing with mechanically bonded aluminum fins having all joints brazed. Factory installed refrigerant metering device, refrigerant line fittings which permit mechanical connection on the liquid line and female sweat or mechanical connection on the gas line, and condensate pan with primary and auxiliary drain connections shall be provided. Unit shall also be equipped with hot gas reheat coil installed in the unit.
c. Fan shall be forward curved, centrifugal type, driven by factory lubricated single speed, three phase fan motor complete with internal overload protection, and resiliently mounted. Fan shall have horizontal air discharge or vertical air discharge as shown on the Contract Documents.
d. Unit shall be provided with factory installed electric heater for supplemental heating to mount in discharge air passage. Elements to be of heavy duty nichrome internally delta-connected on three phase. Heater to have line break high limit controls.
e. Certain units require multiple power connections for energy management purposes and are indicated on the schedules. Coordinate this requirement.
f. Unit shall be provided with 1 inch medium efficiency throwaway filters. Initial and one replacement set to be provided with unit. Filter retaining rack to be arranged for removal and replacement in space allotted.
g. Unit control shall be through the Building Control System furnished in Specification Section 15900. Provide a clearly marked terminal strip with each unit for connection to BCS system.

4. Unit Accessories: Refer to Schedules shown on the Contract Documents.

PART 3 - EXECUTION

3.1 GENERAL

A. Packaged Split System Air Conditioning Unit, Air Cooled:

1. Install in accordance with manufacturer's recommendations.
2. All openings made in walls or the roof the piping/electrical shall be patched and sealed completely, using materials of similar to existing type construction, to the Owner's satisfaction.
3. All refrigerant piping shall follow refrigerant piping techniques.
4. Condensate traps shall be minimum 4 inches deep and shall be field installed. Install plug in condensate drain on opposite side of unit from traps. Condensate drain connection shall be not less than 3/4".
5. All wiring shall comply with applicable local and national codes. Final connections shall be made with greenfield type electrical conduit for ease in removal.
6. Maintain necessary access space for filter change and normal maintenance. Piping and electrical connections shall be so located as to eliminate any interference with removal and replacement of filter.
7. Maintain space clearances around heat pump per manufacturer's recommendation.
8. After installation of unit, all interconnecting piping, controls and wiring, check each unit for satisfactory operation of fan on continuous and automatic control setting, unit operation on cooling, change over and heating and so indicate on tag pasted on unit indicating: "Checked for proper operation on __Date___ by __Name__."
9. Insert installation and maintenance instructions and parts lists in a one inch ring binder marked "OPERATION AND MAINTENANCE INSTRUCTIONS" and furnish to Owner.
10. Manufacturer shall review the drawings for piping distances. Contractor shall provide pipe sizes and any necessary accessories required by the Manufacturer as the result of their review.

END OF SECTION 15780

SECTION 15840
SHOP FABRICATED DUCTWORK

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Galvanized Steel Rectangular Ductwork.

1.3 QUALITY ASSURANCE

A. All ductwork shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.

B. All ductwork shall be fabricated to withstand the pressure and velocity required on this project.

C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.

D. All ductwork shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.

E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

1.4 SUBMITTALS

A. Submission for acceptance is required.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 15010, Mechanical General Provisions for requirements.

1.5 SHOP DRAWINGS

A. Shop Drawings: Provide shop drawings of sheet metal ductwork as follows:

1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.
2. Show duct sizes.
3. Show fitting details.
4. Show lighting and ceiling diffusers.

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 A 653. 13 ga and heavier conforming to ASTM A 653.
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 A 653. 13 ga. and heavier conforming to ASTM A 653.

2.2 FABRICATION

A. Galvanized Steel Ductwork:

1. Fabricate ductwork as indicated on the drawings. Sizes given are inside clear dimensions. Allowances must be made for duct liner if indicated. Unless otherwise indicated on the drawings, the metal gauge shall be in accordance with SMACNA-HVAC Duct Construction Standards - Metal and Flexible, Latest Edition.

2. Elbow Fabrication:

   a. 90 deg. elbows 12" or less in width shall be radiused whenever possible.
   b. All radiused elbows shall be full radiused (R=1.5).
   c. All mitered 90 deg. elbows shall have turning vanes. Ducts with a width/depth ratio of 1 or more shall have double thickness turning vanes; single thickness is permissible for less than 1.

3. Tee or Take-off Fabrication:

   a. Take-off to round run-outs shall be conical or bell mouth. Where conical or bellmouth fittings can not be used due to take-off size to main, provide factory fabricated side takeoff fitting equal to Flexmaster U.S.A., Inc. Type “STO”. Provide with handle extension for insulated ducts to clear the insulation thickness specified.
   b. Take-off to square or rectangular shall be 45 deg. clinch collar or proportional divisions.
   c. A volume damper shall be located downstream of each take off on square and rectangular take-offs, and integral to round run-outs.

4. Transitions:

   a. Concentric Transition: Maximum angle 45 deg. diverging, 60 deg. converging (SMACNA Fig. 2-7).
   b. Eccentric Transition: Maximum angle 30 deg. diverging or converging (SMACNA Fig. 2-7).

5. At the Contractor’s option, ductwork may be joined at the transverse joints with prefabricated galvanized Ductmate Industries, Inc. (”25" or “35") or Ward Industries, Inc. sections, or with fabricated TDF or TDC T-24 type flanged transverse joints with bolted corners, gaskets, and sealants, constructed in accordance with the SMACNA HVAC Duct Construction Standards - Metal and Flexible, latest edition, Table 1-12. Ductmate “25" may be used only on ductwork with a pressure classification of 2" w.g. or less on the discharge side of air handling units or fan power terminal units. Plastic joint clips are not acceptable. Flanged and prefabricated joints by different manufacturers shall not be jointed. Formed on flanges shall not be used.

B. Ductwork, General: Each duct section shall have both ends covered with polyethylene or other suitable material to protect against the entrance of dirt, debris or water during shipment and storage prior to installation.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install in strict accordance with the Sheet Metal and Air Conditioning Contractor's National Association, Inc.'s (SMACNA) recommendations.

B. The drawings, due to their small scale, are diagrammatic in nature and are not necessarily complete in all details. For this reason not all necessary offsets, risers or falls are shown. Coordinate the installation of the ductwork with all other trades and to provide all necessary offsets, etc. as required for completion of this project without any additional cost to the Owner, Architect and/or Engineer.

C. All ductwork shall be run parallel or perpendicular to building structure whenever possible.

D. All ductwork shall be properly sealed.

E. Coordinate the location, provide the necessary access and install all devices provided in other specification sections within Division 15. 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 (Refer to Division 7 for Firestopping materials). The sleeve shall be permanently affixed to the wall (see Section 15090: Supports, Hangers, Anchors and Sleeves 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 15860 - Sheet Metal Specialties.

3.2 CLEANING AND PROTECTION

A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of duct, debris or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork

system, the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.

3.3 DUCT SEALING REQUIREMENTS

A. All ducts shall have SMACNA Seal Class A (all transverse joints, longitudinal seams and duct wall penetrations).

3.4 LEAK TESTING

A. Ductwork rated at over 3" positive pressure shall be leak tested using a test rig as described in the SMACNA Balancing Manual.

B. Test ductwork that is rated over 3” positive pressure at 25% above specified operating pressure. Ductwork to be tested in segments and CFM leakage shall be limited to 5% of the system airflow for that section.

C. Leaks must be located and sealed. All audible leaks, regardless of size, must be sealed.

3.5 INSTALLATION

A. Galvanized Steel Ductwork:

1. Install ductwork as indicated on the drawings. If any conflict occurs notify the Owner's Representative prior to any extensive rerouting.
2. Install ductwork to allow clearance for the installation of duct insulation.
3. Provide duct liner as specified and/or detailed. (See 3.6 Schedule for liner requirements.)

3.6 SCHEDULES

A. Ductwork shown to be round or oval is to be provided under Section 15846 - Pre-Fabricated Ductwork.

B. System Pressure Classification and Duct Material Schedule for Shop Fabricated Ductwork:

	System	Section	Maximum Pressure	Duct Material
1.	Outside Air Plenum		2" neg.	A
2.	Outside Air Duct		2" neg.	A
3.	Supply To Terminal	A.C Unit	3" pos.	A
4.	Supply	Terminal to Diffuser	1" pos.	A
5.	Supply	AHU to grille	3 pos.	A
6.	Return	Inlet Grille to Terminal	2" neg.	A
7.	Return	Term to Return Air Fan	4" neg.	A
8.	Return	All AHU Return	1" neg.	A
9.	General Exhaust	Inlet to Unit	1" neg.	A

Schedule Legend:

Duct Material

A Galvanized Steel

END OF SECTION 15840

SECTION 15860
SHEET METAL SPECIALTIES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Volume dampers.

B. Flexible duct connectors.

C. Insulating duct coating.

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 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.

C. Provide Florida Product Approval Numbers for all Products required by the Florida Building Code.

1.4 SUBMITTALS

A. Submission for acceptance is required.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 15010, Mechanical General Provisions for requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. 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. Safe Air Inc./ Dowco

B. Flexible Duct Connectors:

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

C. Insulating Duct Coating:

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

2.2 FABRICATION

A. 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.
   i. Based on Ruskin Manufacturing, Co. CD30AF1 for rectangular ducts (CDR82 for round ducts) with velocities over 1501 feet per minute.

B. 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:

(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.

C. Insulating Duct Coating:

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

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 15 including but not limited to control dampers, air flow measuring stations, etc.

3.2 INSTALLATION

A. Volume Dampers: Install at branch take-offs.

B. 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.

C. Insulating Duct Coating:

1. Apply to exposed supply and return air ducts located above roof or exterior to the building.
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.

3.3 SCHEDULES

A. Flexible Duct Connector Schedule

1. Indoor and Outdoor Material Width Schedule

	Duct Size (Max. Dim.)	Pressure (Max.)	Width
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 15860

SECTION 15870
GRILLES, REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

A. Grilles.

B. Registers.

C. Diffusers.

1.3 QUALITY ASSURANCE

A. Manufacturer shall certify cataloged performance and ensure correct application of all air outlet types.

B. All components within the conditioned air stream or exposed in active or non-active plenums shall conform to the NFPA 90A standard for Flame/Smoke/Fire Contribution of 25/50/0.

1.4 SUBMITTALS

A. Submit schedule and product data for acceptance. Coordinate submittal by "G" number and include construction details, capacity ratings including air side pressure drops and NC levels.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 15010, Mechanical General Provisions for requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Grilles:

1. Anemostat
2. Krueger

3. Metal*Aire Division of Metal Industries, Inc.
4. Nailor
5. Price
6. Titus
7. Trox

B. Registers:

1. Anemostat
2. Krueger
3. Metal*Aire Division of Metal Industries, Inc.
4. Nailor
5. Price
6. Titus
7. Trox

C. Diffusers:

1. Anemostat
2. Krueger
3. Metal*Aire Division of Metal Industries, Inc.
4. Nailor
5. Price
6. Titus
7. Trox

2.2 FABRICATION

A. Fixture designations as shown on the drawings.

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 15250.

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 15870

SECTION 15891
MECHANICAL CLEANING OF DUCTWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 SCOPE OF THE WORK

A. Provide all labor, materials, facilities, equipment and services to thoroughly clean ductwork systems located within the entire building.

1. The Contractor will provide the estimated dates from start to finish to perform the cleaning services.

B. The cleaning work for each building is to include but not limited to the following components:

2. All supply and return ductwork, lined and unlined, including ductwork plenums, branches, risers, etc.
3. Exhaust duct system.
4. Exhaust fan.
5. Fire and fire/smoke dampers.

