
IFB NO. Y16-786-MM
INVITATION FOR BIDS
FOR
ORANGE COUNTY CONVENTION CENTER WEST CONCOURSE D CHILLER AND
AHU REPLACEMENT

TECHNICAL SPECIFICATIONS

VOLUME II



**ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D – CHILLER & AHU REPLACEMENT
100% BID DOCUMENTS**

**FOR
ORANGE COUNTY
CAPITAL PLANNING & CONSTRUCTION GROUP
ORANGE COUNTY CONVENTION CENTER
P.O. BOX 691509
ORLANDO, FLORIDA 32869-1509**

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

JUNE 29, 2015

**ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT
100% BID DOCUMENTS**

DIVISION 01 PROCUREMENT AND CONTRACTING REQUIREMENTS

01 11 00 Summary of Work
01 25 00 Substitution Procedures
01 26 00 Contract Modification Procedures
01 29 00 Payment Procedures
01 31 00 Project Management and Coordination
01 31 19 Project Meetings
01 33 00 Submittal Procedures
01 73 29 Cutting and Patching
01 77 00 Closeout Procedures
01 78 00 Warranties and Bonds

DIVISION 02 EXISTING CONDITIONS

02 41 13 Selective Demolition

DIVISIONS 03 THRU 06 – NOT USED

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 14 16 Fluid Applied Waterproofing
07 21 00 Building Insulation
07 62 00 Sheet Metal Flashing and Trim
07 92 00 Joint Sealants

DIVISION 08 - OPENINGS

08 11 13 Hollow Metal Door Frames
08 14 16 Flush Wood Doors
08 71 00 Door Hardware

DIVISION 09 - FINISHES

09 22 16 Non-Structural Metal Framing
09 29 00 Gypsum Board
09 65 13 Resilient Base and Accessories
09 91 00 Painting

DIVISIONS 10- THRU 22 – NOT USED

DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING

23 01 30.51 HVAC Air-Distribution System Cleaning
23 05 00 Common Work Results for HVAC Systems
23 05 10 Basic Materials and Methods for HVAC Systems
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 17 Adjustable Frequency Drives
23 05 18 Control Wiring
23 05 19 Meters, Gages and Accessories for HVAC Piping
23 05 23 General-Duty Valves for HVAC Piping
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 48 Vibration and Seismic Controls for HVAC
23 05 53 Identification for HVAC Piping and Equipment
23 05 80 Air Control and Accessories
23 05 93 Testing, Adjusting and Balancing for HVAC
23 07 00 HVAC Insulation
23 09 00 Building Automation System

23 09 93	Sequence of Operations for HVAC Controls
23 21 13	Hydronic Piping
23 21 23	Hydronic Pumps
23 25 00	HVAC Water Treatment
23 25 00A	OU Cooling Chilled Water Service Agreement
23 31 01	Shop Fabricated Ductwork
23 33 00	Air Duct Accessories
23 41 00	Particulate Air Filtration
23 73 00	Packaged Air Handling Units
23 73 00A	Trane White Paper Product Data
23 82 16	Coils

DIVISIONS 24 THRU 25 – NOT USED

DIVISION 26 ELECTRICAL

26 01 00	Operation and Maintenance Manuals
26 01 03	Minor Electrical Demolition for Remodeling
26 01 05	Investigation of Existing Electrical Systems
26 05 00	Common Work Results
26 05 03	Equipment Wiring Systems
26 05 07	Submittals
26 05 08	Substitutions
26 05 09	Reference Standards and Regulatory Requirements
26 05 10	Electrical Symbols and Abbreviations
26 05 19	Building Wire and Cable
26 05 26	Grounding and Bonding
26 05 29	Hangers and Supports
26 05 33	Conduit
26 05 34	Outlet Boxes
26 05 35	Pull and Junction Boxes
26 05 53	Identification for Electrical Systems
26 08 03	Demonstration of Completed Electrical Systems
26 08 13	Tests and Performance Verification of Electrical System
26 27 26	Wiring Devices
26 28 19	Enclosed Disconnect Switches
26 41 13	Lightning Protection System (Modification of Roof Top Equipment)

DIVISION 27 COMMUNICATIONS – NOT USED

DIVISION 28 ELECTRONIC SAFETY AND SECURITY

28 05 00	Common Work Results for Electronic Safety and Security
28 05 07	Submittals for Electronic Safety and Security
28 05 08	Substitutions for Electronic Safety and Security
28 31 00	Addressable Fire Alarm Detection System (Extension of Existing)

DIVISIONS 29 THRU 48 – NOT USED

END OF TABLE OF CONTENTS

DRAWING INDEX

SHEET #	ARCHITECTURAL SHEET INDEX	SCALE
A202	ENLARGED PLANS LEVEL 3 FLOOR PLANS – ARCHITECTURE	AS SHOWN
A203	ROOF DETAILS LEVEL 3 FLOOR PLANS – ARCHITECTURE	AS SHOWN
A204	WALL AND DOOR LEVEL 3 FLOOR PLANS – ARCHITECTURE	AS SHOWN
A205	ENLARGED PLANS LEVEL 3 CEILING PLANS – ARCHITECTURE	AS SHOWN
SHEET #	MECHANICAL SHEET INDEX	SCALE
M001	GENERAL NOTES, ABBREVIATIONS AND LEGENDS	NONE
M100	OVERALL WEST CONCOURSE D – MECHANICAL	1"=20'-0"
MD100	DEMO OVERALL WEST CONCOURSE D – MECHANICAL	1"=20'-0"
MD201	ENLARGED DEMO LEVEL 2 FLOOR PLAN – MECHANICAL	1/4"=1'-0"
MD202	ENLARGED DEMO LEVEL 3 FLOOR PLANS – MECHANICAL	1/4"=1'-0"
MD203	ENLARGED DEMO LEVEL 3 FLOOR PLANS – MECHANICAL	1/4"=1'-0"
MD204	ENLARGED DEMO ROOF PLAN – MECHANICAL	1/4"=1'-0"
M101	PARTIAL RENO LEVEL 3 FLOOR PLANS – MECHANICAL	1/8"=1'-0"
M201	ENLARGED RENO LEVEL 2 FLOOR PLAN – MECHANICAL	1/4"=1'-0"
M202	ENLARGED RENO LEVEL 3 FLOOR PLANS – MECHANICAL	1/4"=1'-0"
M203	ENLARGED RENO LEVEL 3 FLOOR PLANS – MECHANICAL	1/4"=1'-0"
M401	CHILLED WATER PIPING SCHEMATIC – MECHANICAL	NONE
M501	CONTROLS SCHEMATICS – MECHANICAL	NONE
M601	SCHEDULES – MECHANICAL	NONE
M701	PHOTOS – MECHANICAL	NONE
M702	PHOTOS – MECHANICAL	NONE
M901	DETAILS – MECHANICAL	NONE
SHEET #	MECHANICAL REFERENCE SHEET INDEX	SCALE
R101	1ST FLOOR PLAN / AREA 1 – MECHANICAL	N.T.S.
R102	1ST FLOOR PLAN / AREA 2 – MECHANICAL	N.T.S.
R103	2ND FLOOR PLAN / AREA 1 – MECHANICAL	N.T.S.
R104	2ND FLOOR PLAN / AREA 2 – MECHANICAL	N.T.S.
R105	2ND FLOOR PLAN / AREA 3 – MECHANICAL	N.T.S.
R106		
SHEET #	ELECTRICAL SHEET INDEX	SCALE
E001	GENERAL NOTES AND LEGENDS	NONE
E100	PARTIAL OVERALL WEST CONCOURSE D RENO – ELECTRICAL LEVELS 2 &	1"=20'-0"
ED100	PARTIAL OVERALL WEST CONCOURSE D DEMO – ELECTRICAL LEVELS 2 & 3	1"=20'-0"
ED201	LEVEL 2 & 3 DEMO FLOOR PLANS – ELECTRICAL	1/8"=1'-0"
E201	LEVEL 2 & 3 RENO FLOOR PLANS – ELECTRICAL	1/8"=1'-0"
E501	PARTIAL ELECTRICAL RISER	NONE
E601	ELECTRICAL SCHEDULES	NONE
E602	ELECTRICAL SCHEDULES	NONE
E603	ELECTRICAL SCHEDULES	NONE
E901	ELECTRICAL DETAILS	N.T.S.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT DESCRIPTION

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

1.3 SCOPE OF WORK

- A. Summary Of Work:
 1. Remove the existing air-cooled chilled water plant serving West Concourse D to include all rooftop-mounted chillers, pumps, piping, and all electrical accessories.
 2. Provide new chilled water piping and tertiary pumps to serve West Concourse D from the existing OCCC West Concourse D piping connected to OUC's chilled water loop.
 3. Replace existing AHU's and FCU's within West Concourse D per the contract drawings. New AHU's shall have a minimum of 18-deg delta T chilled water coils and shall be same capacity as existing AHUs.
 4. Provide electrical and fire alarm support including but not limited to demolition of equipment, disconnect/reconnect of equipment, etc.
 5. Convert existing office space into new mechanical room including demolition of existing walls and addition of new walls and doors.

1.4 CONTRACTOR RESPONSIBILITIES

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.5 WORK UNDER OTHER CONTRACTS

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

1.6 WORK SEQUENCE

- A. The facility shall remain occupied and operational while work is in progress. All work shall be fully coordinated in writing with Orange County Convention Center Project Manager prior to commencement of work. All work shall be performed between the hours of 9:00 pm and 6:00 am, Monday through Friday. Work performed after normal business hours shall 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.
- B. The contractor may work on the weekends at his or her discretion with prior written approval from Orange County Convention Center Project Manager. Weekend work shall not be an additional cost to the Owner. The contractor will coordinate with the Orange County Convention Center Project Manager for access to the building on weekends and after hours work.