C. Contractor will provide all labor, material and services to obtain access to associated components including:

1. Removal of ceiling tiles.
2. Installation of new access panels and removal/replacement of existing panels.
3. See Section 3.9 for specification on reinstallation of removed materials.

D. The bidders are encouraged to attend the pre-bid, site visit conference prior to submission of a bid proposal, to compare site conditions with drawings and/or specifications and to satisfy themselves of conditions existing at the site and all other matters that may be incidental to the work performed under this contract. No allowance will be made to the successful contractor by reason of any error on his/her part due to neglect to comply with the requirements of this paragraph. No extra charge will be allowed for work caused by unfamiliarity with the work area.

E. It is the responsibility of the Contractor to verify field conditions before start of work.

F. The Contractor will repair and replace to match existing materials where access

to walls or ceilings was made, or damage occurs, including but are not limited to:

1. Ductwork and components.
2. Insulation.
3. Others as applicable.

G. Scope of the work also includes the following:

1. The Contractor, on the basis of field inspections and review, must determine the method of cleaning the HVAC systems and its component to prevent any damage to the system and its operation. Upon completion of the initial inspection, the Contractor will notify the Project Engineer of the proposed methods and their effects to the system.
2. Reset all balancing dampers to original settings if moved during work. Be sure to mark original position so that during the final inspection, original settings can be field verified.
3. Report to Project Engineer any system defects discovered during the cleaning operation, which will require repair to an HVAC system (e.g. equipment, ductwork, dampers, registers, etc.).

1.3 QUALITY ASSURANCE

A. Ductwork shall be cleaned in compliance with latest edition of the following standards:

1. Mechanical cleaning of non-porous air conveyance system components, NADCA 1992-01.
2. Debris levels shall conform to:

Surface Debris Weight	< 100MG/100cm^3
Total Surface Bacteria	< 30,000 cfu/g
Total Surface Mold	< 15,000 cfu/g

Note: cfu/g refers to colony forming units per gram of debris.

3. Plans and specifications which exceed the requirements in any of the referenced standards.

B. All sheetmetal shall be fabricated and installed by an experienced Contractor specializing in this type of work and approved by the Engineer.

1.4 SUBMITTALS TO THE ENGINEER

A. Shop drawings locating all proposed duct penetrations and ceiling access holes in plaster ceilings.

B. Provide MSDS sheets on all solvents, cleaners and disinfectants to be used on the project.

C. Provide submittals on any equipment or materials replacing the existing during the remediation process, i.e., diffusers, flex duct, fire dampers.

PART 2 - PRODUCTS

2.1 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA Duct Construction Standards.

B. Review locations with the Project Engineer prior to installation.

C. Fabricate rigid and close-fitting doors or galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch (25 mm) thick insulation sheet metal cover. All materials to be approved prior to use.

D. Access doors smaller than 12 inches may be secured with sash locks.

E. Provide two hinges and two sash locks for sizes up to 18 inches (450 mm) square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 49 inches (600 x 1200 mm). Provide an additional hinge for large sized.

F. Access doors with sheet metal screw fasteners are not acceptable.

G. All doors must be leak tight at the completion of the job.

H. Doors shall be similar to Ventlock insulated access door, or Ruskin Model #CAD.

2.2 DUCT DISINFECTANT

A. Equal to Madacide, as supplied by Mateson Chemical, EnviroCon as manufactured by Bio-Cide International, Inc., or approved equal.

2.3 SANITIZER

A. An E.P.A. registered sanitizer "Oxine" as manufactured by Bio-Cide International or approved equal. Product shall be a mixture of Oxychloride compounds.

2.4 ENCAPSULANT

A. A duct liner adhesive coating, Foster 40-10 or 40-23, as manufactured by Foster Products Corporation, or approved equal. It shall be a quick setting waterbase adhesive and coating designed for field application to faced or unfaced fiberglass duct liner insulation, or to unfaced fiberboard ductboard insulation. The coating shall dry to form an effective air erosion preventive coating, sealing and reinforcing the surface. The coating shall be resistant to fire, water, oil, grease, bacteria and fungus.

2.5 PLENUM PLANT

A. Porous Surface: The paint shall be Porta-Sept as manufactured by Porter Plains, Inc. or approved equal. Paint shall contain an EPA registered anti-

microbial, Intersept, which inhibits the growth of bacteria, mold, mildew and fungi.

B. Non-Porous Surface: The coating shall be Tough-Coat as manufactured by Vac Systems Industries or approved equal. Coating shall meet NFPA Standards 90A and 90B, and contain an anti-microbial agent.

2.6 DUCT LINING

A. To match existing.

2.7 GASKETING

A. To match existing.

PART 3 - EXECUTION

3.1 PRE-CLEANING PREPARATIONS

A. Prior to start of work, the HVAC system is to be carefully inspected and checked for all conditions affecting the cleaning. Defects are to be reported in writing to the Project Engineer, and work will not precede until defects have been documented. Commencement of work will constitute acceptance of the conditions of the area to which the cleaning work is to be performed, and all defects in work resulting from such accepted service will be corrected by this trade without additional expense to the Owner.

No cleaning is to be performed to ducts where the process has the capability of damaging the duct lining. This decision will be made by the Project Engineer after review of the Contractor's findings, and the Project Engineer has seen the field conditions.

B. Disassemble all removable items as required for access to work area. Store the removables in a Project Engineer approved storage area until the completion of the cleaning work.

C. Fire protection devices (such as smoke detectors, panel, etc.) shall be protected prior to cleaning procedures. They are to be cleaned and tested at the conclusion of the work.

D. The Contractor shall coordinate the shutdown and reactivating of the fire alarm system to avoid accidental alarms during cleaning process and related work.

E. The Contractor shall coordinate the shutdown of the air handling equipment with the Owner before starting work, and shall conform to the OSHA requirements regarding fan motor disconnect lock-outs.

F. The Contractor shall have samples collected by gathering the gross debris from the surface of the duct at a minimum of three (3) locations per system prior to and after cleaning. This shall be accomplished by utilizing protective clean surgical gloves to handle the surface debris. A 100 cm^2 area shall be scraped, and the debris placed in a 4 oz. sterile container with a screw cap. The container

shall be adequately marked as to sample location, date and time as a minimum. The total weight will be established per 100 cm^2 of surface area. The quantity of viable microorganisms will be determined by culture methods. Data will be presented as Colony Forming Units (cfu's) per gram and will be compiled for both bacteria and mold/fungi. Samples and tests will be performed by an independent third party testing Contractor. The Contractor and Project Engineer shall conduct inspections to insure that the samples are retrieved at locations that are representative of the ductwork.

3.2 CLEANING PROCEDURES

A. Sequence of work on each air handling system:

1. Review area with the Project Engineer.
2. Determine locations of ductwork, ventilation needs, sensitive equipment protection requirements, access and cleaning procedures.
3. Notify Maintenance Staff to shut down the air handling system(s).

3.3 CLEANING AND REMOVAL METHOD

A. The following general ductwork cleaning procedures are to be used as a guideline throughout the project. Determination of which method should be used in each area is to be made by the Contractor and the Project Engineer. Contractors are to provide detailed procedures in their bid proposal. Deviations from specified methods of removal must be approved by the Project Engineer prior to their implementation.

B. Methods:

1. Debris Collection Equipment:

a. Equipment used shall be portable and sized to enter the areas easily. Electrical requirements shall be the responsibility of the Contractor, and any cost incurred due to modifications to the electrical systems shall be at the Contractor's expense.
b. The collection systems shall be self-contained units, with the appropriate components to adequately collect dirt and debris loosened from the ductwork. Air duct cleaning is to be performed by a high powered vacuum system with three stages of filtration. The final stage shall be HEPA filter. HEPA efficiency shall be 99.97 @ 0.3 micron.
c. The collection system shall be capable of producing a minimum of .42" water gauge negative static pressure in the area of ductwork to be cleaned.

2. Agitation Equipment:

a. Air power cleaning of all interior ductwork, fan housings and HVAC units performed by a high pressure compressed air system which will be directed through small access doors in the ductwork. All access doors are to be provided per Section 2.1.

b. Compressed air powered Gollum technology generating 90 CFM at 110 psi, as means of dislodging the debris shall be used. Air powered lances, extended whip sections, or oscillating brush systems may also be used.
c. Electric robotic air powered brushing systems, or electric rotary brush systems may be used.
d. Cleaning tools such as skipper balls, or air sweeps may not be used due to their inability to contact clean all sides of the duct.
e. Where ductwork is large enough and able to support the weight of a worker, hand tools and vacuums may be used. If workers enter the inside of the duct, they must follow the OSHA confined space requirements (OSHA 29 CFR 1910.146).

C. Open Ductwork: During the cleaning process, provide temporary closures of metal or taped polyethylene on open ductwork to prevent the dust during the cleaning process from dispersing throughout the work area.

D. All lined ductwork is to be encapsulated as applicable.

E. Controlling Odors: All responsible measures shall be taken to control any and all offensive odors and/or mist vapors generated during the cleaning process.

F. Containment: Debris removed during the cleaning process shall be collected and tagged as to its origin within the Air Conveyance System (ACS). Precautions must be taken to ensure that debris is not dispersed outside the ACS during the cleaning process.

3.4 CLEANING OF HVAC COMPONENTS

A. Ceiling Plenums and Mechanical Rooms: All loose debris shall be removed, and the entire ceiling plenum or mechanical room including, but not limited to, duct exterior, walls, deck, top of ceiling tiles, structural steel, piping, conduit, light fixtures shall be mechanically vacuumed. The plenum or Mechanical Room shall be visibly clean, but will not be subject to verification as per NADCA Standards.

B. Volume, Fire and Zone Dampers: Duct mounted volume, fire and zone damper sets are to be marked to their current setting, then inspected and cleaned if necessary. External moving parts are to be treated with an approved dry lubricant material. After cleaning, the dampers shall be repaired as necessary to insure proper operation and returned to original settings. Contractor shall indicate locations of damaged and/or repaired dampers.

3.5 FINAL INSPECTION

A. A final check is to be carried out to ensure that no dust or debris remain on surfaces as the result of dismantling operations.

B. The Project Engineer will thoroughly inspect the place jointly with the Contractor, to determine whether any damage has been done on the finishes, equipment or

any other part of the work place. A final inspection report will be prepared jointly between the Project Engineer and the Contractor detailing the list of items to be fixed by the Contractor.

3.6 VERIFICATION

A. General verification of cleanliness will be determined after Mechanical Cleaning and before the application of any treatment or introduction of any treatment-related substance. Verification of Non-Porous Surface cleaning and shall be conducted after Mechanical Cleaning and before the system is restored to normal operation.

B. Verification of Non-Porous Surface Cleaning:

1. All Non-Porous Interior Duct surfaces must be visibly clean and capable of passing the NADCA Vacuum Test.
2. The weight of debris collected by the NADCA Vacuum Test, as outlined in Appendix A of the NADCA Standards, shall not exceed 1.0 mg/cm^2.
3. The Contractor shall include in the bid, the cost for four independent vacuum tests to be performed at the time and location as directed by the Engineer. If any areas fail, the failed area shall be recleaned and retested at no cost to the Owner.
4. Debris shall conform to the following:

Surface Debris Weight	< $100mg/100cm^2$
Total Surface Bacteria	< 30,000 cfu/g
Total Surface Mold	< 15,000 cfu/g

Note: Cfu/g refers to colony forming units per gram of debris.

3.7 SEQUENCE OF WORK

A. Since the systems must be operational during the normal work hours, the Contractor shall submit to the Owner a procedure and schedule for cleaning the ductwork and installing filters which will minimize contamination of already cleaned areas. This schedule must be approved by the Owner prior to starting work.

3.8 SANITATION

A. A sanitizer shall be applied to all supply and return air metal only ductwork cleaned as part of this project. Application shall be as per manufacturer's recommendation.

3.9 RESTORATION, REPAIRS AND INSTALLATION

A. Repair and restore space in accordance with the final inspection list specified herein. If no additional modification of the work space is to take place, re-install all removable equipment and fixtures back in the space.

B. Any damages to the finishes, floor, walls or any other item or fixture that has been the result of actions by the Contractor personnel is to be repaired to their original condition without any additional costs.

C. Reinstall existing and install new accessories in accordance with manufacturer's instructions.

D. Demonstrate resetting of fire and balancing dampers to authorities having jurisdiction and Owner's representative.

E. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers at fire dampers, and elsewhere if required. Provide suitable size access doors for hand access or shoulder access where necessary.

F. Reconnect mixing box to ducts. Replace flexible ducts, clamps and gasketing if damaged during removal.

G. Reconnect diffusers to ducts, replace straps or clamps and flexible duct if damaged during removal.

H. Repair or replace duct insulation damaged during the work. Materials to match existing.

I. The Contractor shall replace existing prefilters and filters with new filters for each system as required.

END OF SECTIONN 15891

SECTION 15900
BUILDING MANAGEMENT SYSTEM

Part 1 – General

1.1 General

A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.2 BMS Description

A. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

C. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.

D. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

F. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

G. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BMS functions.
5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.

1.3 Quality Assurance

A. General

1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.
2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
3. The BMS Contractor shall have a branch facility within a 50-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. Maximum response time shall be 3 hours.
4. As evidence and assurance of the contractor’s ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer’s latest standard of design at the time of bid.
6. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system both existing and new.

B. Workplace Safety And Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.

2. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.

3. The Contractor and its employees and subtrades shall comply with federal, state and local safety regulations.

4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.

5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.

6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.

7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.

8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.

9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manger shall be empowered to make technical, scheduling and related decisions on behalf of the BMS Contractor. At a minimum, the Project Manager shall:

Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
Manage the financial aspects of the BMS Contract.
Coordinate as necessary with other trades.
Be responsible for the work and actions of the BMS workforce on site.

1.4 Work By Others

A) The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX

BMS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	Low Volt. WIRING/TUBE	LINE POWER
BMS low voltage and communication wiring	BMS	BMS	BMS	N/A
BMS conduits and raceway	BMS	BMS	BMS	BMS
Automatic dampers	BMS	15	N/A	N/A
BMS Current Switches.	BMS	BMS	BMS	N/A
BMS Control Relays	BMS	BMS	BMS	N/A
All BMS Nodes, equipment, housings, enclosures and panels.	BMS	BMS	BMS	BMS
Fan Coil Unit controls	BMS	BMS	BMS	16
Control damper actuators	BMS	BMS	BMS	16

1.5 Submittals

A. Shop Drawings, Product Data, and Samples

1. The BMS contractor shall submit its qualifications to the Owner's Authorized Representative after bidding has been completed but prior to the submittal of shop drawings. These qualifications shall be submitted within 15 days of contract award.
2. Once the BMS contractor receives approval from the OAR for their qualifications, the BMS contractor shall submit a list of all shop drawings with submittals dates within 45 days of contract award.
3. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
4. Allow 15 working days for the review of each package by the Engineer in the scheduling of the total BMS work.
5. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
6. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
7. The BMS Contractor shall correct any errors or omissions noted in the first review.
8. At a minimum, submit the following:
   a. BMS network architecture diagrams including all nodes and interconnections.
   b. Systems schematics, sequences and flow diagrams.

c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
d. Samples of Graphic Display screen types and associated menus.
e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
g. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
h. Details of all BMS interfaces and connections to the work of other trades.
i. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 Record Documentation

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
   a. Table of contents.
   b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings on the latest version of AUTOCADD shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
   c. Manufacturers product data sheets or catalog pages for all products including software.
   d. System Operator’s manuals.
   e. Archive copy of all site-specific databases and sequences.
   f. BMS network diagrams.
   g. Interfaces to all third-party products and work by other trades.
2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 Warranty

A. Standard Material and Labor Warranty:

1. Provide a two-year labor and material warranty on the BMS.
2. If within twenty-four (24) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in

operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.

3. Maintain an adequate supply of materials within 50 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.

2. Part 2 – Products

2.1 Network Area Controllers (NAC)

A. The Network Area Controller (NAC) shall provide a thin-client, Graphical User Interface (GUI) to the Building Automation System (BAS).

1. Local Access. The NAC shall be installed upon the owner's Local Area Network (LAN) and shall support local operator access using standard web browsers including at a minimum Microsoft Internet Explorer 8, Mozilla Firefox 3, Google Chrome 7, and Apple Safari 6.

2. Remote Access. A high-speed connection from the NAC to the Wide Area Network (WAN) shall be provided and maintained by the owner to facilitate remote operator access to the BAS using the standard web browsers including at a minimum Microsoft Internet Explorer 8, Mozilla Firefox 3, Google Chrome 7, and Apple Safari 6.

B. The NAC(s) shall meet or exceed the requirements of a BACnet® Operator Workstation (B-OWS) and a BACnet® Building Controller (B-BC).

C. The NAC(s) shall not require any hardware, software or firmware licensing agreements.

D. The NAC(s) shall support the following hardware characteristics as a minimum:

1. One (1) ISO-8802.3 Ethernet Port – 10/100 Mbps

2. One EIA-232 Port – 115.2 Kbps maximum

3. Two EIA-485 Ports – 76.8 Kbps maximum

4. Local onboard and/or expandable hardware inputs/outputs (I/O)

a. Expandable to a minimum of 96 Inputs and 64 Outputs

5. 8 MB operating RAM

6. 1 MB non-volatile RAM

7. 128 MB Flash EEPROM

E. The NAC(s) shall support the following communication protocols at a minimum:

1. ASHRAE 135-2008 BACnet®

a. Point-to-Point (PTP)

b. Master Slave/Token Passing (MS/TP)

c. Ethernet

d. BACnet® IP (B/IP)

2. Modbus

a. RTU (master or slave)

b. TCP (master or slave)

3. Simple Mail Transfer Protocol (SMTP)

4. Simple Network Management Protocol (SNMP)

5. Hyper Text Transfer Protocol (HTTP)

6. Short Message Service (SMS) – for GSM / GPRS modems

F. The NAC database and all necessary Graphical User Interface (GUI) resources including animations are to be stored on the NAC. Web-enabled applications that require system graphics to be stored on the client machines will not be acceptable.

G. The NAC shall support unlimited access by five (5) simultaneous clients

H. Multiple NAC devices shall be capable of being installed on the same BACnet® internetwork without any separate server applications, separate network management or additional licensing.

1. Browser clients shall have the ability to access any NAC on the internetwork directly

I. The NAC shall provide native BACnet® communications directly with all BACnet® devices on the BACnet® internetwork. Applications that require translation of data, gateways, or mapping of any kind shall not be acceptable.

1. The NAC shall provide BACnet® client and server functionality on all data links without any additional modules or licensing

J. Real-time values displayed on the web browser shall update automatically without requiring a manual “refresh” of the web page.

K. HTML programming shall not be required to create or display system graphics or

data on a web page.

L. A new point displayed on a B-OWS graphic screen shall appear automatically on the identical graphic screen served by the NAC with no further programming or file transfer required.

M. The NAC shall be capable of automatically uploading any changes to existing GUI images or animations.

N. The NAC shall support operator interface via the web browser the following at a minimum:

1. Password Protection

a. Multiple-level password access protection shall be provided.

b. Passwords may be exactly the same for all software applications provided to communicate with the internetwork including the web-based browser interface. Passwords and access credentials shall be able to be imported from the B-OWS to the NAC.

c. A minimum of [99] levels of access shall be supported with a configurable matrix of operator actions allowed for each access level, broken down into at least 20 possible operator actions

d. A minimum of 128 passwords shall be supported at each NAC

e. Operators will be able to perform only those commands available for their respective passwords.

f. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving an NAC browser interface in an unsupervised logged-in state.

g. The NAC shall be configurable to provide read-only access without requiring log-on

h. Unencrypted passwords shall not be transmitted between the NAC and the client browser

2. Alarming and Event Notification

a. NAC shall be capable of generating configurable automatic and dynamic alarm notification that is presented on-top of any current browsing screens in the form of a pop-up message

b. NAC shall be capable of e-mail notification of system alarms configurable to include notification class, recipient, inclusive and exclusive times and days as well as transition states (to alarm, to fault, return to normal)

c. System shall provide log of notification messages.

d. Alarm messages shall be in user-definable text and shall be entered either at the B-OWS terminal or via remote communication

e. An alarm summary shall be available to show all alarms including but not limited to whether or not they have been acknowledged

f. System shall provide ability to prioritize and differentiate communications for at least 255 different levels of alarms

g. Alarm messages shall be fully customizable in size, content, behavior and sound.

3. Weekly, Annual and Special Event Exception Scheduling

a. Provide ability to view and modify the schedule for the calendar week and up to 255 special events in a graphical format. Each calendar day and special event shall provide at least six time/value entries per day.

b. Provide the ability for the operator to select scheduling for binary, analog, or multi-state object values.

c. Provide the ability for the operator to designate days, date ranges, or repeating date patterns as exception schedules.

d. Provide the capability for the operator to define special or holiday schedules and to link the BACnet schedule to a BACnet calendar, thereby over-riding weekly schedule programming on holidays defined in the BACnet calendar.

e. There shall be a provision with proper password access to manually override each schedule.

f. Provide the capability to designate any exception schedule to be “Executed Once” then automatically cleared.

g. Provide the ability to name each exception schedule with a user defined term to describe each special event.

4. Trend Log Graphing

a. All data points (both hardware and software) system-wide shall be assignable to a historical trending program by gathering configurable historical samples of object data stored in the local controller (B-BC, B-AAC, B-ASC).

b. All trend log information shall be displayable in text or graphic format. All information shall be able to be printed in black & white

or color and exported directly to a Microsoft Excel Spreadsheet.

5. Runtime Log Information

   a. B-OWS Software shall be capable of displaying Runtime and On/Off Cycle data of all Binary data points (both hardware and software) system-wide. Runtime logs shall provide the following at a minimum:

      1) Total Accumulated Runtime

      2) Accumulated Starts Today

      3) Total Accumulated Starts

      4) Timestamp each Start/Stop and duration of each on/off cycle

      5) Monitor equipment status and generate maintenance messages based upon user designated run time

6. Ability to Manually Override any Database point

   a. All hardware and software points may be temporarily overridden for a user adjustable configured time period

7. Custom navigation file tree

8. Color Graphical User Interface (GUI)

   a. All color graphic displays shall be dynamic with current point data automatically updated from the BACnet internetwork to the browser without operator intervention. Manual operator intervention shall use the same methodology as on the B-OWS application.

   b. Depending upon configured access level; the operator shall be able to manually adjust digital, analog or calculated values in the system, adjust values of control loops, override points or release points to automatic mode.

O. The NAC shall provide the capability to create individual user (as determined by the log-on user identification) home pages. Provide the ability to limit a specific user to a defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

P. The NAC shall include an Audit Trail feature that automatically records the time, date, and user, and action associated with all user changes made via Web Browser clients.

Q. The NAC shall store complete help files describing system configuration, and use

of the browser interface, the help files shall be served on-line as part of the browser interface.

1. The web browser interface shall include tool tips to describe the functionality of the interface.

2.2 Advanced Applications Controllers (AAC)

A. General

1. Provide a micro-processor based, networkable, custom programmed, BACnet® Advanced Application Controller for each heat pump, wall-mounted where shown on floor-plans. Each AAC shall include an LCD user interface and all input/output points required to monitor and control each unit as a stand-alone system, according to the specified sequence of operation. In addition AAC's shall allow monitoring and remote control via a supervisory network (BACnet) with a WEB-Based Browser-accessible front end.