1.7 CONTRACTOR USE OF PREMISES

- A. General: During the construction period, the Contractor shall have limited use of the premises for construction operations, including use of the site. The Contractor shall coordinate which areas are acceptable to Convention Center Staff for use during the life of the project. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portion of the project.
- B. General: Limited use of the premises to construction activities in areas indicated within the limit of the premises. The Contractor may only use portion(s) of the site for storage or work areas only with prior approval from Orange County Convention Center Project Manager.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
3. Burial of Waste Materials: Do not dispose of organic and hazardous material on site, either by burial or by burning.
4. Where appropriate, maintain the existing building in a watertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
5. Confine construction operations to the areas permitted by the contract documents and other Owner directives.
6. Provide protection and safekeeping of material and equipment stored on premises.
7. Contractor will move any stored material and equipment, which interfere with operations of the Owner or other contractors at no additional cost to the Owner..
8. Comply with Owner's requirements for ingress and egress procedures, prohibitions against firearms, procedures for transportation of workers, safety and fire prevention requirements and all applicable pollution control requirements. Refer to the following reference requirements:
 - a) Orange County Safety and Health Manual
<http://www.orangecountyfl.net/VendorServices/OrangeCountySafetyandHealthManual.aspx>
 - b) Orange County Policy Manual page 96 regarding Firearms
<http://www.orangecountyfl.net/portals/0/resource%20library/employment%20-%20volunteerism/Policy%20Manual.pdf>
9. Contractor to require all employees and subcontractors to wear non-objectionable clothing; prohibit revealing clothing and articles of clothing with offensive writings displayed. The contractor shall require offending personnel to leave the premises until such clothing is changed.
10. Contractor employees and subcontractors will not fraternize with County employees or the general public during the entire construction period.
11. Use of sound equipment (such as boom boxes, stereos, radios, etc.) is not allowed.
12. Contractor and their personnel shall abide to Orange County Tobacco free policy while on any Orange County Convention Center property. This policy shall apply to building, parking lots, parks, break areas and worksites. Tobacco is defined as tobacco products, including but not limited to: Cigars, cigarettes, pipes, chewing tobacco and snuff. Failure to abide by the policy may result in civil penalties levied under Chapter 386, Florida Statutes and/or Contract enforcement remedies. Refer to the following documents:
 - a) Orange County Smoking Policy:
<http://www.orangecountyfl.net/Portals/0/resource%20library/employment%20-%20volunteerism/Employee%20Handbook.pdf>
13. Conduct that is disrespectful, abusive or otherwise objectionable to the Owners' employees or general public will not be allowed at any time during the construction period. Repetitive complaints and violations of the requirements listed above will be cause for dismissal and or permanent removal of offending personnel from the project.
14. Contractor to coordinate with the Owner the site location for storage of equipment, machinery, materials, tools and a construction waste dumpster.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.8 SECURITY AND IDENTIFICATION

- A. All costs for background investigations will be Contractor's responsibility. The County shall have the right to request any additional investigative background information including, but limited to, the employment record, Right-To-Know records, E-Verify system records (if the Contractor uses this service as a means to determine employment eligibility, available through www.uscis.gov), training records, payroll records, position for which hired including site location of any personnel assigned to perform the services. The Contractor shall furnish, in writing, such information to the extent allowed by law, prior to commencement of services. The County reserves the right to conduct its own investigation of any employee of the Contractor.
- B. A Level 1 (5 years) Background Check for the contractor's staff must be approved by Orange County's Security team prior to working in any County facility. Contractors are responsible for obtaining the necessary forms for background checks for work at the Convention Center.
 1. For security purposes and to maintain privacy when submitting FDLE Background Checks via e-mail the subject line of the email must contain the following ****EXEMPT****.
 2. The Convention Center will inform the contractor of their Background Check results.
 3. Upon Background Check approval the contractor's staff shall arrange an appointment with the Convention Center staff to obtain an Orange County photo ID badge. An affidavit of Identity form (issued by the contractor) and a State of Florida ID or Drivers License will be required.
- C. Contractor's employees will not be allowed in Orange County facilities without completed and approved background investigations.

1.9 OWNER OCCUPANCY

- A. Owner Occupancy: The Owner will be occupying the building during construction. Normal occupancy hours are 7:00 a.m. to 6:00 p.m. Monday through Friday, however this may vary with show activity.
 1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.
 2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.
 3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.10 DISTRIBUTION OF RELATED DOCUMENTS

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

1.11 CONTRACT DOCUMENT FILE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

shall be made available to the Engineer and the County's representatives throughout this same period.

PART 2 - PRODUCTS

2.1 ASBESTOS FREE MATERIAL

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

PART 3 - EXECUTION (Not applicable).

END OF SECTION 01 11 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling request for substitutions made during bidding and after award of the Contract.
- B. The Contractor's Installation Schedule and the Schedule of Submittals are included under Section "Submittal Procedures".

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: The Contract will be awarded based on the design, methods, materials and/or equipment as addressed in the Contract Drawings and/or described in the Contract Specifications, without any consideration for substitution or "or-equal" replacement. Addressing, describing or naming an item is intended to establish the type, function, characteristics and quality required in order to establish a base for bidding.
 - 1. Within thirty (30) days after Contract award, the Contractor may submit for approval substitutes for any equipment and/or material. In addition to the product documents, a written certification shall accompany the documentation indicating that the proposed substitute will have the same characteristics, will perform in accordance with the design requirements and that complies with all the requirements set for in the Contract. Any additional information required by the Owner or County Representative shall be provided by the Contractor. Rejection of any proposed substitute will be considered final and the Contractor shall not get into any agreement with manufacturers or providers until the submittal has been finally approved.
 - 2. The submission of this documentation shall follow the requirements set quality required in order to establish a base for bidding.

1.4 SUBMITTALS

- A. Substitution Request Submittal: Request for substitution will be considered if received within thirty (30) days after contract award. As long as this time allowance will not impact the construction schedule.
 - 1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
 - 2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:

- a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
3. Engineer's Action: Within two weeks of receipt of the request for substitution, the Engineer will request additional information or documentation necessary for evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the project specified by name. Decision on the use of a product substitution or its rejection by the Engineer is considered final. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

END OF SECTION 01 25 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 MINOR CHANGES IN THE WORK

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

1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
 - 1. Proposal requests issued by the Project Manager are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.
 - 2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owner's review, an estimate of cost necessary to execute the proposed change.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
 - d. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amount.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representatives findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.
 - 1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 - 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Comply with requirements in Section 012500 "Substitution Procedures" - if the proposed change in the work requires that substitution of one product or system for a product or system not specified.
 - 5. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amounts.
- C. Proposal Request Form: Project Manager will transfer the information to the appropriate forms for approval. Use AIA Document G 709 for Change Order Proposal Requests.
- D. Proposal Request Form: Use forms provided by the Owner for Change Order Proposals.

1.5 CONSTRUCTION CHANGE DIRECTIVE

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

1.6 CHANGE ORDER PROCEDURES

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

PART 2- PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION 01 26 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SCHEDULE OF VALUES

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.4 APPLICATIONS FOR PAYMENT

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit four (4) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.
- F. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors of sub-subcontractors and suppliers for the construction period covered by the previous application.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. The Owner reserves the right to designate which entities involved in the work must submit waivers.
 4. List all Subcontractor's start and finish dates to substantiate any Notice to Owner received by the Project Manager.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
1. List of principal subcontractors
 2. List of principal suppliers and fabricators
 3. Schedule of Values
 4. Approved Contractor's Construction Schedule (preliminary if not final)
 5. Schedule of principal products
 6. Schedule of unit prices (if applicable)
 7. Submittal schedule (preliminary if not final)
 8. List of Contractor's staff assignments
 9. List of Contractor's principal consultants
 10. Copies of building permits for trades requiring separate permits
 11. Copies of authorizations and licenses from governing authorities for performance of the Work
 12. Initial progress report
 13. Report of Pre-construction Meeting
 14. Initial settlement survey and damage report, (if required)
 15. Listing of all long lead procurement items monthly applications for payment will be accompanied with updated schedule and review of as-built drawings
- H. Interim Application for Payment: Payment will be processed once a month. No applications will be processed without receipt of previous months waiver of lien described in subsection F above. Payment for item will be based on percentage completed as determined and approved by the County Project Manager or invoice for stored materials. Retainage (5%) will be held for all interim applications.
- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

occupancy of designated portions of the Work. Application shall also include all items listed in Part H. above.

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

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

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

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

PART 2- PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION 01 29 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 COORDINATION

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.4 SUBMITTALS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

3.2 CLEANING AND PROTECTION

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

END OF SECTION 01 31 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 PRE-CONSTRUCTION CONFERENCE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.4 PRE-INSTALLATION CONFERENCE

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

1.5 COORDINATION MEETINGS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

representatives.

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

1.6 PROGRESS MEETINGS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 19

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

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

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

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

1.3 ELECTRONIC SUBMITTAL PROCEDURES

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

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

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

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Project Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Project Manager will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow two weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Engineer.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 23 73 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 23 73 00.01.A).
 - 2) Where multiple products are shown, highlight/circle or identify product intended to be used
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.5 SUBMITTAL LOG

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

1.6 DAILY CONSTRUCTION REPORTS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.7 SHOP DRAWINGS

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

1.8 PRODUCT DATA

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.9 SAMPLES

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION 01 33 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- d. Structural steel
 - e. Lintels
 - f. Timber and primary wood framing
 - g. Structural decking
 - h. Miscellaneous structural metals
 - i. Stair systems
 - j. Exterior curtain wall construction
 - k. Equipment supports
 - l. Piping, ductwork, vessels and equipment
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Refer to Divisions 23 and 26 regarding Fire Rated Penetrations.
- 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.
 - a. Shoring, bracing and sheeting
 - b. Primary operational systems and equipment
 - c. Air or smoke barriers
 - d. Water, moisture, or vapor barriers
 - e. Membranes and flashings
 - f. Fire protection systems
 - g. Noise and vibration control elements and systems
 - h. Control systems
 - i. Communication systems
 - j. Conveying systems
 - k. Electrical wiring systems
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.
- 1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
 - a. Processed concrete finishes
 - b. Preformed metal panels
 - c. Window wall system
 - d. Stucco and ornamental plaster
 - e. Acoustical ceilings
 - f. Carpeting
 - g. Wall covering
 - h. HVAC enclosures, cabinets or covers
 - i. Roofing systems

PART 2- PRODUCTS

2.1 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

indicated by Engineer/Owner. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3- EXECUTION

3.1 INSPECTION

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

3.2 PREPARATION

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

3.3 PERFORMANCE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

3.4 CLEANING

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

END OF SECTION 01 73 29

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following: List exceptions in the request.
 - 1. In the Application for Payment that coincided with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.
 - 2. Advise Owner of pending insurance change-over requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - 5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - 1. Results of the completed inspection will form the basis of requirements for final acceptance.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.4 FINAL ACCEPTANCE

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

1.5 RECORD DOCUMENT SUBMITTALS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

4. Submit one (1) hardcopy of the most current record set of drawings when the project is considered 50% substantially complete for review and comment by Owner.
 5. Organize record drawing sheets, and print suitable titles, dates and other identification on the cover of each set.
 6. Provide three (3) additional sets of black line drawing sets of As-Built Drawings.
 7. Provide one (1) CD-ROM with all As-Built Drawings in AutoCAD and PDF format.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.
1. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.
- D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Engineer for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Engineer and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owner's records.
- G. Maintenance Manuals: Organize operating and maintenance data into four (4) suitable sets of manageable size and electronically as PDFs on one (1) CD-ROM compact disc. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions
 2. Spare parts list
 3. Copies of warranties
 4. Wiring diagrams
 5. Recommended turn-around cycles
 6. Inspection procedures
 7. Shop Drawings and Product Data

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

8. Fixture lamping schedule

PART 2- PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 CLOSE-OUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that required regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. All items to be provided or completed prior to Certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:
 1. Maintenance manuals
 2. Record documents
 3. Spare parts and materials
 4. Tools
 5. Lubricants
 6. Fuels
 7. Identification systems
 8. Control sequences
 9. Hazards
 10. Cleaning
 11. Warranties and bonds
 12. Maintenance agreements and similar continuing commitments
 13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.
- B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:
 1. Start-up
 2. Shutdown
 3. Emergency operations
 4. Noise and vibration adjustments
 5. Safety procedures
 6. Economy and efficiency adjustments

3.2 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

6. Manufacturer's Certificates and Certifications
 7. Maintenance Service Contracts
 8. Spare Parts Inventory List
 9. Special Systems Operating Permits or Approvals
 10. Asbestos free materials notarized statement
- E. Provide all documents for each section listed. List individual documents in each section in the Table of Contents, in the sequence of the Table of Contents of the Project Manual.
- F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the product or work item.
- G. Separate each section with index to sheets that are keyed to the Table of Contents listing.
- H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.
- I. Electronic Close-out DVD: At the completion of the project, submit one copy of a DVD with entire project close out information below in PDF format. All letter, legal and brochure size sheets shall be portrait and the As-built drawings will be landscape. All fonts will be Arial. All items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify words on the scanned documents.
1. Contacts: Set up a separate PDF for the contacts. No bookmarks are needed for this section.
 2. As-Built: All as-built drawings will be landscape.
 3. Submittals: All technical submittal items (approved and approved as noted) will be provided and sorted by the 16 standard divisions. Bookmarks will be needed for the appropriate divisions.
 4. Operations and Maintenance Manual: Specify the division name only in the bookmarks (1-46). Please note that all items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify works on the scanned documents.
 5. Permitting: This should include the Certificate of Occupancy and any other document that the Project Manager may include pertaining to the permitting for the project.