2. Provide a 5 year standard manufacturer's warranty for the AAC

B. Network Protocol and Operator Connections

1. The AAC's shall allow direct connection to a host network using BACnet® MS/TP (EIA-485) protocol. The network communication speed shall be operator selectable up to 76.8 kbps.

2. Each AAC shall be BTL tested, and listed to meet the B-AAC Standard Device Profile including BIBBs for this level of device. A Protocol Implementation Conformance statement for the AAC proposed shall be submitted along with shop drawings. Network points to be viewable on each AAC are listed in the sequence of operation, however provide a minimum of 32 Read/Write objects per AAC.

3. Each AAC shall include an externally mounted port allowing operators to connect a laptop computer directly to the AAC for network configuration, custom programming, and trouble-shooting.

C. Hardware Components

1. Provide the following hardware input points at minimum in each AAC:
   a. Room temperature sensor, local or remote 10K thermistor with an accuracy of +/- 0.1 Deg C
   b. User set-point adjustment control with programmable set-point limits
   c. On-board room humidity sensor, with replaceable CMOSense element, overall accuracy of +/- 1.8 % over 10 – 90 % range
   d. On-board room passive infra-red occupancy sensor, with a maximum detection distance of 5m (16.4 ft), and 64 detection zones

e. In addition to the above, provide 4 user-definable universal inputs capable of accepting 0 -5 VDC, 4 – 20 mA, 10K thermistor, or dry contacts. Refer to the sequence of operation for specific input point requirements.

2. Provide hardware analog and digital output points as required by the sequence of operation, however include the following point types at minimum to allow for future expansion:
   a. Six universal outputs, user-definable as analog or digital
   b. Two additional digital output points
   c. Digital output points shall be dry contacts capable of switching 0.5 Amps at 24 VAC.
3. Provide a large LCD screen for display and adjustment of AAC points and mapped network points. Security codes MUST be provided to prevent unauthorized access from the local LCD screen. Minimum LCD size shall be 128 x 64 pixels. The screen shall be back-lit, however the light may be configured to shut off after a programmable inactive time.

4. Provide push-buttons on the panel face to facilitate navigation, point adjustment, data entry, and switching of operational modes (password protected).

5. AAC memory shall include a minimum 64 Kb RAM for logs and temporary data, and 512 kb flash EEPROM for non-volatile storage of firmware configuration and custom database. Provide a 24 hour clock and 365 day calendar on-board. Clock accuracy shall be +/- 1 second over 24 hours, and system time shall be retained during power outages exceeding 7 years.

6. Provide a software configurable buzzer which shall be set-up to trigger on the occurrence of selected alarms, and shall be audible and acknowledgeable either to all users, or only to those users with sufficient password authority.

7. AAC's shall be capable of monitoring and controlling at least 4 networked, remote temperature sensors, each with adjustable set-point and outputs for zone controls. These networked sensors shall not consume input/output points in the AAC.

D. Custom Configuration

1. Each AAC shall allow custom setup of the primary user interface screen; definition of all points to be monitored, controlled and displayed; alarms; schedules; trends; password access; and programmed sequence of operation as required to optimize the AAC for the specific requirements of this project, and also to allow future modification by the owner. AAC's using canned programs for pre-determined HVAC applications are not acceptable.

2. Each AAC shall allow the following custom set-up at minimum:

a. Primary User Interface screen set-up, including display of time, system mode, fan mode, primary temperature display, and display of up to 3 additional operator-defined AAC or network points.
b. ALL physical Inputs AND Outputs of the controller MUST be able to be overridden at the LCD screen for technician checkout of the system locally.
c. Seven additional user defined point groups, each including up to six AAC or network points per group, to be displayed and adjusted by system users with sufficient password authority. Each group, and each individual point shall be defined to allow/disallow editing and manual override by users, and the password level required. Point definition shall also determine if units are to be displayed, and whether point names are displayed as text, or alternatively using an icon chosen from an on-board list of industry standard symbols.
d. custom programs of 2000 bytes each, using a BASIC control language, with source code stored on board.
e. The AAC may be defined with full access by all users without password protection, or with three levels of password protected access. Each level of access shall be enabled by entering a 4 digit password via the front panel keys. AAC's that require removal of the faceplate to unlock the keyboard are not acceptable.
f. Alarm states shall be defined using AAC custom programming, with the definition including the password level required to acknowledge, reset, and clear alarms. When an AAC alarm condition exists, an alarm icon shall be displayed on all screens.
g. 48 user-definable program-driven variables, with selectable ranges and standard or custom units.
h. user-definable PID controls loops
i. user-definable trend logs, each with 150 samples of 6 points each, and programmable sampling times
j. 8 user-definable runtime logs to accumulate the run-times of selected digital points, and record the time and date of the last 100 changes of state
k. 2 user-definable system groups, 50 points per group, allowing related points to be grouped together on one display for use in network graphics
l. 1 user-definable weekly schedule, including 4 on/off pairs for each weekday, and two additional daily schedules triggered by the annual schedule or by custom programming
m. Override of the unoccupied schedule for a programmed period of time shall be triggered via a front panel button
n. 1 annual schedule, allowing pre-programming of holidays 365 days in advance

2.3 Input Devices

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.
2. Outside Air Sensors
    a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
    b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
    c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
3. Duct Mount Sensors
    a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
    b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
    c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

B. Humidity Sensors

1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
7. Acceptable Manufacturers: Veris Industries, and Mamac.

C. Power Monitoring Devices

1. Current Measurement (Amps)
    a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.

b. Current Transformer – A split core current transformer shall be provided to monitor motor amps.
   - ◊ Operating frequency – 50 - 400 Hz.
   - ◊ Insulation – 0.6 Kv class 10Kv BIL.
   - ◊ UL recognized.
   - ◊ Five amp secondary.
   - ◊ Select current ration as appropriate for application.
   - ◊ Acceptable manufacturers: Veris Industries

c. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
   - ◊ 6X input over amp rating for AC inrushes of up to 120 amps.
   - ◊ Manufactured to UL 1244.
   - ◊ Accuracy: +.5%, Ripple +1%.
   - ◊ Minimum load resistance 30kOhm.
   - ◊ Input 0-20 Amps.
   - ◊ Output 4-20 mA.
   - ◊ Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).
   - ◊ Acceptable manufacturers: Veris Industries

D. Status and Safety Switches

1. General Requirements

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

d. Acceptable manufacturers: Veris Industries

2.4 Output Devices

A. Actuators

1. General Requirements
    a. Damper and valve actuators shall be electronic as specified in the System Description section.
2. Electronic Damper Actuators
    a. Electronic damper actuators shall be direct shaft mount.
    b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
    c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
    d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
    e. Acceptable manufacturers: Belimo or equivalent.

B. Control Dampers

1. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.
2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches

in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48”x48” size shall not leak in excess of 8.0 cfm per square foot when closed against 4” w.g. static pressure when tested in accordance with AMCA Std. 500.

5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5” w.g., but no more than 4000 FPM or 6” w.g. Acceptable manufacturers are Ruskin CD50 and Vent Products 5650.
6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Ruskin CD36 and Vent Products 5800.
7. Multiple section dampers may be jack-shafted to allow mounting of direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

1. Control Pilot Relays
   a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
   b. Mounting Bases shall be snap-mount.
   c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
   d. Contacts shall be rated for 10 amps at 120VAC.
   e. Relays shall have an integral indicator light and check button.
   f. Acceptable manufacturers: Lectro or equivalent.
2. Lighting Control Relays
   a. Lighting control relays shall be latching with integral status contacts.
   b. Contacts shall be rated for 20 amps at 277 VAC.
   c. The coil shall be a split low-voltage coil that moves the line voltage contact armature to the ON or OFF latched position.
   d. Lighting control relays shall be controlled by:
      ◊ Pulsed Tri-state Output – Preferred method.
      ◊ Pulsed Paired Binary Outputs.
      ◊ A Binary Input to the Facility Management System shall monitor integral status contacts on the lighting control relay. Relay status contacts shall be of the “dry-contact” type.
   e. The relay shall be designed so that power outages do not result in a change-of-state, and so that multiple same state commands will simply maintain the commanded state. Example: Multiple OFF command pulses shall simply keep the contacts in the OFF position.

D. Electronic Signal Isolation Transducers

1. A signal isolation transducer shall be provided whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
2. The signal isolation transducer shall provide ground plane isolation between systems.
3. Signals shall provide optical isolation between systems.
4. Acceptable manufacturers: Advanced Control Technologies

E. External Manual Override Stations

1. External manual override stations shall provide the following:
   a. An integral HAND/OFF/AUTO switch shall override the controlled device pilot relay.
   b. A status input to the Facility Management System shall indicate whenever the switch is not in the automatic position.
   c. A Status LED shall illuminate whenever the output is ON.
   d. An Override LED shall illuminate whenever the HOA switch is in either the HAND or OFF position.
   e. Contacts shall be rated for a minimum of 1 amp at 24 VAC.

2.5 Miscellaneous Devices

A. Power Supplies

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC +10%, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

3. Part 3 – Performance / Execution

3.1 BMS Specific Requirements

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.

2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection. .

B. Custom Reports:

1. Provide custom reports as required for this project:

C. Actuation / Control Type

1. Primary Equipment
   a. Controls shall be provided by equipment manufacturer as specified herein.
   b. All damper and valve actuation shall be electric.
2. Air Handling Equipment
   a. All air handlers shall be controlled with a HVAC-DDC Controller
   b. All damper and valve actuation shall be electric.

3.2 Installation Practices

A. BMS Wiring

1. Refer to Specification Section 15058 CONTROL WIRING.

B. BMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

   Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

C. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

D. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.

E. HVAC Input Devices – General

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.
3. Outside Air Sensors
   a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
   b. Sensors shall be installed with a rain proof, perforated cover.

4. Duct Temperature Sensors:
    a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
    b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
    c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
    d. The sensor shall be mounted to suitable supports using factory approved element holders.
5. Space Sensors:
    a. Shall be mounted per ADA requirements.
    b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.

3.3 Training

A. The BMS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

3.4 Sequences

Refer to Sheet M701 for sequence of operations.

ATTACHMENT I

DMZ SECURITY STANDARD

1.0 Purpose

The purpose of this document is to establish requirements that will better manage and secure all platforms within the Orange County Government Board of County Commissioners (OCGBCC). The DMZ is a secure environment with limited access to the OCGBCC internal network.

2.0 Scope

The scope of this document applies to all platforms located within the OCGBCC DMZ.

3.0 Policies

3.1 Activity

Any and all activity within and through the OCGBCC DMZ shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

3.2 Web Servers

All internal ISS-ESU policies apply to the OCGBCC DMZ and are augmented by the DMZ Security Standard. The following differences are noted:

3.2.1 Microsoft Internet Information Server (IIS) version 5.0 or higher shall be the only platform within the OCGBCC DMZ to run as a Web or FTP server.

3.2.2 All platforms within the OCGBCC DMZ shall be patched immediately upon the release and testing by the ISS-ESU.

3.3 Administrative Rights

ISS-ESU shall be the only group with administrative rights to servers in the DMZ.

3.4 Production Servers

The OCGBCC DMZ shall host production servers only.

3.5 Remote Access

Remote Access to the OCGBCC DMZ shall be allowed only using Microsoft Terminal Services or Microsoft Remote Desktop protocols.

3.6 Traffic

3.6.1 Internet Activity

HTTP/HTTPS/FTP/SMTP/IMAPS are the only protocols allowed from the Internet into the DMZ.

3.6.2 Internal Activity

Traffic using the following protocols from the DMZ to the internal network shall not be allowed: Kerberos, NetBIOS, Microsoft-DS, Microsoft's Well Known Ports (88, 135, 137, 138, 139, 389, 445, 464, 530, 543, 544, 636, 749, 3389), LDAP, RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.

3.6.3 Routing

3.6.3.1 All approved access from the DMZ to the internal network shall be routed through a proxy server residing in the DMZ.

3.6.3.2 The Enterprise DMZ proxy server shall only use firewall conduits to access approved resources within the OCGBCC network.

3.7 Data

3.7.1 Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.

3.7.2 Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: Name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information.

3.7.3 The OCGBCC DMZ shall not have access to data containing bank information.

3.7.4 The OCGBCC DMZ shall not have access to social security information.

3.7.5 The OCGBCC DMZ shall have read only access to live data, if such data is also used by applications residing in the internal OCGBCC network.

4.0 Guidelines

4.1 Should databases in policy 3.7.4 need to receive updates by the OCGBCC DMZ, the write operations should be made to a physically separate "staging" data repository. This separate data repository should contain only updates for the specific records being changed. An application server within the internal network should be used to apply the changes in the staging data repository to the live database.

4.2 The DMZ should access data repositories in the internal OCGBCC network using SQL database calls.

5.0 Enforcement

Any server found within the OCGBCC DMZ that does not met the above criteria shall be immediately disconnected from the OCGBCC DMZ. Any employee found to have violated this policy may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions

Term	Definition
Bank Information	Checking account numbers, credit card numbers, or any unique number from a bank institution.
HTTP	HyperText Transfer Protocol – The underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions web servers and browsers should take in response to various commands.
HTTPS	HyperText Transfer Protocol over Secure Socket Layer (SSL) – By convention, URLs that require an SSL connection start with https: instead of just http:.
FTP	File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.
SMTP	Simple Mail Transfer Protocol – A protocol for sending e-mail messages between servers. In addition, SMTP is generally used to send messages from a mail client to a mail server.
IMAPS	Internet Message Access Protocol – A protocol for retrieving e-mail messages. With IMAP4, you can search through your e-mail messages for keywords while the messages are still on mail server and, then, choose which messages to download to your machine.
LDAP	Lightweight Directory Access Protocol – A set of protocols for accessing information directories.
DNS	Domain Name System (or Service or Server) – An Internet service that translates domain names into IP addresses. Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on numeric IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address.
SQL	Structured query language – SQL is a standardized query language for requesting information from a database.
DMZ	Demilitarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.
SSL	Secure Sockets Layer – A protocol for transmitting private documents via the Internet. SSL uses a cryptographic system that uses two keys to encrypt data - a public key known to everyone and a private or secret key known only to the recipient of the message.

ATTACHMENT II

ENCRYPTION AND CERTIFICATION AUTHORITIES

1.0 Purpose

The purpose of this document is to ensure that all Orange County Government Board of County
Commissioner's (OCGBCC) sensitive data is secured by using strong encryption algorithms that have received substantial public review and have been proven to work effectively. Orange County Information Systems and Services Enterprise Security unit (ISS-ESU) provides access to a variety of Encryption Services and Enterprise Certification Authorities (CA).

2.0 Scope

This document applies to all data transmitted and stored within the OCGBCC information systems. It applies to all OCGBCC employees, consultants, and all other affiliated third parties operating within the OCGBCC information systems and networks.

3.0 Policies

3.1 Activity

3.1.1 Any and all activity within and through the OCGBCC information systems involving encryption shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

3.1.2 The ISS-ESU shall approve the storage and transfer of any data containing personal information and/or residing in the DMZ.

3.2 Encryption Algorithms

3.2.1 One of the following standard encryption ciphers shall be used to encrypt data. The key length for these algorithms shall be no less than 128bits:

- Triple-DES (3DES)
- Rijndael (AES)
- RSA
- Blowfish
- Twofish
- CAST

3.2.2 PGP is an approved encryption standard provided that the PGP private key used to encrypt and /or sign data has been generated using a cipher meeting the requirements in section 3.2.1.

3.3 Data Hashing

The following standard data hashing algorithms shall be used to hash data. The key length for the algorithms shall be no less than 128bits.

- MD5
- SHA-1
- SHA-2

3.4 SSL Certificates
Web Server, SSH, IMAPS, SMTPS SSL certificates should have key lengths of no less than 128bits.

3.5 Sensitive Data
Any data containing sensitive information, including, but not limited to: name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information, should be encrypted when stored and during network transfers.

3.6 DMZ

3.6.1 Any and all activity within and through the OCGBCC DMZ shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

3.6.2 Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.

3.6.3 Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information.

3.7 Data Backups

3.7.1 Any backup of OCGBCC should be encrypted. Sensitive data as listed in 3.5 of this document shall be backed up using encryption algorithm standards found in 3.2.

3.8 Laptops and Removal Devices

3.8.1 All laptop hard drives should be encrypted.

3.8.2 Any sensitive data (see section 3.5 of this document) stored on laptops and removable devices shall be encrypted.

3.8.3 All individuals who work with sensitive data (see section 3.5 of this document) shall have their laptop hard drives encrypted.

4.0 Guidelines

4.1 SSL certificates issued to servers and applications used by internet users should be provided by commercial CA authorities (i.e. Verisign, Thawte) to avoid security warnings from being presented to the end users.

4.2 SSL certificates issued to servers and applications used by internal OCGBCC resources should be issued by OCGBCC's Certification Authority.

5.0 Enforcement

Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions

Term	Definition
Encryption	Transforming understandable data into a form that is incomprehensible and that looks like random noise.
Hashing	An algorithm that takes an entire message and, through process of shuffling, manipulating, and processing the bytes using logical operations, generates a small message digest of the data.
DMZ	De-Militarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.
Certification Authority (CA)	In cryptography, a certificate authority or certification authority (CA) is an entity which issues digital certificates for use by other parties.

ATTACHMENT III

ANTIVIRUS STANDARDS

1.0 Purpose

The purpose of this document is to establish requirements which must be met by all computers connected to the Orange County Government Board of County Commissioners (OCGBCC) network to ensure effective virus detection and prevention.

2.0 Scope

This document applies to all OCGBCC computers running any version of the Microsoft Windows Operating Systems. This includes, but is not limited to, all servers, desktop computers, laptop computers, PC-based printers and appliances.

3.0 Policy

3.1 Virus Software – Servers

Trend Micro Server Protect or Trend Micro OfficeScan shall be installed and enabled on all OCGBCC computers running any server version of the Microsoft Windows Operating Systems.

3.2 Virus Software – Workstations

Trend Micro OfficeScan shall be installed and enabled on all OCGBCC computers running any non-server version of the Microsoft Windows Operating Systems.

3.3 Virus Software – Exchange Servers

Trend Micro ScanMail shall be installed and enabled on all OCGBCC computers running Microsoft Exchange Server.

3.4 Virus Software – Internet Mail

All incoming and outgoing internet email shall be scanned by Trend Micro Interscan Messaging Security Suite before being delivered.

3.5 Virus scanning

Antivirus software shall be running at all times on the computers on which it is installed. Real-time scanning of incoming and outgoing files shall be enabled at all times. Antivirus scans of servers shall be executed on a weekly basis in accordance with the schedules set in Trend Micro Server Protect. Antivirus scans of workstations shall be executed on a weekly basis in accordance with the schedules set in Trend Micro OfficeScan.

4.0 Guidelines

- When employees receive unwanted and unsolicited emails, they should be deleted and should avoid replying to the sender. These messages should not be forwarded.
- Employees should never open any files or macros attached to an email from an unknown, suspicious or untrustworthy source. These attachments should be deleted immediately. These messages should not be forwarded.
- Employees should never download files from unknown or suspicious sources.

5.0 Enforcement

Trend Micro’s antivirus products are installed on all servers and workstations during the initial installation of the operating systems, and are continuously monitored to ensure they are running. Any employee or temporary found to have willfully stopped and/or paused these programs will be considered to be violating these policies and may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions

Term	Definition
Virus	A program or piece of code that is loaded onto your computer without your knowledge and runs against your wishes. Viruses can also replicate themselves. All computer viruses are manmade. A simple virus that can make a copy of its self over and over again is relatively easy to produce. Even such a simple virus is dangerous because it will quickly use all available memory and bring the system to a halt. An even more dangerous type of virus is one capable of transmitting itself across networks and bypassing security systems.

ATTACHMENT IV

WEB SECURITY STANDARD

1.0 Purpose

The purpose of this document is to establish requirements that will better manage and secure all web server platforms within the Orange County Government Board of County Commissioners (OCGBCC).

2.0 Scope

The scope of this document applies to all web server platforms located within the OCGBCC.

3.0 Policies

3.1 Activity

Any and all web server installations, removals or modifications shall require the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

3.2 Hardware

3.2.1 All hardware platforms operating as a web server shall abide by all standards, policies and guidelines of the OCGBCC Enterprise Systems unit.

3.2.2 All hardware platforms operating as a web server shall reside on server hardware. Any exception shall require a documented wavier by the Information Systems and Services Enterprise Security unit (ISS-ESU).

3.3 Software

3.3.1 Web Server Platforms

3.3.1.1 Microsoft

Microsoft's Internet Information Server (IIS) is the approved, supported web server platform for OCGBCC.

3.3.1.2 Apache Software Foundation

Apache Software Foundation's HTTP Server (Apache) is approved but is unsupported. Any production use of (Apache) shall include an appropriate support model that is approved by the ISS-ESU.

3.3.1.3 Other

Other web server platforms may qualify for use, but shall require an evaluation, approval and a documented wavier by the ISS-ESU.

3.3.2 Databases

3.3.2.1 Location
A database server shall not reside on the same hardware platform as a web server.

3.4 Security

3.4.1 General
All web servers shall comply with all other documented ISS-ESU standards to include, but not limited to: virus, patch and account management.

3.4.2 Account Management

3.4.2.1 Local Account Access
Only accounts with local administrator privileges shall be allowed to log on locally to a web server.

3.4.2.2 Process/Application Accounts
All web server processes and applications shall run only under a low privilege local account. Web server processes shall not run under an account with domain, power user or a local administrator privileges.

3.4.2.3 Web Server Anonymous Accounts
Web server anonymous accounts shall only have read and execute permissions to folders/files within the web server directories. Change and delete permissions to folders/files that are directly accessible via a web browser shall not be granted to web server anonymous accounts.

3.4.3 Permissions

3.4.3.1 Operating System Permissions
ISS-ESU shall secure the operating system's file/folder permissions and security policies of all web servers. These permissions are to be modified solely by ISS-ESU.

3.4.3.2 Vendor/Third Party Access
Local administrator privileges on web servers are for authorized personnel only. Access to vendors and any other third party shall be provided solely on a temporarily, case-by-case basis through ISS-ESU.

3.4.3.3 Developer Access
Developer access to web server content directories shall be available by WebDav or FrontPage server extensions only. Developers shall be granted "Author Pages" rights with the FrontPage Server Extensions

3.4.4 Java Server Engines
Java server engines are approved but are not supported. Any production use of a Java server engine shall include an appropriate support model that is approved by (ISS-ESU).

3.4.5 FTP
Web servers that also run an FTP server shall not map FTP directories to
directories accessible via a web browser.

3.4.6 IIS Virtual Directories, Application Pools, Settings
Any and all creations, removals or modifications to IIS Settings, Virtual
Directories, Application Directories, and Application Pools shall require the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

3.4.7 Other
-Shares are not allowed on any directory accessible via web browser.
- Microsoft Windows web servers and any web application shall not be installed on the same drive as the host operating system.
- Executable files (.exe, .com, .bat, .dll, etc) shall not be placed into directories accessible via a web browser without the direct involvement and documented
approval by the Information Systems and Service Enterprise Security unit (ISSESU).