3.3 FINAL CLEANING

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

END OF SECTION 01 77 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 01 78 00
WARRANTIES AND BONDS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 WARRANTY REQUIREMENTS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1.4 WARRANTY PERIOD

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

1.5 SUBMITTALS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 78 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 02 41 13
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SCOPE OF SECTION

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

1.2 REFERENCE STANDARDS

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

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

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

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

1.3 PROTECTION

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

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

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

1.4 SECURITY

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

1.5 HOUSEKEEPING

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

1.6 OCCUPIED SPACES

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

PART 2 - MATERIALS

2.1 LUMBER

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

2.2 TAPE

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

2.3 TEMPORARY CLOSURES

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

PART 3 - EXECUTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3.1 RELOCATION AND REMOVAL

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

3.2 PORTABLE COVERINGS

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

3.3 DEMOLITION

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

3.4 OWNERSHIP OF MATERIALS

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

3.5 SALVAGE OPERATIONS

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

3.6 REMOVAL

- 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

remain. When removing nails by claw hammer, place a small piece of wood under the hammer head to keep claws at right angle to the nail and prevent damage to the surface.

3.7 DISPOSAL

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

3.8 CLEANING

- A. Clean surfaces as described in specifications.

3.9 CONCRETE

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

3.10 UTILITIES AND RELATED EQUIPMENT, PLUMBING, AND ELECTRICAL WORK

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

3.11 DRYWALL

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

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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3.13 FIRESTOPPING AND DRAFT STOPPING

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

3.14. ACOUSTICAL LAY-IN CEILING

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

END OF SECTION 02 41 13

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 07 14 16
FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fluid applied waterproofing.

1.2 SUBMITTALS

- A. Product Data: For products indicated.
 - 1. Include material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: ASTM C 836 and coal-tar free.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals, LLC, Building Systems; Sonoshield HLM 5000.
 - b. CETCO; LDC 60.
 - c. Tremco Incorporated; Tremproof 201/60.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.
- C. Sheet Flashing: 50-mil- minimum, nonstaining, uncured sheet neoprene.
 - 1. Adhesive: Manufacturer's recommended contact adhesive.
- D. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.
- E. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

2.4 PROTECTION COURSE

- A. Protection Course: Extruded-polystyrene board insulation with continuous surface skins on both faces intact, unfaced; ASTM C 578, Type X, 1/2 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- D. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing according to waterproofing manufacturer's written instructions and to recommendations.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations. Before coating surfaces, remove dust and dirt from joints and cracks.

3.5 WATERPROOFING APPLICATION

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations.
- B. Cure waterproofing, taking care to prevent contamination and damage during application and curing.
- C. Install protection course with butted joints over waterproofing before starting subsequent construction operations.

3.6 PROTECTION

- A. Protect waterproofing from damage during remainder of construction period.
- B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sound attenuation blanket insulation.

1.2 SUBMITTALS

- A. Product Data: Each type of insulation product specified.
- B. Product Test Reports: From and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.
- C. Research or Evaluation Reports: Reports of the model code organization acceptable to authorities having jurisdiction that evidence compliance of foam-plastic insulations with building code in effect for Project.

1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Sound Attenuation Insulation:
 - a. CertainTeed Corporation.
 - b. Knauf Fiber Glass GmbH.
 - c. Owens-Corning Fiberglas Corporation.
 - d. Schuller International, Inc.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
 - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thickness, widths, and lengths.

2.3 SOUND ATTENUATION BLANKET INSULATION

- A. Sound Attenuation Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Thickness: To match cavity space indicated; provide single thickness blanket.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF INSULATION

- A. Apply insulation units to substrates, complying with manufacturer's written instructions. Bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Install insulation in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Do not force or compact insulation into stud cavity.

3.5 PROTECTION

- A. General: Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Formed sheet metal fabrications.

1.2 SUBMITTALS

- A. Product Data: For products indicated.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653, G90 coating designation.

2.2 MISCELLANEOUS MATERIALS

- A. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
1. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Obtain field measurements for accurate fit before shop fabrication.
 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2.4 SHEET METAL FABRICATIONS

- A. Fabricate from the Following:
 - 1. Galvanized Steel: Minimum 0.028 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, sealants, and other miscellaneous items required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- B. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Sealants for interior applications.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Joint Sealant - One-Part Latex Sealant: For interior use for horizontal and vertical joints around door frames, and joints between dissimilar materials.
1. Products and Manufacturers: Provide one of the following.
 - a. AC-20 + Silicone; Pecora Corp.
 - b. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
 - c. Tremflex 834; Tremco, Inc.
 2. Warranty: Manufacturer's standard warranty.
- B. Joint Sealant - Acoustic Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Product and Manufacturer: Provide the following.
 - a. Pecora Corporation; AC-20 FTR.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.2 MISCELLANEOUS MATERIALS

- A. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

PART 3 - EXECUTION

3.1 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
 - 1. Remove excess sealants from surfaces adjacent to joint.

3.2 CLEANING

- A. Clean off excess sealants 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.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 08 11 14
HOLLOW METAL DOOR FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Hollow metal door frames.

1.2 SUBMITTALS

- A. Product Data: For products indicated.
- B. Shop Drawings: Include the following:
1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 2. Locations of reinforcement and preparations for hardware.
 3. Details of each different wall opening condition.
 4. Details of anchorages, joints, field splices, and connections.

1.3 QUALITY ASSURANCE

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amweld Building Products, Inc.
 2. Ceco Door Products
 3. Curries Company
 4. Steelcraft

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 INTERIOR DOOR FRAMES

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Cement Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.

2.4 FRAMES

- A. General: Comply with ANSI/SDI A250.8.
- B. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as face welded.
- C. Hardware Reinforcement: ANSI/SDI A250.6.
- D. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches on center, to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on center and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 5. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
- C. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Reinforce door frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2.6 FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap door frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with veneer faces.
 - 2. Factory machining for hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of door and pocket door frame. Include details of core and edge construction. Include factory-finishing specifications.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed and wet work is complete.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist), or show telegraphing of core construction in face veneers.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Certificate of Occupancy.
 - a. Solid-Core Interior Doors: Manufacturer's standard warranty.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

PART 2 - PRODUCTS

2.1 SOLID-CORE WOOD DOORS

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

1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Eggers Industries; Architectural Door Division.
 - c. Marshfield DoorSystems, Inc.
 - d. VT Industries, Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Urea-Formaldehyde: Wood materials shall contain no added urea-formaldehyde.

2.3 VENEER FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:

1. Grade: Premium.
2. Species: Match Architect's sample.
3. Cut, Match and Balance: Match Architect's sample.
4. Exposed Vertical and Top Edges: Same species as faces or a compatible species.
5. Construction: Five plies. Stiles and rails bonded to core, then entire unit abrasive planed before veneering.
6. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 FABRICATION

- A. General: Fabricate doors in sizes indicated for Project-site fitting.

- B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

- C. Machining: Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Provide screw-attached metal labels.
 2. Cores: Provide mineral core as needed to provide fire-protection rating indicated.
 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- E. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch midrail blocking, in doors indicated to have armor plates.
 - d. Provide lock blocks, as required, in doors indicated to have exit devices.
 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: Minimum 550 lbf per WDMA T.M.-10.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Door hardware as scheduled.

1.2 SUBMITTALS

- A. Product Data: Include manufacturer's technical product data for each item of door hardware.
 - 1. Submit catalog cuts and/or product data sheets for all scheduled finish hardware.
- B. Door Hardware Schedule: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - 1. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
- C. Keying: Submit separate detailed keying schedule for approval indicating clearly how the owner's final instructions on keying of locks has been fulfilled.

1.3 QUALITY ASSURANCE

- A. General: All hardware shall meet the requirements of Federal, State and Local codes having jurisdiction.
- B. Regulatory Requirements: Comply with provisions of the following:
 - 1. Where required to comply with accessibility requirements, comply with the Accessibility Code for Building Construction.
- C. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver keys to Owner by registered mail or overnight package service.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1.5 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

- A. Manufacturer's Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. In the event of product failure, promptly repair or replace item with no additional cost to the owner.
 - 1. Locksets: Minimum five (5) years
 - 2. Door closers: Minimum ten (10) years

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Schedule" Article.

2.2 HINGES, GENERAL

- A. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Fasteners: Comply with the following:
 - 1. Screws: Phillips flat-head screws. Finish screw heads to match surface of hinges.

2.3 KEYING

- A. Keys: Nickel silver; permanently inscribed with a visual key control number and including the notation "DO NOT DUPLICATE."
 - 1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five great-grand master keys.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2.4 FABRICATION

- A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Door Frames: Comply with DHI A115 series.
- B. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.
- C. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

- A. General: Install each door hardware item to comply with manufacturer's written instructions.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Door Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3.4 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.

3.6 DOOR HARDWARE SCHEDULE

- A. General: The following schedule shall not be considered entirely exclusive. Provide additional hardware, as required, for compliance with the Code, or authority having jurisdiction. Should any particular door or item be omitted in any scheduled hardware group, provide door or item with hardware same as required for similar purposes.

1. Hardware Group No. 1: Provide the following:

Quantity	Description	Model Number	Finish	Mfgr
6 EA	HW HINGE	3CB1 4.5 X 4.5	652	IVE
1 SET	CONST LATCHING BOLT	FB53	630	IVE
1 EA	STOREROOM	45H7D 15R	626	BES
1 EA	COORDINATOR	COR X FL	628	IVE
2 EA	SURFACE CLOSER	4040XP X 62A	689	LCN
2 EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2 EA	WALL STOP	WS406/407CCV	630	IVE
1 SET	SEALS	188S	BLK	ZER

END OF SECTION 087100

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 2. Suspension systems for interior gypsum ceilings and soffits.

1.2 SUBMITTALS

- A. Product Data: For products indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Wall Framing: Horizontal deflection of L/240 of the wall height under a horizontal load of 5 lbf/sq. ft.

2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized.
 3. Depth: As indicated on Drawings.
 4. Minimum Base-Metal Thickness: 0.0188 inch (25 gauge), except as indicated below.
 - a. Provide 3-5/8-inch, 20 DW gauge metal studs at 16 inches on center for walls between 10 to 12 feet in height.
 - b. Provide 3-5/8-inch, 20 STR gauge metal studs at 16 inches on center for walls between 12 to 16 feet in height.
 - c. Provide 0.0312-inch thick studs for framing supporting ceramic tile substrates.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- B. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- C. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

2.3 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch.
 - b. Depth: As indicated on Drawings.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 0.0312 inch.

2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types and other assembly components indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Stud Spacing: 16-inches on center unless otherwise indicated.
- E. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- F. Direct Furring:
 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- G. Z-Furring Members:
 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.2 SUBMITTALS

- A. Product Data: For products indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Protected Openings Identification: All corridor partitions, smokestop partitions, horizontal exit partitions, exit enclosures, and fire rated walls required to have protected openings shall be effectively and permanently identified with signs or stenciling as follows.
1. Locate identification above ceiling areas and in concealed spaces. Provide the following wording: "FIRE AND SMOKE BARRIER PROTECT ALL OPENINGS".
 - a. Letter Size: 2-inches high
 - b. Spacing: 4 feet on center, maximum.
 - c. Letter Font: Helvetica Regular
 - d. Letter Color: Red.
 2. Also provide a 3-inch wide painted red line below the identification signage to identify the direction and extent/length of the rated wall. Extend the painted line the full length of the wall; identify directional changes and where rated walls end.

1.4 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. G-P Gypsum.
 - b. Lafarge North America Inc.
 - c. National Gypsum Company.
 - d. USG Corporation.
- B. Regular Type and Type X (fire rated):
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.

2.2 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Paper-faced galvanized steel sheet.
 - 2. Shapes: As indicated.

2.3 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening backer board, use screws of type and size recommended by panel manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS

- A. General: Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Penetrations:
 - 1. Refer to Division 07 regarding firestop sealing of wall and ceiling penetrations.
 - 2. Seal around all non-fire rated penetrations of gypsum panel walls and ceilings completely to minimum of Smoketight requirements.

3.3 INSTALLING TRIM ACCESSORIES

- A. General: Attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 in specific locations identified, where approved by Architect, as indicated on the Drawings, and as follows:
 - 1. Ceilings: Unless otherwise indicated install control joints as follows:
 - a. Install control joints in areas exceeding 2500 sq. ft.
 - b. Space control joints not more than 50 feet on center.
 - c. Install control joints where ceiling framing or furring changes direction.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2. Partitions and Furring: Unless otherwise indicated install control joints as follows:
 - a. Install control joints in partitions and wall furring runs exceeding 30 feet.
 - b. Space control joints not more than 30 feet on center.
 - c. Install control joints in furred assemblies where control joints occur in base exterior wall.

3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 3: Ceiling plenum areas and concealed areas.
 2. Level 4: All other locations.

3.5 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet and moisture damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall base.

1.2 SUBMITTALS

A. Product Data: For products indicated.

B. Samples: For products indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 WALL BASE

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

1. Armstrong World Industries, Inc.
2. Johnsonite; A Tarkett Company.
3. Roppe Corporation, USA.
4. VPI, LLC, Floor Products Division.

B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style: Style B.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- E. Outside and Inside Corners: Job formed.
- F. Color: To be selected by Architect from manufacturer's full range.

2.2 MISCELLANEOUS MATERIALS

- A. Filler Material: Type approved by resilient product manufacturers for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

3.2 RESILIENT WALL BASE INSTALLATION

- A. General: Install resilient base in accordance with manufacturer's instructions and recommendations.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch wall base during installation.
 - 4. On irregular substrates, fill voids along top edge of wall base with manufacturer's recommended filler material.
- B. Clean wall base in accordance with manufacturer's instructions and recommendations.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
- D. Replace damaged wall base.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Painting.

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

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

1.2 SUBMITTALS

A. Product Data: For each paint system specified.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1. After color selection, the Architect will furnish color chips for surfaces to be coated.

C. 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. Submit 3 Samples on rigid backing, 8-1/2" x 11".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products and Manufacturers: Subject to compliance with requirements, products and manufacturers specified include, but are not limited to, the following:

1. The Sherwin-Williams Company

B. Other Products and Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Company (Moore)
2. Glidden Professional
3. PPG Industries, Inc. (PPG)

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2.2 PAINT MATERIALS, GENERAL

- A. 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.
- B. Colors: Provide color selections made by the Architect.

PART 3 - EXECUTION

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

3.2 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.

3.3 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.

3.4 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. Comply with procedures specified in PDCA P1.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3.5 INTERIOR PAINT SCHEDULE

A. Gypsum Drywall – Walls:

1. Paint System, Application and Finish: Latex; two Finish Coats over Primer.
 - a. Primer: Promar 200 Zero VOC Latex Primer
 - b. Finish Coats: Promar 200 Zero VOC Interior Latex
 - c. Sheen Level: Match Architect's sample.

B. Ferrous Metal: Includes steel doors and frames.

1. Paint System, Application and Finish:
 - a. Primer: Kem Kromik Universal Metal Primer
 - b. Finish Coats: ProIndustrial Urethane Alkyd Enamel
 - c. Sheen Level: Match Architect's sample.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 01 30.51
HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF THE WORK

- A. Provide all labor, materials, facilities, equipment and services to thoroughly clean HVAC systems located within the West Concourse D.
 - 1. The Contractor will provide the estimated dates from start to finish performing the cleaning services.
 - 2. The HVAC units, specific to this bid are: AHU-75, AHU-76, AHU-77, AHU-78, AHU-79, and AHU-80.
- B. The cleaning work for each building is to include but not limited to the following components:
 - 1. Main Air Handling Unit(s):
 - a. Outside air intake(s).
 - 2. All supply and return ductwork, lined and unlined, including ductwork plenums, branches, risers, etc.
 - 3. All associated air terminal devices, i.e. supply diffuses, return registers, etc.
 - 4. Variable air volume (VAV) boxes.
 - 5. Reheat coils (electric or hot water).
 - 6. Sound attenuators.
 - 7. Exhaust duct system and all associated registers.
 - 8. Exhaust fan and return fan.
 - 9. Fire and fire/smoke dampers.
- C. Contractor will provide all labor, material and services to obtain access to HVAC units and 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

or ceilings was made, or damage occurs, including but are not limited to:

1. Ductwork and components.
2. Insulation.
3. Pneumatic and electric control components.
4. 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 Latest Edition.
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 ARCHITECT/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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- 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 cm² 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 cm² 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 HVAC units, 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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. All A/C coils, drain pans, heating coils, humidifiers, fans, registers and grilles to be power washed using a high pressure, low fluid volume equipment. Cleaning to be performed in

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

the steps:

1. Using biodegradable industrial type concentrated detergent.
 2. Using a concentrated disinfectant, fungicide, odor counteractant, EPA approved material such as Oxine.
- E. Induction Units: The induction unit covers shall be removed, and the entire unit interior completely brushed and vacuumed. All unit nozzles shall be clean and inspected. The Owner shall be notified of any broken or missing nozzles. Units subject to visual verification only.
- F. VAV Boxes: Disconnect inlet ducts, open access door and completely brush and mechanically vacuum all interior surfaces.
- G. Duct Re-heat Coils: Duct mounted coils shall be hand washed (air or water) on both coil faces. Thoroughly clean coil faces insuring the removal of debris, while avoiding damage to the fins. Remove corrosion from around the coil frames and paint all corroded metal surfaces. Perform pressure differential readings across the coil to verify cleanliness. Final pressure differentials across the coil shall be within 10% of manufacturer's original ratings.
- H. 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.
- I. Grilles, Registers and Diffusers: Whenever the grilles, registers and diffusers (GRD) are removable, they shall be removed, washed, dried, sanitized and replaced. When the GRD are restricted by a facade or welded in place, hand vacuuming and cleaning are acceptable. The Contractor shall avoid disturbing the existing volume damper settings. The Contractor is not responsible for cleaning the debris built-up on the ceiling.

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 Verification of Coil Cleaning 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/Air Handling Unit surfaces must be visibly clean and

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- 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/cm².
 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.

- C. Verification of Coil Cleaning: Mechanical cleaning must restore the coil-pressure drop to within 10% of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean based on a thorough visual inspection.

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 and replace straps or clamps and flexible duct if damaged,

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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 SECTION 23 01 30.51

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.1 ARTICLES INCLUDED

- A. Definitions.
- B. Permits, Fees and Notices.
- C. Applicable Publications.
- D. Code Compliance.
- E. Scope of Work.
- F. Record Drawings.
- G. Intent of Drawings and Specifications.
- H. Quality Assurance
- I. Submittals.
- J. Product Requirements, Equals and Substitutions.
- K. Manufacturers Instructions.
- L. Transportation and Handling.
- M. Storage and Protection.
- N. Cutting, Patching and Demolition.
- O. Cleaning Up/Removal of Debris.
- P. Starting of Mechanical Systems.
- Q. Operating and Maintenance Manuals.
- R. Training of Owners Operators.
- S. Guarantee of Work.
- T. System Testing.

1.2 ARTICLES

- A. Definitions:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.
 2. The term "Provide", means furnish and install as part of the work covered in Division 23.
 3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
 4. The term "Install only" means to install under the work of Division 23 equipment furnished by other Divisions, or by the Owner.
 5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.
 6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the plumbing system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.
 7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
 8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well organized high quality installation system (duct, pipe, control wire or tube, conduit, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (duct, pipe, control wire or tube, conduit, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.
 9. For additional definitions refer to the Division 01 requirements.
- B. Permits, Fees and Notices: Refer to the Division 01 requirements.
- C. Applicable Publications:
1. Publications listed in each Section form a part of that Section to the extent referenced.
 2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
 3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.
- D. Code Compliance:
1. Life Safety Code - NFPA 101
 2. Florida Building Code, 2010
 3. Florida Mechanical Code, 2010
 4. Florida Accessibility Code, 2010
 5. NFPA.
- E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all HVAC as indicated in the Contract Documents.
- F. Record Drawings: Refer to the Division 01 requirements.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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 Division 01 requirements.

H. Quality Assurance:

1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

I. Submittals: Refer to the Division 01 requirements.

J. Product Requirements, Equals and Substitutions: Refer to the Division 01 requirements.

K. Manufacturer's Instructions:

1. Installation of work shall comply with manufacturer's printed instructions.
2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- L. Transportation and Handling: Refer to the Division 01 requirements.
- M. Storage and Protection:
 - 1. Store products in accordance 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: Refer to the Division 01 requirements.
- O. Cleaning Up/Removal of Debris:
 - 1. Comply with the Division 01 requirements.
 - 2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.
- P. Starting of Mechanical Systems:
 - 1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
 - 2. Provide labor to assist the Owner's Representative in acceptance review.
 - 3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
 - 4. Provide information and assistance and cooperate with test, adjust and balance services.
 - 5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
 - 6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.
- Q. Operating and Maintenance Manuals: Refer to the Division 01 requirements.
- R. Training of Owners Operators:
 - 1. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
 - 2. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shut-down and any emergency procedures.
 - 3. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.
- S. Guarantee of Work:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Comply with the Division 01 requirements.
 2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
 3. Insert warranties in appropriate locations in operating and maintenance manuals.
 4. Materials and equipment having seasonal operation limitations, shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 23 specifications specify a longer period.
- T. System Testing:
1. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
 2. Provide all necessary labor, materials and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 23 and the work of other divisions exists.
 3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 23 05 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 10
BASIC MATERIALS AND METHODS OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Fire and smoke stopping. (Refer to Division 07)
- B. Electrical requirements. (Refer to Division 26)
- C. Concrete work.
- D. 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 Division 01 requirements.
- B. Shop Drawings: Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.
- C. Product Data: Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.
 - 1. Fire and smoke stopping material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fire and Smoke Stopping Material: (Refer to Division 07 for requirements).