4.0 Guidelines

- It is recommended that all web applications use the enterprise FTP and SMTP servers for all FTP/SMTP traffic.

5.0 Enforcement

Any web server not meeting the above criteria may be immediately disconnected from the OCGBCC network. Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions

Term	Definition
FTP	File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring Web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.

WebDav	Web-based Distributed Authoring and Versioning – Extensions to HTTP that allows users to collaboratively edit and manage files on remote Web servers.
Front Page Extensions	A series of scripts that can be employed using Microsoft FrontPage, a visual HTML editor.
SMTP	Simple Mail Transfer Protocol – A protocol for sending e-mail messages between servers. In addition, SMTP is generally used to send messages from a mail client to a mail server.

ATTACHMENT V

STANDARDS SUMMARY

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

WEB SERVERS

Web and Database Placement

A database server shall not reside on the same hardware platform as a web server.

Anonymous Accounts

Web server anonymous accounts shall only have read and execute permissions to folders/files within the web server directories. Change and delete permissions to folders/files that are directly accessible via a web browser shall not be granted to web server anonymous accounts.

DMZ

Web Server Platforms

Microsoft Internet Information Server (IIS) version 5.0 or higher shall be the only platform within the OCGBCC DMZ to run as a Web or FTP server.

Services and Protocols

Traffic using the following protocols from the OCGBCC DMZ to the internal network shall not be allowed: Kerberos, NetBIOS, Microsoft-DS, Microsoft's
Well Known Ports, LDAP, RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.

Encrypted Data

Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: Name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information. The OCGBCC DMZ shall not have access to data containing bank information. The OCGBCC DMZ shall not have access to social security information.

Data Access

The OCGBCC DMZ shall have read only access to live data, if such data is also used by applications residing in the internal OCGBCC network.

ANTIVIRUS

Virus scanning

Antivirus software shall be running at all times on the computers on which it is installed.

MICROSOFT SECURITY PATCHES

Patch Installation

MS Security patches may be applied immediately upon release by Microsoft. All vendors must support their applications in this environment.

ATTACHMENT V

DESKTOP COMPUTING STANDARDS

AUTHORIZED PRODUCTS

1: HARDWARE

Dell Desktop minitower and small form factor (SFF) PC

- Dell GX960
  - Energy Smart system enabled
  - Intel Core 2 Duo processor or better
  - Minimum 2 Gb of Memory
  - Maximum 4 Gb Memory
  - USB Keyboard and Mouse
  - 160 GB SATA Hard drive
  - DVD+/- RW
  - 4 Year Basic Limited Warranty and 4 year Onsite Service
  - Intel vPro enabled

Dell Laptop

- Dell Latitude e6510
  - Intel Core 2 Duo processor or better
  - Minimum 2 Gb of Memory
  - Maximum 4 Gb of memory
  - CD-RW/DVD
  - 80 GB Hard Drive
  - 4 Year Limited Warranty and 4 year Onsite Service
  - Intel vPro enabled
- Dell Latitude e4300
  - Intel Centrino Core 2 Duo processor
  - Minimum 2 Gb memory
  - Maximum 4 Gb memory
  - CD-RW/DVD
  - 80 Gb Hard Drive
  - 4 Year Limited Warranty
  - Intel vPro enabled
    - *All PCs with 4yr limited warranty*

- PDAs- Blackberry Devices Only

2: OPERATING SYSTEMS and PROTOCOLS

Desktop/Laptop

- Microsoft Windows 7 Professional with IE 8 (for new PCs)
- Microsoft Windows XP Service Pack 3 (for existing PCs)
- Internet Explorer 8.0- *IE8 is current County Standard included with Windows 7. IE7 is available for backwards compatibility.*
  - *Application software may specifically require a certain Internet Explorer version. Contact ISS for assistance as needed.* ServiceCenter@ocfl.net

- Microsoft Office 2003 or greater (Standard or Professional Suite)

Portable Devices

- Blackberry OS

Network Connectivity

- Cisco Wireless Access Points, Cisco 802.11 LAN Card
- TCP/IP
- Sprint Wireless AirCard

3: CLIENT DATABASES

Desktop/Workstations Only, Single User Only

- Microsoft Access (user databases not supported)
- Oracle Client
- SQL Server Client

4: PERIPHERALS and ACCESSORIES

- HP LaserJet series
  - Black and White LaserJet
    - P1606dn < 4 users
    - P3015dn (supports secure printing – PIN)
    - P4015dn 8+ users (supports secure printing – PIN)
  - Color LaserJet
    - CP2025dn
    - CP4525dn 7+ users (supports secure printing – PIN)
    - 5550dn 15+ users (supports secure printing – PIN)
- *Desktop Copier and combo unit purchases directly connected to the PC must be reviewed and approved by ISS. Contact ServiceCenter@ocfl.net for more information and assistance.*

UNSUPPORTED PRODUCTS

1: HARDWARE

- Pre-Pentium class desktop systems
- Non-Dell PCs
- Non-Blackberry Smartphones

2: OPERATING SYSTEMS AND PROTOCOLS

- Microsoft Windows 2000
- Microsoft Windows NT 4.0
- Microsoft Windows 3.x, Windows 95 and 98
- MAC OS

3: CLIENT DATABASES

- Dbase
- RBASE
- Paradox
- FOXPRO

4: DESKTOP APPLICATIONS

Desktop/Workstation

- MS Office platforms prior to Office 2000
- ProComm
- Microsoft Internet Explorer, 4.x, 5.x
- McAfee Viruscan **Trend Micro is OCGOV standard*
- WordPerfect
- Quattro
- Hotmetal
- Freelance
- Harvard Graphics
- Lotus Suite
- Netscape, Opera, Firefox Browsers
- Rumba
- LAN Workplace
- Exceed
- Visio 3.x and older
- SHL Vision & Vision Express, WIN9x/WINNT/UNIX
- McAfee Remote Desktop32
- Reflection version 9 or lower
- PC Anywhere

5: PERIPHERALS AND ACCESSORIES

- HP LaserJet Series 4 and older printers
- Inkjet printers

PROHIBITED PRODUCTS

1: HARDWARE

- Personal (non-County) PCs
- Any network (voice or data) device not operated, administered or expressly approved by Orange County ISS.
- Any internet access device not operated, administered or expressly approved by Orange County ISS.

2: OPERATING SYSTEM AND PROTOCOLS

- Windows 9x
- Windows Vista
- 64 bit operating systems

Network Protocols

- NETBUI
- AppleTalk
- Token Ring
- Any network (voice or data) software or service not operated, administered or expressly approved by Orange County ISS.
- Any internet access service not operated, administered or expressly approved by Orange County ISS.

3: APPLICATIONS

- Any Alpha/Beta Software not operated, administered or expressly approved by Orange County ISS
- Anti-virus products other than Trend Micro
- Personal firewall products
- Network scanning tools
- Remote access software other than ISS authorized VPN
- User installed screen savers
- Games
- 3rd Party Desktops
- Disk Compression
- Non-Static BITMAP Backgrounds or screen savers
- iTunes (or other content sharing applications)
- P2P software

4: PERIPHERALS AND ACCESSORIES

- Portable music devices
- Personal (non-County) mass storage devices (hard drives, thumb drives, etc)
- Webcams

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DESCRIPTION OF WORK

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

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

C. The Division 16 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.

D. Only trained, and licensed personnel shall be used by the Contractor to perform work. The Contractor shall not perform work, which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.

E. Refer to other Division 16 Sections for additional work requirements.

F. 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 110.26. All electrical room doors shall open in the direction of egress.

1.4 WORK SEQUENCE

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

1.5 CODES, FEES, AND STANDARDS

A. Conform to all applicable requirements of Section Reference Standards and Regulatory Requirements.

B. Obtain permits and request inspections from authority having jurisdiction and applicable utility

companies.

C. Pay for all required licenses, fees, and inspections.

D. Material shall be new and free of defects with UL listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if UL Listing is not available for material.

1.6 PROJECT/SITE CONDITIONS

A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.

B. The Contractor shall install all equipment so that all Code required and Manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.

C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.7 INVESTIGATION OF SITE

A. Check site and existing conditions thoroughly before bidding. Advise A/E of discrepancies or questions noted.

B. Each Bidder shall visit the site and shall thoroughly familiarize himself with existing field conditions and the proposed work as described or implied by the Contract Documents. During the course of the site visit, the electrical bidder shall verify every aspect of the proposed work and the existing field conditions in the areas of construction and demolition which will affect his work. The Contractor will receive no compensation or reimbursement for additional expenses he incurs due to failure to make a thorough investigation of the existing facilities. This shall include rerouting around existing obstructions.

C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.

D. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Contractor shall field verify dimensions of all site utilities, conduit routing, boxes, etc., prior to bidding and include any deviations in the contract. Notify A/E if deviations are found.

E. All existing electrical is not shown. The Contractor shall become familiar with all existing conditions prior to bidding, and include in his bid the removal of all electrical equipment, wire, conduit, devices, fixtures, etc. that is not being reused, back to its originating point.

F. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.

G. Remove existing power, lighting, systems, material and equipment which are made obsolete or which interfere with the construction of the project. Reinstall power, lighting, systems, materials and equipment which are required to remain active for the facility to be fully functional.

H. All items removed and not re-used shall be immediately turned over to Owner as they are made available by renovation. Remove items from job site and deliver to Owner's storage location(s)

as directed by project manager. Discard complete items which Owner elects to refuse.

I. Investigate site thoroughly and reroute all conduit and wiring in area of construction in order to maintain continuity of existing circuitry. Existing conduits indicated in Contract Documents indicate approximate locations only. Contractor shall verify and coordinate existing site conduits and pipes prior to any excavation on site. Bids shall include hand digging and all required rerouting in areas of existing conduits or pipes.

J. Work is in connection with existing buildings which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. Notify Owner 24 hours in advance of any shut-down of existing systems. Perform work during non-general operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.

K. Bid shall include all removal and relocation of all piping, fixtures or other items required for completion of alterations and new construction.

L. See 16060 for additional requirements due to existing conditions.

1.8 CONTRACT DOCUMENTS

A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.

B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc which is the most expensive and costly to implement.

C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.

D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.

E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.

F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.

G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.

H. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division those requirements shall govern.

1.9 MATERIALS AND EQUIPMENT

A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or

denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

B. Where Contract Documents list basis of design 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 in this Division of the Specifications for substitutions.

C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.

D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.

E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 16 methods and materials unless specifically noted otherwise.

F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.

G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.

H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.

I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.

J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.

K. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

1.10 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).

1.11 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.

B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Division 16 Contract Documents or not.

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

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

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

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

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

H. 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.

1.12 PROVISION FOR OPENINGS

A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.

B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.

C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.13 SURFACE MOUNTED EQUIPMENT

A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish as directed by Engineer.

1.14 INSTALLATION

A. Erect equipment to minimize interferences and delays in execution of the work.

B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.

C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.

D. Equipment supports shall be secured and supported from structural members except as field accepted by the A/E in writing.

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

F. The Contractor shall keep the construction site clean of waste materials and rubbish at all times. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.

G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and a layout made prior to the setting or embedment thereof, so as to cause no delay to the project schedule.

1.15 PROGRESS AND RECORD DRAWINGS

A. Keep two sets of blueline prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.

B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:

1. All raceways 1-1/2" and above, exactly as installed.
2. All site raceways exactly as installed.
3. Any combining of circuits (which is only allowed by specific written permission) or change in homerun outlet box shall be made on as-builts.
4. Any circuit number changes on plan shall be indicated on as-builts.
5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..

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

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

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

F. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

1.16 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.

1.17 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.

1.18 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.