2.2 FABRICATION

- A. Fire and Smoke Stopping: All work is provided under Division 07.
- B. Electrical Requirements: All work is provided under Division 26.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

C. Concrete Work:

1. This contractor to provide detailed dimension drawings, including anchor bolt locations where required for all bases and pads required for equipment furnished under this Division.
2. Concrete for equipment bases and pads shall be 3000 p.s.i. design mix prepared in accord with ASTM C94. Cement shall be in accord with ASTM C150. Aggregate shall be fine sand in accord with ASTM C33. Water shall be clean, fresh, drinkable.

D. Placing of Equipment: Product description not applicable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Installation of materials and equipment shall be in accordance with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

- A. Fire and Smoke Stopping: Fire and smoke stopping shall be provided in Division 07.

- B. Electrical Requirements: Refer to Division 26 for electrical requirements.

C. Concrete Work:

1. Concrete pads and curbs for supports of equipment shall be a minimum of 4" high with chamfered edges and sized for approved equipment.
2. Surfaces of concrete shall be troweled smooth. When forms are removed, fill voids with cement and rub smooth with rubbing stone.
3. Do not pour concrete when ambient temperature is less than 40°F, and falling.

D. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
2. All air handling units shall have code required and manufacturer required clearances around all equipment.
3. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
4. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.
5. Exercise caution during equipment placing operations to insure that structure is not overloaded.
6. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required, or use crane to place equipment directly on permanent and finished support.

END OF SECTION 23 05 10

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Motors for equipment furnished under this Section.

1.3 SUBMITTALS

- A. Motors:
 - 1. Submission for acceptance is required. All three phase motors are based on NEMA Premium™ efficiency motors as described below by the minimum allowable efficiency. As a result, all motor starting codes are based on Code letter F or greater as defined by NEC Article 430. In the event that a manufacturer provides a motor with a code letter less than F, the overcurrent protection of the motor shall be coordinated with the Electrical Contractor to comply with NEC Article 430.
 - 2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

1.4 APPLICABLE PUBLICATIONS

- A. NEMA Publication ICS.
- B. NEMA Publications MG-1, MG-2, MG-13.

1.5 QUALITY ASSURANCE

- A. Motor efficiencies in accordance with IEE Standard 112 Method B as defined by NEMA MG1-1.23 a. and b.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Motors:
 - 1. A.O. Smith/Century E-Plus
 - 2. Baldor Electric Company, Premium Efficiency.
 - 3. Emerson Electric Company, U.S. Electrical Motors Div., Premium Efficiency Type 'DE' & 'RE'.
 - 4. The Louis Allis Company, High Efficiency.
 - 5. General Electric Company, Premium Efficiency Energy Saver®
 - 6. Reliance Electric Manufacturing Company, XE™ Premium Efficiency Motors.

2.3 FABRICATION – MOTORS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. NEMA Premium™ efficiency type having the following minimum efficiencies:

Minimum Nominal Full-Load Motor Efficiency (%)						
	Open Motors			Totally Enclosed		
Number of Poles	2-Pole	4-Pole	6-Pole	2-Pole	4-Pole	6-Pole
Speed (RPM)	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
HP						
0.75	---	85.5	---	---	85.5	---
1	82.5	85.5	82.5	77.0	85.5	82.5
1.5	84	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93	91.7	91.0	92.4	91.7
20	91	93	92.4	91.0	93.0	91.7
25	91.7	93.6	93	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93	94.7	94.1	93.0	94.5	94.1
60	93.6	95	94.5	93.6	95.0	94.5
75	93.6	95	94.5	93.6	95.4	94.5
100	93.6	95.4	95	94.1	95.4	95.0
125	94.1	95.4	95	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95	95.8	95.4	95.4	96.2	95.8
250	95	95.8	95.4	95.4	96.2	95.8
300	95	95.8	95.4	95.4	96.2	95.8

2. Drip proof, except motors located outdoors to be TEFC or as otherwise specified.
3. Continuous duty, 40°C ambient.
4. Regreasable ball bearing design.
5. Class B insulation, except motors for variable speed drive application to be specially built for Adjustable Frequency Drive (AFD) duty and include Class F insulation and be suitable for operation down to 10% on fan and pump applications.
7. Assembly to meet application.
8. 1.15 service factor.
9. Slide bases as required.
10. 60 Hz. terminal box large enough to accommodate the required conduit and wiring.
11. 200, 208, 230 or 460 volt, 3 phase as scheduled.
12. Provide shaft grounding rings on all motors driven by a VFD. Typically to an AEGIS – SGR model or approved equal.

B. Fractional Horsepower Motors:

1. Permanent split capacitor.
2. 115 volt, 1 phase, 60 Hz.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3. Thermally protected.
4. Other features of motors supplied as an integral part of a factory assembly shall be acceptable as the manufacturers standard based on acceptance of the assembly as a whole.

PART 3 - EXECUTION

3.1 GENERAL

- A. Furnish all necessary wiring diagrams to Division 26 for installation and power wiring.

3.2 MOTORS – INSTALLATION

- A. Motors:
 1. Install in accordance with requirements of the duty.
 2. Lugs to be provided under this Division.
 3. All motors shall have overload protection as required by NEC.

END OF SECTION 23 05 13

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 17
ADJUSTABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Adjustable frequency drive units (AFD) for all motors identified as operating at variable speed.

1.3 QUALITY ASSURANCE

- A. All adjustable frequency drives and bypass assemblies and control panel enclosures must be the product of a single manufacturer.
- B. AFD shall be UL or ETL listed. Components used in all options shall be UL listed. The entire AFD and bypass assembly shall be U.L. marked with a short circuit current rating of at least 100,000 amperes. The VFD short circuit rating shall be posted in the operating instructions or on the product label. This shall be in compliance with the UL listing and rating requirement.
- C. The AFD shall be designed to meet the power line transient conditions defined within ANSI/IEEE C62.41-2002 - "Guide on the Surge Environment in Low-Voltage (1,000 V and less) AC Power Circuits" and shall have a voltage withstand rating of 6 KV in accordance with UL 1449.
- D. AFD shall be in certified for with FCC emission limits for Class A computing devices. If required to meet these limits, isolation transformers, and/or line filters shall be provided.
- E. Ambient noise generated by the AFD shall be limited to an amount equal to 3 dBA greater than the fan or pump system noise level at design rpm. If acoustic enclosures are required to meet these limitations provide same with the AFD.
- F. AFD manufacturer shall submit an analysis to certify that the drive, when installed in the electrical distribution system shown on the Contract Documents is in compliance with the requirements of IEEE 519-2014. The Point of Common Coupling (PCC) shall be defined as the secondary lugs of the Utility Company Transformer. The transformer impedance shall be 5.75% with the appropriate short circuit current based on this value.
- G. AFD and option design and construction thereof shall comply with all applicable provisions of the latest National Electrical Code.
- H. Power components shall undergo burn in to ensure product function. Circuit boards shall be tested under thermal cycling and the complete unit shall be tested under full load conditions to ensure maximum product reliability.
- I. A Factory Authorized Service Engineer is to be provided for start up which shall include verification of proper installation and wiring. Inspect all components, circuit boards and control wiring. Ensure proper power source and control signal. Apply power and provide full operational testing and calibration. Also provide training for owner's operators.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- J. Provide full three year on-site parts and labor warranty including travel time and expense. Warranty period shall begin at date of substantial completion.
- K. AFD's shall be fully protected during the duration of construction of the project. Units shall be covered to protect from all dirt, dust and debris. Contractor will be responsible for replacing any unit that has dirt, dust or debris infiltration into the unit.
- L. The supplier shall offer a service support group which shall be able to provide the following additional services; not included in this contract:
 - 1. Emergency service calls.
 - 2. Overnight service parts.
 - 3. Service contracts.
 - 4. In-plant training of client personnel in basic troubleshooting.
 - 5. Coordinate enrollment of client personnel in factory-held service schools.

1.4 SUBMITTALS

- A. Submission for acceptance is required. Submittal shall show compliance with all paragraphs and statements listed in part 2 below.
- B. A complete harmonic analysis showing compliance with IEEE 519-2014 shall be provided with the submittal as defined in paragraph 1.3 above.
- C. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Adjustable Frequency Drive Units:
 - 1. ASEA Brown Bovari (ABB)
 - 2. Century (MagnaTek)
 - 3. Cutler Hammer
 - 4. Danfoss
 - 5. Hitachi
 - 6. Reliance Electric
 - 7. Square D
 - 8. SSD Drives, Inc.
 - 9. Trane
 - 10. Toshiba
 - 11. Yaskawa

2.2 EQUIPMENT REQUIREMENTS

- A. Adjustable Frequency Drive:
 - 1. The adjustable frequency drive shall convert either 208/230 or 460 volt $\pm 10\%$, three phase, 60 HZ (± 2 HZ) utility power to adjustable voltage/frequency, three phase, AC power for step-less motor control from 5% to 105% of base speed.
 - 2. The adjustable frequency drive (AFD) shall produce an adjustable AC voltage/frequency output for complete motor speed control using transistorized sine-coded PWM technology, and an input power factor near unity over the entire speed range. The AFD shall not produce excessive or objectionable motor

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

acoustical noise. The AFD shall not induce voltage line notching back to the utility line and total harmonic distortion (THD) shall not exceed the limits set in IEEE Std. 519 -2014 when installed in the electrical distribution system shown on the Contract Documents. The AFD shall be automatically controlled by a grounded electronic control signal.