1.19 SUBSTANTIAL COMPLETION

A. The Contractor shall be fully responsible for contacting all applicable parties (A/E or Project Manager) to schedule required observations of the work by Engineer. A minimum of 72 hours notice shall be given for all required observations of the work by Engineer, and minimum of 120 hours for substantial completion observation. Time and date shall be agreed on by all applicable parties in writing.

B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

1.20 PROHIBITION OF ASBESTOS AND PCB

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

B. Prior to the final review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 16 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed and dated by a duly authorized agent of the manufacturer.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION

SECTION 16012
SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. See Section 01631 Products Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addenda, Contractor represents that he:

1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.
2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
3. Waives all claims for additional costs related to substitution which may subsequently become apparent.
4. Will provide the same warranties for the substitution as for the product specified.
5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

1.4 SUBMITTALS

A. Submittals shall consist of a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2" x 11" sheets; one (1) for "ELECTRICAL SUBMITTALS" (Power and Lighting).

1. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).
2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for Submittals included at end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full

width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting, (and if required) "SYSTEMS SUBMITTALS" for Sections 16700 - 16799 submittals.

B. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.

2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.

3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.

4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).

5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:

a) Fabrication and erection dimensions.

b) Arrangements and sectional views.

c) Necessary details, including complete information for making connections with other work.

d) Kinds of materials and finishes.

e) Descriptive names of equipment.

f) Modifications and options to standard equipment required by the work.

g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).

h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.

i) Conduit/raceway rough-in drawings.

j) 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

C. Remainder of submittals are to be submitted no later then 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.

D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.

E. Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.

F. Shop Drawing Review Notation.

	Action	Description
1.	No Exception Noted	No exceptions taken. Resubmittal not required.
2.	Rejected	Not in compliance with Contract Documents. Resubmit.
3.	Submit Specific Item	Resubmit item as specified.
4.	Make Corrections Noted	Make corrections noted, resubmittal not required.
5.	Revise and Resubmit	Make corrections noted, resubmittal is required
6.	Review not Required	Not required for review. No action taken. Copy retained for reference.

G. 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.

H. Note that the acceptance of shop drawings or other information submitted in accordance with

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

1.6 DELAYS

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

1.7 RE-SUBMITTALS

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

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

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

GENERAL CONTRACTOR:

SUBCONTRACTOR:

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

ORANGE COUNTY
LEVO CAT SCHOOL
HVAC REPLACEMENT

MPE NO. 2011-154

ELECTRICAL SUBMITTALS

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

ORANGE
COUNTY
LEVO CAT
SCHOOL HVAC
REPLACEMENT

MPE NO.2011-154

ELECTRICAL
SUBMITTALS

(Size To 11")

-SECTION 16014
REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. The requirements stated herein are in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 REFERENCES

A. The following references may or may not be referenced within these specifications:

ADA	Americans with Disabilities Act
AIA	American Institute of Architects (The)
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	American Society for Testing and Materials
BOCC	Board of County Commissioners of Orange County
CRSI	Concrete Reinforcing Steel Institute
DCA-ARM	Department of Community Affairs - Accessibility Requirements Manual
DOCA or DCA	State of Florida Department of Community Affairs
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council
FAC	Florida Administrative Code
FBC	Florida Building Code
FEMA	Federal Emergency Management Agency
FMG	FM Global (formerly Factory Mutual System)

FS	Florida Statutes
HL	Hospital Licensure. Chapter 59-A3, FAC
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
ICPEA	International Power Cable Engineer's Association
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code (ANSI C2)
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	The Occupational Safety and Health Act
SBE	State Board of Education
UL	Underwriters Laboratories, Inc.
NEC	National Electrical Code
DOC	Department of Corrections - State of Florida
FAC	Florida Administrative Codes, Chapter 33-8, Rules of the Department of Corrections, County and Municipal Detention Facilities.

1.4 REGULATORY REQUIREMENTS

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

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

a) American with Disabilities Act (ADA)
b) American National Standards Institute (ANSI)
c) American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
d) American Society of Mechanical Engineers (ASME)
e) American Society for Testing and Materials (ASTM)
f) Concrete Reinforcing Steel Institute (CRSI)
g) Department of Community Affairs (DCA)
h) Institute of Electrical and Electronics Engineers (IEEE)
i) National Energy Conservation Policy Act (NECPA)
j) National Electrical Safety Code (NESC)
k) National Electrical Manufacturers' Association (NEMA)
l) National Fire Protection Association (NFPA) Codes and Standards as adopted by Authority having Jurisdiction including the National Electrical Code (NEC)

m) The Occupational Safety and Health Act (OSHA)
n) Underwriters Laboratories, Inc. (UL)
o) Applicable Florida Statutes and Referenced Codes/Standards.
p) All Federal, State, Local Codes, Laws and Ordinances as applicable.
q) Florida Building Code 2010

2. ORANGE COUNTY
a) Florida Building Code 2010
b) National Electrical Code 2008
c) NFPA 1 Uniform Fire Code 2009 Florida Edition
d) NFPA 101 Life Safety Code 2009 Florida Edition

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

END OF SECTION

ORANGE COUNTY
LEVO CAT SCHOOL - HVAC REPLACEMENT

SECTION 16015
ELECTRICAL SYMBOLS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Symbols and abbreviations specifically applicable to all Division 16 sections in addition to those in Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

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

1.4 ABBREVIATIONS

A. The following abbreviations or initials are used.
   A/C Air Conditioning
   AFD Adjustable Frequency Drive
   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
   CCTV Closed Circuit Television
   cd Candela
   CFM Cubic Feet per Minute
   CH Chiller
   CKT. Circuit
   CKT BRKR Circuit Breaker

C/L Center Line
Clg. Ceiling
Comp. Compressor
Conn. Connection
Cond. Condenser
Cont. Continuous
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
ICTC Intercom Termination Cabinet
IMC Intermediate Metallic Conduit
Incand. Incandescent
in. Inches
J.B. Junction Box

KVA KiloVolt Ampere
KW Kilowatts
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
Ø Phase
P. Pole
PL Compact Fluorescent Lamp
P.T. Potential Transformer
PSF Pounds per Square Foot
PSI Pounds per Square Inch
PB Pullbox
PNL Panel
PR Pair
Pri. Primary
PTZ Pan, Tilt, Zoom
PVC Polyvinyl Chloride
Recept. Receptacle
RPM Revolutions per Minute
R.S. Rapid Start

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY
LEVO CAT SCHOOL - HVAC REPLACEMENT

SECTION 16090
TESTS AND PERFORMANCE VERIFICATION OF ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section pertains to the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.

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

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 TESTS

A. System:

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

2. Procedure:

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

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

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

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

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

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

B. Motors:

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

C. Grounds:

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

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

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

3.2 DATA PROCESSING

A. Testing Data:

1. Tabulate data for submission.

2. Submit data on 8 1/2" x 11" sheets with date and name of checker with one copy for each O & M Manual.

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

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

B. Equipment Check Out:

1. At completion of construction after all performance verification and testing information has been gathered, submitted, and approved, provide one copy of this information to the Authorized Manufacturer's Representative of the equipment.

a) Manufacturer's Authorized Representative must be trained by the manufacturer and authorized to inspect, adjust, test, and repair equipment.

2. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is in operation, and sign a Check Out Memo for a record. (See Section 16098 Operation and Maintenance Manuals).

a) Check out of equipment is to include examining performance of equipment and certifying equipment has been installed per manufacturer's recommendations, that all necessary adjustments have been performed and that equipment is operating properly.

3. Submit one copy (for each O & M Manual) of the memo on each major item of equipment. Accepted memos shall be inserted in each O & M Manual with the performance verification information and submittal data. Memos shall be submitted and accepted before instruction to Owner or a request for final inspection.

4. Items requiring Check Out Memos are all major items of equipment.

5. Do not submit Check Out Memo form at the time submittal brochures are submitted. This form shall be completed and submitted before Instruction in Operation to Owner or a request for final inspection.

END OF SECTION

SECTION 16095
DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DESCRIPTION

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

1. Miscellaneous Electrical Equipment
   a) Electrical power equipment
   b) Motor control devices
   c) Starting devices

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

1.4 TIME

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

1.5 ATTENDING PARTIES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

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

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

C. Performance Verification and Demonstration to Owner

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

END OF SECTION

CHECK OUT MEMO

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

Project Name _____

Type of Equipment Checked _____

Equipment Number _____

Equipment Manufacturer _____

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

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

CHECKED BY:

_____
MANUFACTURER'S REPRESENTATIVE (print)

_____
ADDRESS

_____
TELEPHONE, FAX, E-MAIL

_____
MANUFACTURER'S REPRESENTATIVE (signature, title)

_____
DATE CHECKED

WITNESSED BY:

_____
CONTRACTOR'S REPRESENTATIVE (signature, title)

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

ORANGE COUNTY
LEVO CAT SCHOOL - HVAC REPLACEMENT

SECTION 16098
OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

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

1.2 SUMMARY

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

1.3 OPERATION AND MAINTENANCE MANUALS

A. O& M Manuals shall consist of a minimum of one (or if required) two hard cover view type 3-ring binder(s) sized to hold 8 1/2" x 11" sheets; one (1) for ELECTRICAL OPERATION AND MAINTENANCE (Power and Lighting) (black).

1. Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3". Provide additional binders if 3" size is not sufficient to properly hold submittals.

2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for O & M's at the end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e. ELECTRICAL OPERATION AND MAINTENANCE for Power and Lighting.

B. O & M Data:

1. Manufacturer's operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e. surge suppression - switchboard MDPA).

2. Include troubleshooting instructions, list of special tools required, theory of operation, manufacturer's care and cleaning, preventative maintenance instructions, wiring diagrams, and point-to-point schematics.

C. O & M Manuals to include:

1. Completed forms and information per Division 1, General Requirements, and this section of the specifications.
   a) Table of Contents
   b) Project Addresses
   c) Reinforced Separation Sheets tabbed with the appropriate specification reference number and typed index for each Section in the Systems Schedule
   d) Check Out Memo
   e) Conductor Insulation Resistance Test Memo
   f) D-C High Voltage Cable Test Report
   g) Ground Test Information
   h) Motor Test Information
   i) Voltage and Amperage Readings Tabulated Data.
   j) Progress and Record Drawing Certification
   k) Spare Parts Certification Memo

2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted as required in Section 16012 "Submittals". These shall be inserted in binder in proper order.

3. Product Data: Product data and/or Catalog sheets shall be a copy of the final and accepted submittal submitted as required in Section 16012 "Submittals". These shall be inserted in binder in proper order.

4. Warranty/Guarantee: Provide copy of warranty/guarantee in respective location in O & M binder, (Power and Lighting) (Systems). Original warranty/guarantee is to be incorporated into separate project warranty book with warranty/guarantees provided for other sections and divisions of the specifications and submitted for Architectural/Owner acceptance.

5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section

6. Wiring diagrams, schematic, etc. inserted in proper order, for:
   a) Control devices, motor controls.
   b) Automatic transfer switches.
   c) Manual Transfer Switches.

7. For Section 16100 thru 16199:
   a) Product data and/or catalog sheets on all equipment applicable to this project.
   b) Equipment supplier list for each section's equipment.
   c) Floor boxes; in addition to above provide:
      1. Installation/removal instructions.
      2. Parts list.

1.4 PROCESSING SUBMITTALS

A. Submit a minimum of three (3) sets of O & M Manuals, two (2) sets for Owner, one (1) set for Engineer.

B. The Contractor shall review the manuals before submitting to the A/E. No request for payment will be considered until the brochure has been reviewed and submitted for acceptance.