3. The AFD shall be self contained, totally enclosed in a NEMA 1 ventilated cabinet and capable of operation between 0° and 40°C except where located outdoors enclosure to be NEMA 3R or 4X watertight and dust-tight enclosure, depending on the manufacturers offering. The entire AFD assembly shall be mounted in a common enclosure requiring only a power in and a power out connection.
4. The AFD maximum output current rating shall be as follows:

Horsepower (HP)	FLA @ 208 V	FLA @ 460 V
5	16.7	8.2
7-1/2	24.2	11.0
10	28.0	14.5
15	46.2	21.0
20	59.4	27.0
25	----	34.0
30	----	40.0
40	----	52.0
50	----	65.0
60	----	77.0
75	----	106.0
100	----	130.0

5. AFD shall be a minimum of 97% efficient at 100% rated output power, 60 HZ.
6. The AFD shall have the following basic features:

- a. Operator control interface.
 - (1) Hand/Off/Auto operator switch.
 - (2) Panel mounted digital display capable of indicating unit status, frequency and fault diagnostics, including overcurrent, overvoltage, overheating, ground fault or short circuit.
- b. Electronic control follower board, 0-5 VDC, 0-10 VDC or 4-20 mA or 0-135 ohms (coordinate requirement with controls contractor).
- c. Minimum/maximum adjustable speeds (Minimum speed factory set at 12 HZ, maximum speed factory set at 60 HZ, may vary based on application).
- d. Manual speed potentiometer control for use when AFD is in manual control mode.
- e. Adjustable linear timed acceleration and deceleration for soft starting/stopping (adjustable from 1-300 sec) recommended range 20-60 seconds depending on inertial load. Factory set at 60 seconds.
- f. 3-80 HZ controlled speed range (factory set at maximum frequency of 60 HZ).
- g. Output terminals for remote frequency meter and ammeter.
- h. RFI/EMI filter.
- i. Manual bypass circuit with three contactors to provide full speed starter operation for motors 100 HP and less and an electronic, solid state, full-wave, soft-start controller for all motors 125 HP and larger for operation in the event of AFD electronics failure complete with disconnect and overload protection in all three phases. Provide a three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal,

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- providing solid state protection by opening starter for loss of any phase, low voltage or any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.
- j. Line circuit breaker disconnect (door-interlocked) with current limiting fuses on the line side of the circuit breaker having a minimum AIC rating of 200,000 Amps. The disconnect switch shall have a minimum short circuit rating of 100,000 amps.
 - k. Provide line impedance reactors to the power line to reduce the total harmonic distortion (THD) level to that allowed by IEEE 519-2014. If the harmonic distortion level required by IEEE 519-2014 can be met without these devices, they may be omitted.
 - l. Isolation transformer with electrostatic shields for optimum noise protection and phase shifting capability shall be provided where the addition of line impedance reactors will not lower the total harmonic distortion (THD) level to that allowed by IEEE 519-2014. If the harmonic distortion level required by IEEE 519-2014 can be met with only line reactors, then phase shifting isolation transformers may be omitted.
7. The AFD controller shall include the following protective circuits/features:
- a. Current limit shall be provided at 100% of the motor FLA. If current exceeds 100% of the motor current, the AFD will slow down the motor. If the current continues to rise the AFD shall shutdown on overcurrent. Current limit will be adjustable by qualified service personnel for application of AFD to smaller than nameplate motors.
 - b. Current limit/soft stall feature - current limit/soft stall allows continuous operation while in an overload condition. It limits the current by slowing down the frequency. The soft stall feature will be field set and the current limit adjusted to 100% of the motor FLA or drive FLA whichever is smaller.
 - c. Instantaneous electronic trip - automatically safely shutdown motor if:
 - (1) Current exceeds 200% of design.
 - (2) Phase-to-phase output short circuit occurs.
 - (3) Phase-to-ground output short circuit occurs.
 - (4) Phase loss occurs.
 - d. The AFD shall be programmable to provide restart automatically, if desired, when input line returns to normal in the event of:
 - (1) Intermittent power outage.
 - (2) Phase loss.
 - (3) Overvoltage shutdown.
 - (4) Intermittent voltage spike.
 - e. Insensitive to incoming power phase.
 - f. Line-to-line fault protection.
 - g. Line-to-ground short circuiting and accidental motor grounding protection.
 - h. Electronic overload protection.
 - i. Over-temperature protection.
8. The AFD shall be designed and constructed to operate within the following service conditions:
- a. Elevation up to 3300 feet without derating.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- b. Ambient temperature range - 0°C to 40°C.
- c. Atmosphere - non-condensing relative humidity to 90%.
- d. A-C line voltage variation - 10% to +10%.
- e. A-C line frequency variation ± 2 HZ.

9. Bases of Design: Danfoss FC102 or Trane TR200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Adjustable Frequency Drive:

1. Furnish adjustable frequency drive for each motor identified as requiring an adjustable frequency drive or variable speed operation.
2. Receive, unload and deliver drives to electrical contractor on job-site for storage, uncrating and installation by Division 26.
3. Furnish all necessary wiring diagrams to electrical contractor for installation and power wiring.
4. Coordinate the purchased equipment with the motor served and with the automatic temperature control system, paying specific attention to the signal sent and received and the ground source.
5. Start-up shall be by a factory trained field service engineer. Start-up shall be done with the cooperation of the controls contractor. The minimum speed shall be set for 20% at the AFD. The control signal shall be full scale so that the minimum speed will be 20% (adjustable).
6. AFD to be mounted where indicated on the drawings or within sight of the motor controlled.
7. Where a remote disconnect is provided for a motor controlled by an adjustable frequency drive, coordinate with the supplier of the disconnects to ensure that a late make, early break auxiliary contact rated for ten amps continuous duty is provided on the disconnect. This auxiliary contact must be wired into the AFD start circuit to ensure shut-down of the AFD in the event of the disconnect being opened.
8. AFD may be mounted directly to masonry, CMU or concrete walls using appropriate fastening methods, including back plates. When the wall is an exterior wall or any wall where condensation may occur, provide appropriate stand-off, i.e., (Uni-strut channel).
9. AFD may be mounted directly to equipment such as factory or field built AHU. In this case, through bolts and backing plates along with an appropriate stand-off shall be used. Seal all holes. Self-tapping screws with exposed ends will not be acceptable.
10. When AFD is required to be located in areas where walls are not available, provide a Uni-strut type frame securely mounted to floor adequately braced to form a rigid mounting surface.
11. AFD shall be generally mounted with the center of the unit at 60" above the finished floor. Service clearance shall be provided in accordance with the latest edition of the National Electric Code and under no circumstances less than the following:

<u>Voltage to Ground</u>	<u>Minimum Clearance Distance</u>
110V or 120V	3'-0"
208V, 220V, 240V or 277V	3'-6"
460V or 480V	4'-0"
Greater than 480V	5'-0"

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

12. Adjustable frequency drives shall be accessible.
13. Provide housekeeping pad for all floor mounted adjustable frequency drives.

END OF SECTION 23 05 17

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 18
CONTROL WIRING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to Division 26 for electrical wiring requirements.

1.2 WORK INCLUDED

- A. Building Control System Wiring.

1.3 DEFINITIONS

- A. Control Wiring: All wiring, high or low voltage other than power wiring, required for the proper operation of the mechanical systems.
- B. Power Wiring: All line voltage wiring to the mechanical equipment. Line voltage which also serves as a control circuit, such as a line voltage thermostat, or involves interlocking with a damper, shall be considered control wiring.

1.4 QUALITY ASSURANCE

- A. All work will be in accordance with the requirements of the National Electrical Code.

1.5 SUBMITTALS

- A. Submittals are not required.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All material used in the completion of the wiring under this section will comply with the requirements of Division 26 Electrical and Section 23 09 00 – Building Automation System.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cooperate completely with the contractor for Division 26.
- B. Provide all conduit, wire and accessories necessary to complete the control wiring as specified under WORK INCLUDED.
- C. Because of variations in requirements from manufacturer to manufacturer, all details may not be included in the Contract Documents. This sub-contractor must obtain approved coordinated wiring diagrams before proceeding with the control wiring.
- D. All control wiring shall be properly installed in an approved raceway system or when allowed, run exposed in concealed spaces. All control wiring run in exposed areas shall

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

be in an approved raceway unless otherwise noted.

- E. Control wire run exposed shall be neatly bundled and routed parallel and/or perpendicular to building structure or equipment casing. Routing of wire shall be so that it does not interfere, chafe or obstruct service or maintenance of the equipment served.
- F. Exposed control wire shall be properly secured and/or supported within equipment enclosures. Cable shall be secured on no greater than 18" centers.
- G. All openings made for the passing of control wire shall be properly bushed to prevent chafing. Hole size shall be suitable for the quantity of wires or tubing passing through while allowing for ease of pulling and future expansion. Oversized holes beyond these requirements are not allowed.
- H. Holes made within air handling equipment which may allow the transfer or bypassing of air shall be properly sealed after wire is pulled. Expanding foam sealant and proper backing material will be acceptable. Seal shall be suitable for maximum unit operating pressures.
- I. Attachments of control devices, raceway and cable supports shall be made with proper attachments. Self-drilling screws which result in exposed end will not be acceptable. Bolts and nuts shall be used with bolt head exposed to view. All fasteners located where exposed to weather or moisture shall be stainless steel or cadmium plated.
- J. Any opening, holes or cuts in equipment enclosures or building structure not used shall be neatly sealed. On equipment, the seal or patch shall be of similar material sealed and painted to match.
- K. The control contractor shall clean all unused or scrap material from the equipment enclosure.
- L. All control wire shall be identified by proper cable identification methods. Verify how cables shall be labeled with the Owner's Representative prior to the start of work. All termination shall be labeled and labels clearly visible.
- M. All control devices, cabinets, equipment and raceways shall be labeled. Verify how the hardware shall be labeled with the Owner's Representative prior to the start of work.
- N. Splices in control wire are not allowed unless the length of run is too great to allow for a continuous run. When splices become necessary, they shall be solder connected with heat shrink tubing. When raceway is used, all splices shall be in junction boxes.
- O. Control devices (i.e., flow switches), connected to cold equipment where the possibility of condensation may occur shall be vaporproof type. The connecting conduit shall be properly sealed with spray type foam after the wires are pulled through. If this is not possible, a weatherproof junction box shall be close mounted to the device to allow for proper moisture sealing. Conduit connections shall be sealed with a silicon type caulk/sealant.
- P. All control devices or wiring located exposed to weather or moisture shall be in an approved raceway system. This system shall be properly supported and sealed to prohibit moisture convection or transfer. Provide flexible conduit similar to seal tight for connection to all equipment. EMT and set screw fittings are not acceptable. All exterior raceway shall be IMC (Intermediate Metallic Conduit) or better with threaded fittings.

END OF SECTION 23 05 18

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 19
METERS, GAGES AND ACCESSORIES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Strainers.
- B. Thermometers and Accessories.
- C. Pressure Gauges and Accessories.
- D. Pressure and Temperature Test Ports.
- E. Pump Suction Diffuser.
- F. Install Miscellaneous Control Devices.

1.3 SUBMITTALS

- A. Submit schedule of all products used. Include make, model and size. When multiple products will be used, generic size and flow range will be acceptable.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Strainers:
 - 1. Crane
 - 2. ITT Grinnell
 - 3. O.C. Keckley
 - 4. Mueller Steam Specialty Co. (MUESSCO).
 - 5. RP&C Division, Conbraco Industries, Inc.
 - 6. Victaulic Co. of America
 - 7. Wheatley Gaso, Inc.
- B. Thermometers and Accessories:
 - 1. Duro Instrument Corp.
 - 2. Taylor
 - 3. H.O. Trerice
 - 4. Weiss
 - 5. Weksler
 - 6. Winter's ThermoGauges
- C. Pressure Gauges and Accessories:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Ashcroft
2. Duro Instrument Corp.
3. H.O. Trerice
4. Weiss
5. Weksler
6. Winter's Thermogauges

D. Pressure and Temperature Test Ports:

1. Peterson Equipment Co., Inc.
2. Sisco P/T Plugs
3. Or approved equal

E. Pump Suction Diffuser:

1. American Wheatley
2. Armstrong Pump Co.
3. Bell and Gossett
4. Mueller Steam Specialty Co (MUESSCO).
5. Patterson Pump Company
6. Taco, Inc.
7. Victaulic Co. of America

2.2 FABRICATION

A. Strainers:

1. "Y" Pattern:

a. HVAC Water Service:

- (1) Size 1/4" thru 2": Cast iron body, threaded connection, threaded blow-off cover, removable stainless steel screen .045" perforations, rated at 450 PSIG. Based on Mueller Steam Specialty Co. (MUESSCO) #11M or approved equal.
- (2) Size 2-1/2" and up: Cast iron body, flanged connection, flanged blow-off cover. Blow-off cover tapped for blow-off valve, removable stainless steel screen .045" perforations, rated at 125 PSIGG. If grooved mechanical system is in use a "T" type grooved end, ductile iron body, available with blow off, 304 SS removable screen, choice of mesh size. Based on Victaulic Style 730 (grooved T type) Mueller Steam Specialty Co. (MUESSCO) #751 or approved equal.

B. Thermometers and Accessories:

1. Industrial Reading Non-Mercury Type:

- a. Construction: Adjust angle, 9" scale with lagging extension brass well, of the blue or red reading spirit (organic) fill type and guaranteed accurate to \pm one scale division. Thermometer shall have glass front to exclude dirt and dust. Thermometers containing mercury are not acceptable. Thermometers installed outdoors shall be specifically designed and weatherproofed for this application.
- b. Stem Length:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- | | | |
|-----|---------------------|--------|
| (1) | 6" pipe and smaller | 3-1/2" |
| (2) | 8" to 12" pipe | 6" |

c. Ranges:

- (1) Chilled water 0 to 120°F or 0 to 100°F as available.

d. Based on Weksler Type EG5H-9 or approved equal.

2. Thermometer Well: Construction - Brass or ductile iron body, with lagging extension, length to accommodate thermometer stem length. Based on Weksler or approved equal.

C. Pressure Gauges and Accessories:

1. Pressure Gauges:

- a. Construction: 4-1/2" dial, high impact polypropylene case, 1/4" bottom connection, 1/2% accuracy in accordance with ANSI B40.1 - 1974 Grade A. Stainless steel rotary with stainless steel pinion gear; stainless steel sector gear; stainless steel link. Stainless steel bourdon tube, 316 stainless steel socket and slotted adjustable pointer.
- b. Case of black high impact polypropylene suitable for surface or direct mounting and with bottom connection. For outdoor locations, provide glycerine filled gauges.
- c. Range: Ranges shall be so selected to indicate pressure reading in midpoint of scale selected.
- d. Based on Weksler Model AA44-2 and AY44-2 or approved equal.

2. Manifold Valves (Trumpet Valve) (Water):

- a. 2, 3 or 4 port. Brass body, spring return, push button brass valves, 1/4" compression connections. Gauge tap at top, calibrated gauge test port with gauge cock. 125 PSIG rated, 20°F to 220°F range. Based on Flow Conditioning Corporation Hydronic Indicator System or approved equal.

3. Piston type snubber: Brass body, threaded connections, suitable for mounting horizontal or vertical. (Required at pump inlet and discharge.) Based on Weksler Type RS-1 or approved equal.

4. Filter type snubber: Brass body, threaded connection, micro metallic stainless steel filter. (For all gauges except pump service). Based on Weksler Type BW42 or approved equal.

D. Pressure and Temperature Test Ports:

1. Brass or stainless steel body with threaded cap and gasket, length to extend past insulation.
2. Two self closing valves with intermediate pocket for added pressure protection. Sized for standard 1/8" probe.
3. Range: 20°F to 230°F.
4. Rating: 250 PSIG water.
5. Based on Peterson Equipment Co., Inc. "Pete's Plug" Model 110 or 110XL or approved equal.

E. Pump Suction Diffuser:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. End Suction Diffuser:
 - a. Construction: Cast iron angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16" diameter openings for pump protection flanged connection. A permanent magnet shall be located within the flow stream and shall be removable for cleaning. The orifice cylinder shall be equipped with a disposable fine mesh strainer, which shall be removed after system start-up. Orifice cylinder shall be designed to withstand pressure differential equal to pump shutoff head and shall have a free area equal to five times cross section area of pump suction opening. Vane length shall be no less than 2-1/2 times the pump connection diameter. Unit shall be provided with adjustable support foot to carry weight of suction piping. Body tapped for pressure gauge and strainer blow-down.
 - b. Size: Inlet system pipe. Outlet pump suction size. When an inlet size pipe size by pump suction size diffuser is not available, provide an inlet size by size nearest to pump suction and a flanged eccentric reducer from pump suction diffuser outlet size to pump suction size.
 - c. Based on Bell and Gossett or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturers written installation instructions.

3.2 INSTALLATION

A. Strainers:

1. "Y" Patterns:

- a. All non-steam "Y" pattern strainers shall be installed with the strainer branch in the downward vertical position.
- b. For all "Y" pattern strainers, provide blow-off valve assembly consisting of ball-type drain valve with hose end cap and pipe nipple.

B. Thermometers and Accessories:

1. Install and adjust thermometers for optimum visibility.
2. Provide thermometers where indicated on schematic flow diagram or schematic equipment details.
3. Install thermometers in compatible thermometer wells.

C. Pressure Gauges and Accessories:

1. Install and adjust gauge for optimum visibility.
2. Provide ball valve shut-off for all hydronic gauges.
3. Provide a manifold valve to facilitate the use of a single gauge to monitor pressure differential from various points of a single piece of equipment (i.e. pump; strainer suction; pump suction; pump discharge, etc.). Mount valve for optimum visibility and access.
4. In lieu of the trumpet valve the contractor may assemble individual components using ball valves as the isolation valve provided the same functions of the trumpet valve are duplicated.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

5. Provide piston type snubbers for pump service.
 6. Provide filter type snubbers for all other fluid services.
 7. Open shut-off valve only enough to obtain accurate reading. Valve to gauge to be closed at all other times.
- D. Pressure and Temperature Test Ports:
1. Install in upright or vertical position as indicated on schematic flow diagram or schematic equipment details.
 2. Install in tee or welded outlet.
- E. Pump Suction Diffuser:
1. Provide suction diffuser for each end suction pump unless design provides for 5 diameters of straight pipe upstream of suction inlet.
 2. Support weight of suction diffuser independent of pump.
 3. Provide blow-down tap sized nipples, 90°F, ball valve and plug for blow-down valve assembly.
 4. After system has been thoroughly cleaned and flushed and prior to turning over to Owner, remove the fine mesh strainer. Turn the strainer over to Owner.
- F. Install miscellaneous control devices such as thermometer wells, tees for flow measuring stations, connections for differential pressure sensors, etc.

END OF SECTION 23 05 19

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 23
GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Automatic Flow Control Valves.
- B. Ball valves.
- C. Butterfly valves.
- D. Check valves.
- E. Combination Automatic Flow Control and Shutoff Valves.
- F. Wheel operators.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.
 - 1. American National Standards Institute (ANSI).
 - 2. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

- A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).
- B. Product data shall be included in the operation for maintenance instruction manuals along with installation, operation and maintenance instructions.
- C. Refer to Division 01 for Submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Automatic Flow Control Valves: (NO SUBSTITUTIONS)
 - 1. Flow Design, Inc.
 - 2. Nexus Controls
 - 3. Griswold
 - 4. Tour & Andersson
 - 5. Victaulic Company
- B. Ball Valves:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Apollo
2. Crane Company
3. Milwaukee Valve.
4. Nibco, Inc.
5. Stockham
6. Victaulic Company
7. Watts

C. Butterfly Valves:

1. API International, Inc.
2. Bray International, Inc.
3. Crane Company
4. Milwaukee Valve
5. Nibco, Inc.
6. Stockham
7. Victaulic Company.

D. Check Valves:

1. API International, Inc.
2. Hammond Valve
3. Milwaukee Valve
4. Mueller Steam Specialty, Co. (Muessco)
5. Nibco, Inc.
6. Stockham
7. Victaulic Company

E. Combination Automatic Flow Control and Shutoff Valves: (NO SUBSTITUTIONS)

1. Flow Design, Inc.
2. Nexus Controls
3. Griswold
4. Tour & Andersson
5. Victaulic Company

F. Wheel Operator:

1. Babbitt
2. Roto Hammer
3. Approved Equal.

2.2 FABRICATION

A. Automatic Flow Control Valves:

1. HVAC Water Service:
 - a. Size ½" thru 2-1/2": Brass wye body design, thread or sweat connection, ground joint union, dual temperature and pressure test ports extended to clear required insulation, range 20°F to 230°F rated at 400 psi water. Stainless steel or nickel plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Victaulic 76-Series or Flow Design, Inc. AutoFlow Model YR or approved equal.

- b. Size 2-1/2" thru 12": Ductile iron body, wafer style connection, dual temperature and pressure test ports, range 20°F to 230°F rated at 150 psi. Stainless steel or nickel plated piston brass orifice and spring, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Victaulic 76-Series or Flow Design, Inc. AutoFlow Model WS or approved equal.

B. Ball Valves:

1. HVAC water service:

- a. Size 1/4" thru 2". Two piece, adapter loaded, full port type with bronze body, threaded or sweat connection, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
- b. Size 1/2" thru 2". Two piece, standard port type with brass body, Vic Press 304™ connection, brass ball and stem, Teflon seat, carbon steel handle, 300 CWP. Victaulic Series 589 or approved equal.
- c. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated. Based on Nibco T-585-70-66 or approved equal.

C. Butterfly Valves:

1. HVAC water service – Above Ground Use:

- a. Size 2-1/2" thru 4": 416 stainless steel stem, lug wafer body drilled and tapped for isolation and removal of downstream piping, cast iron or ductile iron body, long neck body extended to allow for a minimum of 2" insulation, aluminum bronze or stainless steel disc, bubble tight EPDM seat, infinite position, memory stop handle. Class 150, 20°F to 210°F range. Based on Nibco LD-2000-3 or approved equal.
- b. Size 6" and up: As described above with totally enclosed weatherproof gear actuator with indicator and memory stop. Based on Nibco LD-2000-5 for sizes 6" to 12" or approved equal. Based on Nibco LD-1000-5 for sizes 14" to 36" or approved equal.
- c. Size 2-1/2" - 12" grooved end: Ductile iron body to ASTM A-536 with electroless nickel plated ductile iron disc to ASTM A-536, offset stainless steel stem, full 360° seating. EPDM pressure responsive seat. 2-1/2" - 4" to have infinitely variable memory stop handle. Valves 6" and above to have gear operator. Valve has bubble tight shut off up to 300 psi and 230°. Valve will have extended neck allowing up to 2" insulation. Basis of Design: Victaulic Vic300 MasterSeal and AGS-Vic300 or approved equal.
- d. Valves installed in insulated piping to have extended handles to clear insulation.