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

1.5 DELAYS

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

1.6 RESUBMITTALS

A. The A/E shall be reimbursed cost to review re-submittals subsequent to the second submittal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PROJECT ADDRESSES

OWNER:

ARCHITECT:

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

GENERAL CONTRACTOR:

SUBCONTRACTOR:

CHECK OUT MEMO FORM

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

Project Name:

Type of equipment checked:
Equipment Number:

Name of manufacturer of equipment:

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

1. The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.

2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below.*

3. Written operating and maintenance information has been presented to the Contractor, and gone over with him in detail.

4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

Checked By: (Print or Type Name of Manufacturer's Representative)

(Address and Phone No. of Representative)

(Signature and Title of Representative)

(Date Checked)

Witnessed By: Signature and Title of Contractor Rep.)

*Exceptions Noted At Time Of Check-Out (use additional page if necessary)

CONDUCTOR INSULATION RESISTANCE TEST MEMO

PROJECT NAME:_____

CONDUCTOR FROM _____ TO

SIZE

INSULATION TYPE

INSULATION VOLTAGE RATING

DATE _____ TIME

WEATHER CONDITIONS

TEST VOLTAGE (DC)

RANGE

MEGGER INSTRUMENT/SERIAL NUMBER

TESTING METHODOLOGY

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

PHASE A TO GROUND _____

PHASE B TO GROUND _____

PHASE C TO GROUND _____

NEUTRAL TO GROUND _____

ISOLATED GROUND TO GROUND

CONTRACTOR'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

D-C HIGH VOLTAGE CABLE TEST REPORT

Project Name:_____

Location:_____

Description:_____

Rated Voltage:_____

TEST DATA

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

_____
_____

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

Final Test Voltage _____

Time Finish: _____

KV DC after 1 min.

Test Procedure _____ No. of Terminals _____
Joints _____

Witnessed by:_____ Performed by:_____

GROUND TEST INFORMATION

PROJECT NAME:_____

GROUND TYPE:_____

TEST BY:_____

DATE OF TEST:_____

GROUND LOCATION:_____

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

PRIOR TO CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

AFTER CONNECTION TO SYSTEM

GROUND: _____ (OHMS)

WEATHER CONDITIONS (Wet/Dry):

SOIL CONDITIONS (Wet/Dry):

CONTRACTOR'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

MOTOR TEST INFORMATION

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

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

(b) Manufacturer

(c) Model Number

(d) Serial Number

(e) RPM

(f) Frame Size

(g) Code Letter

(h) Horsepower

(i) Nameplate Voltage and Phase

(j) Nameplate Amps

(k) Actual Voltage

(l) Actual Amps

(m) Starter Manufacturer

(n) Starter Size

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

(p) Manufacturer of dual-element fuse

(q) Amp rating of fuse

(r) Power Factor

CONTRACTOR'S REPRESENTATIVE:

DATE:

SIGNATURE OF CHECKER:

DATE:

OWNER'S AUTHORIZED REPRESENTATIVE:

PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT:

DIVISION NUMBER AND NAME:

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

_____

Name Of General Contractor

_____

BY: Authorized Signature And Title

Date

Name Of Subcontractor

_____

BY: Authorized Signature And Title

Date

VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME:_____
SWITCHGEAR/PANELBOARD

FULL LOAD AMPERAGE READINGS:

DATE _____
TIME _____

PHASE A. _____

B. _____

C. _____

N._____

GROUND_____

FULL LOAD VOLTAGE READINGS:

DATE
TIME

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

VOLTAGE AT THE END OF THE LONGEST BRANCH

TYPE OF LOAD

NO LOAD VOLTAGE READINGS:

DATE
TIME

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

_____ ENGINEERS REPRESENTATIVE

_____ OWNER'S AUTHORIZED REPRESENTATIVE

_____ CONTRACTORS REPRESENTATIVE

_____ DATE

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

ORANGE COUNTY
LEVO CAT SCHOOL
HVAC REPLACEMENT

MPE NO. 2011-154

ELECTRICAL OPERATION AND
MAINTENANCE BROCHURE

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

ORANGE
COUNTY
LEVO CAT
SCHOOL
HVAC
REPLACEMENT

MPE NO.2011-154

ELECTRICAL
OPERATION AND
MAINTENANCE
BROCHURE

(Size To 11")

SECTION 16111 - CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for electrical conduit.

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

1. Rigid Metal Conduit (RMC) NEC 344
2. Flexible Metal Conduit (FMC) NEC 348
3. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
4. Electrical Metallic Tubing (EMT) NEC 358
5. Fittings and Conduit Bodies

1.3 REFERENCES

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

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.

D. 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, local and other federal codes where applicable.

2.2 MINIMUM TRADE SIZE

A. 3/4" C.
B. Flexible and seal-tite metallic conduit 1/2" C (maximum 6' long).

2.3 RIGID METAL CONDUIT

A. Comply with:
   1. ANSI C80.1.
   2. UL 6.
   3. NEC 344.

B. Conduit material:
   1. Zinc coated or hot dipped galvanized steel.

C. Fittings:

   1. Threaded.

   2. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.

   3. Zinc plated or hot dipped galvanized malleable iron or steel.

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

2.4 FLEXIBLE METAL CONDUIT

A. Comply with:
   1. NEC 348.
   2. ANSI/UL 1.

B. Conduit material: Steel, interlocked.

C. Fittings:
1. ANSI/NEMA FB 1.
2. ANSI/UL 514B.
3. Die Cast
4. Malleable iron, zinc plated.
5. Threaded rigid and IMC conduit to flexible conduit coupling.
6. Direct flexible conduit bearing set screw type not acceptable.

2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Comply with:
1. NEC 350.
2. ANSI/UL 360.

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

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

2.6 ELECTRICAL METALLIC TUBING

A. Comply with:
1. UL 797.
2. ANSI C80.3.
3. NEC 358.
4. ANSI/UL797.

B. Conduit material: Galvanized steel tubing.

C. Fittings:
1. ANSI/NEMA FB 1.
2. Set screw.
3. Die Cast.
4. Zinc plated malleable iron or steel.
5. Concrete tight.
6. T&B Series 5031/5030.

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.

3. All underground raceways (with exception of raceways installed under floor slab) shall be

installed in accordance with NEC 300.5, except the minimum cover for any conduit shall be 2'. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.

4. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.

5. PVC runs over 150' in length shall utilize rigid steel 90 degree elbows at each riser and at each change in direction. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC 250.80 and NEC 300.5.

6. All underground service lateral raceways shall be protected as required by NEC 300.5, including requirements for installation of warning tape.

B. In Slab Above or on Grade:
   1. Use coated rigid steel conduit.

C. Outdoor Location:
   1. Above Grade:
      a) In general all exterior conduit runs shall be rigid conduit and threaded connectors as specified elsewhere.
      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.

D. Interior Dry Locations:

   1. Concealed: Use rigid metal conduit or Electrical metallic tubing.

   2. Exposed: Use rigid metal conduit or 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.

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 SUPPORTS

A. Arrange supports to prevent misalignment during wiring installation.

B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24" increase distance as required) provide space on each for 25 percent additional conduits.

D. Fasten conduit supports to building structure and surfaces under provisions of Section 16190 Hangers and Supports.

E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach conduit to ceiling support wires.

G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.

H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

3.6 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.

3.7 FIRE AND SMOKE STOPPING

A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.

B. Install conduit to preserve fire resistance rating of partitions and other elements.

C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.

D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in accordance with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in accord with ASTM E119. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

3.8 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. Maintain adequate clearance between conduit and piping.

F. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

G. Cut conduit square using saw or pipe cutter; de-burr cut ends.

H. Bring conduit to shoulder of fittings; fasten securely.

I. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

J. 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.

K. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

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

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

N. Install all conduits concealed from view unless specifically shown otherwise on Drawings

O. Rigid steel box connections shall be made with double locknuts and bushings.

P. All connections to motors or other vibrating equipment including dry type transformers or at other locations where required shall be made with not less than 12" of flexible steel conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.

Q. 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.

R. 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.

S. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.

END OF SECTION

SECTION 16123
BUILDING WIRE AND CABLE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for provision and installation of building wire and cable.

B. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete and operating system for the following:

1. Building wire and cable.

2. Wiring connectors and connections.

C. 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. NEC 330
C. UL 486A-486B

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

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

1.5 SUBMITTALS

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

1.6 QUALIFICATIONS

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

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70, Type THHN/THWN and XHHW.

PART 3 - EXECUTION

3.1 GENERAL

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

B. Conductors #10 AWG or #12 AWG shall be 600 volt type THWN/THHN unless noted otherwise, rated 90 degrees C. dry, 75 degrees C wet.

C. Conductors #8 AWG and larger shall be Type THWN-2/THHN unless noted otherwise, rated 90 degrees C, wet or dry.

D. Use solid conductor for feeders and branch circuits 10 AWG and smaller (except for control circuits).

E. Use conductor no smaller than 12 AWG for power and lighting circuits.

F. Neatly train and lace wiring inside boxes, equipment, and panelboards.

G. All conductors shall be installed in raceway.

H. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit, unless noted otherwise on the Drawings or in these Specifications.

I. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).

J. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.

K. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

3.2 EXAMINATION

A. Verify that interior of building has been protected from weather.

3.3 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.4 WIRING METHODS

A. Use only building wire type (THHN/THWN for #10 and #12 and THHN/THWN-2 for #8 and larger) insulation in raceway unless noted otherwise.

B. Wiring in vicinity of heat producing equipment; use only XHHW insulation in raceway.

C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required to meet the UL listing of the fixture; however, in no case shall the temperature rating be less than 90 degrees C. Remove incorrect insulation types in new work.

3.5 INTERFACE WITH OTHER PRODUCTS

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

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

3.6 FIELD QUALITY CONTROL

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

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

3.7 PULLING

A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.

B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.

C. Use only powdered soapstone or other pulling lubricant acceptable to the A/E. Compound or lubricant shall not cause the conductor or insulation to deteriorate.

D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.

E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.

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. Install circuit conductors in conduit.

D. Circuit conductors to be stranded.

3.9 COLOR CODING

A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

B. Unless otherwise accepted or required by A/E to match existing, color-code shall be as follows:
Neutrals: 277/480V System natural gray
Ground Wire: green, bare
277/480V: Phase A brown, Phase B orange, Phase C yellow

C. All switchlegs, other voltage system wiring, control and interlock wiring, shall be color-coded other than those noted above.

3.10 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 or outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.

F. 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.

G. A calibrated torque wrench shall be used for all bolt tightening.

H. 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.

I. Exterior Locations:

1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.

2. All taps and splices shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.

3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

END OF SECTION

SECTION 16170
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes

1. Equipment grounding conductors.
2. Bonding.
3. Ground Ring.

B. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable codes as accepted by the Authorities Having Jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.

C. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of NEC 250, and state codes. Bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.

D. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed with-in conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors that run with feeders in PVC conduit outside of building(s) shall be bare only.

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

1.6 PROJECT RECORD DOCUMENTS

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

B. Submit test results of each ground rod. See Section 16090 Tests and Performance Verification.

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. 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, T&B, or approved equal. Lightweight and "competitive" devices shall be rejected.
2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or approved equal.
3. Piping Clamps: Burndy GAR-TC Series with two hole compression terminal, T&B, or approved equal.
4. Grounding Screw and Pigtail: Raco No. 983 or approved 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, etc. with all required accessories.

C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the NEC, the NFPA, and applicable standards of IEEE.

D. Where there is a conflict between these specifications and the above applicable codes/standards, or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the code/standard requirements shall be complied with.

E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

3.2 EQUIPMENT GROUNDING CONDUCTORS

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

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

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

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

E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw Raco No. 983 or approved equal shall be provided to connect receptacle ground terminal to the box.

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

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

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

3.3 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.

B. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Architect/Engineer as called for in Section 16090 Test and Performance Verification.

3.4 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