D. Check Valves:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. HVAC water service.
 - a. Horizontal swing check valve:
 - (1) Size 1/4" thru 2". Bronze body threaded or sweat connection, "Y" pattern, bronze seat, renewable teflon or bronze, swing disc, 125 lb. SWP-200 lb. WOG (non-shock). Based on Nibco T-413-B, Y or S-413-B, Y or MIL 409T or approved equal.
 - (2) Size 2" thru 4". Ductile iron body grooved end connection, Type 316 clapper, synthetic rubber bumper and bonnet seals, swing disc, 300 psi CWP. Based on Victaulic Series 712 or approved equal.
 - (3) Size 2-1/2" and up. Iron body flanged connection, bolted cover, bronze seat, renewable bronze swing disc, brass hinge pin, 125 lb. SWP-200 lb. WOG (non-shock). Based on Nibco F918-B or approved equal.
 - b. Vertical lift check valve.
 - (1) Size 3/8" thru 2". Bronze body, threaded or sweat connection, renewable teflon disc and seat, copper or stainless steel spring loaded, stainless steel or silicone bronze stem, Class 125. Based on Nibco T-480 or S-480 or approved equal.
 - (2) Size 2-1/2" thru 10". Iron wafer type body, taped lug connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco W-910-B or approved equal.
 - (3) Size 12" and up. Iron globe body, flanged connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco F-910 or approved equal.
 - (4) Size 2-1/2" thru 24" (grooved end): Enamel or PPS coated ductile iron body, grooved end connection aluminum bronze, elastomer encapsulated ductile iron, or stainless steel disc, stainless steel spring and shaft, EPDM seal, PPS coated or welded-in nickel seat, with spring-assisted disc. Valve may be installed horizontally or vertically for temperature ratings up to 230°. Victaulic Series 716 and W715 or approved equal.

E. Combination Automatic Flow Control and Shutoff Valves:

1. HVAC Water Service:
 - a. Size 1/2" thru 2: Brass wye body thread or sweat connection, union, two-temperature and pressure test port extended to clear require insulation, brass or bronze ball valve with stainless steel ball and stem, non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, steel lever type for heating applications. Range 20°F to 230°F rating 400 psi water. Stainless steel or nickel plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Victaulic 76-Series or Flow Design, Inc. AutoFlow

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

Model AC or approved equal.

- F. Wheel Operators: Ductile iron sprocket rim equal to or larger than hand wheel, malleable iron guide arm, spider rust proof chain. Grooved end valves have chain wheels mounted to the gear operator hand wheels, sprocket rim and guide arms are made of cast aluminum, chain is galvanized steel. Based on Roto Hammer, Babbitt or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off of each major branch from a header and at the base of each pipe riser in order to facilitate service.
- B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.

3.2 INSTALLATION

A. Automatic Flow Control Valves:

- 1. Install with taps in upright or vertical position.
- 2. Tag valve for:
 - a. Type of service.
 - b. Flow in GPM.
- 3. The contractor shall assume the responsibility to obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valves.
- 4. All flows shall be verified.

B. Ball Valves:

- 1. Install valves with adequate access to lever actuator.
- 2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.
- 3. Provide infinite position handle with memory stop on the outlet of all heat exchangers for balancing purposes.

C. Butterfly Valves:

- 1. Install valve between face of 125# or 150 standard ANSI flanges or standard grooved couplings.
- 2. Assure unrestricted valve movement after installation. Valves should be installed with stem of valve parallel to floor.

D. Check Valves:

- 1. Horizontal swing check valves: Install valve with swing disc in the pendent position, cover in upright position.
- 2. Vertical lift check valve:
 - a. Install valve in vertical position, upward flow.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- b. Flanged valves will be installed between 125# or 150 ANSI flanges or other flanged valves.
- c. A spool piece a minimum of 6" face to face will be used to separate a vertical lift check valve and a butterfly valve.
- d. Inspect the face of the flange and valve for casting/matching burrs. If burrs exist remove by draw filing prior to gasket placement.
- e. Grooved end check valves shall be installed with standard grooved couplings.

E. Combination Flow Control and Shutoff Valves:

- 1. Install with taps in upright position in a manner that will allow all the tap to be used as an air vent.
- 2. Tag valve for:
 - a. Type of service.
 - b. Flow in GPM.
- 3. Obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valve.
- 4. All flows shall be verified.

F. Wheel Operator:

- 1. Install operators on valves in excess of 7'-0" above finished floor.
- 2. Extend chains to 5'-0" above finished floor and hook to clips arranged to clear walking aisles.

END OF SECTION 23 05 23

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Pipe Hangers, Rods, Supports and Accessories.
- B. Duct Hangers and Supports.

1.3 QUALITY ASSURANCE

- A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.
- B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.
 - 1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
 - 2. SP-69 Pipe Hangers and Supports: Selection and Application.
 - 3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.
- C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.
- D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.
- E. Welding of steel members shall be in accordance with AWS D1.1.
- F. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as applicable.

1.4 APPLICABLE PUBLICATIONS

- A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.
 - 1. American Institute of Steel Construction (AISC)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. American Welding Society (AWS)
 - 5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
 - 6. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

1.5 SUBMITTALS

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Pipe Hangers, Rods, Supports and Accessories:
 - 1. Anvil International, Inc.
 - 2. Carpenter Paterson, Inc.
 - 3. Cooper B-Line®, Inc.
 - 4. Elcen Metal Products
 - 5. Hilti
 - 6. Michigan Hanger Company
 - 7. PHD Manufacturing, Inc.
 - 8. Unistrut®
- B. Duct Hangers and Supports: Fabricated per Specifications

2.2 FABRICATION

- A. Pipe Hangers, Rods, Supports and Accessories:
 - 1. Pipe Hangers:
 - a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300 or approved equal.
 - b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe or approved equal.
 - c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181 or approved equal.
 - 2. Rods:
 - a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

<u>Copper Tube, Plastic Fiberglass Reinforced Pipe Size</u>	<u>Steel, Cast Iron or Glass Pipe Size</u>	<u>Rod Size</u>	<u>Max Equip. Load</u>
1/4" to 2"	1/4" to 2"	3/8"	730 lbs.
2-1/2" to 5"	2-1/2" to 3"	1/2"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs.
8" to 12"	6"	3/4"	3230 lbs.
14"	8" to 12"	7/8"	4480 lbs.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

16"	14" to 16"	1"	5900 lbs.
18" to 20"	18" to 20"	1-1/4"	9500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

- b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" in maintained. Based on Anvil Fig. 146 or approved equal.

3. Supports:

- a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange or approved equal.
- b. Pipe Saddle Cold Piping; MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr.°F at 75°F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
- c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274 or approved equal.
- d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 19 5 or approved equal.
- e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261 or approved equal.

4. Accessories:

- a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation. Based on Anvil Fig. 167 or approved equal.
- b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation. Based on Anvil Fig. 160 thru 165 or approved equal.
- c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 230 or approved equal.
- d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 299 or approved equal.
- e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 290 or 290L or approved equal.

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

PART 3 - EXECUTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3.1 GENERAL REQUIREMENTS

- A. Where applicable install in accordance with the manufacturers written installation instructions.
- B. Where supports are in contact with copper pipe provide copper plated support, or wrap pipe with sheet lead.
- C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.
- D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed and painted black within one week of installation. At substantial completion all supports shall be free of rust and in a "like new condition".
- E. Hangers and supports, including attachments & pipe supports, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a "like new condition".

3.2 INSTALLATION

- A. Pipe Hanger, Rods, Supports and Accessories:
 - 1. Select proper hanger for piping systems.
 - 2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
 - 3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
 - 4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
 - 5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
 - 6. For vibration isolation hanger intermediate attachment requirements for isolated equipment refer to Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.
 - 7. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
 - 8. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
 - 9. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT
SPACING TABLE

- a. Steel Pipe (Schedule 40 & 80):
 - Up to 1": 7 ft. on center

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- | | | |
|--|--------------------|------------------|
| | 1-1/4" and larger: | 10 ft. on center |
|--|--------------------|------------------|
- b. Copper Pipe (Types L, K and M):
- | | | |
|--|--------------------|-----------------|
| | Up to 1" size: | 5 ft. on center |
| | 1-1/4" and larger: | 7 ft. on center |
- c. Ductile Iron and Cast Iron: Two hangers per section length.
- d. Polyvinyl Chloride (PVC):
- | | | |
|--|----------------|-----------------|
| | Up to 1-1/2": | 3 ft. on center |
| | 2" and larger: | 4 ft. on center |
10. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
 11. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
 12. Provide protective shields on all cold and dual temperature piping required to be insulated.
 13. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated. Fill void between saddle and pipe with insulation as specified.
 14. Provide turnbuckles on all hangers which require leveling or aligning.
 15. Provide steel clevis where detailed and/or required.
 16. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.
- B. Duct Hanger and Supports: Installation of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.

END OF SECTION 23 05 29

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Vibration isolators.
- B. Bases.
- C. Braided Flexible pipe connectors.

1.3 QUALITY ASSURANCE

- A. The vibration isolation materials manufacturer shall be responsible for the proper selection of spring rates to accomplish the specified minimum static deflections for all spring and pad type isolators based on the weight distribution of equipment to be isolated.
- B. The vibration isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases to support mechanical equipment scheduled to receive a supplementary base.
- C. Vibration isolation shop drawings shall show isolator locations, and load on each isolator, deflection, compressed spring height, solid spring height, spring diameters and color coding.

1.4 SUBMITTALS

- A. Submit a schedule indicating make, model, type and deflection for each system or weight range.
- B. Product data and shop drawings, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Submit manufacturer's certification of installation quality.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Vibration Isolators:
 - 1. Amber/Booth Company
 - 2. Mason Industries, Inc.
 - 3. Peabody Noise Control, Inc. - Kinetics.
 - 4. Vibration Mountings and Controls, Inc.
- B. Bases:
 - 1. Amber/Booth Company

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

2. Mason Industries, Inc.
3. Peabody Noise Control, Inc. - Kinetics.
4. Vibration Mountings and Controls, Inc.

C. Braided Flexible Pipe Connectors:

1. Flexonics
2. Keflex, Inc.
3. Mason Industries, Inc.
4. Metraflex Co.
5. Proco Products, Inc.
6. Unisource Manufacturing Inc.
7. Wheatley Gaso, Inc.

2.2 MATERIALS

A. Vibration Isolators:

1. Type A: Double Deflection Neoprene Mount: Double deflection neoprene mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom so they need not be bolted to the floor. Bolt holes shall be provided for these areas where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang. Based on Mason Type ND or approved equal.
2. Type B: Spring Type Mount: Spring type isolators shall be free standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Based on Mason Type SLF or approved equal.
3. Type C: Restrained Spring Type Mount: Spring type isolators shall be laterally stable with housing and complete with 1/4" neoprene acoustical friction pads between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. A housing shall be used that includes vertical limit stops to prevent spring extension when weight is removed. The installed and operating heights shall be the same. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operations. Mountings used out of doors shall be hot dipped galvanized. Based on Mason Model SLR or approved equal.
4. Type D: Vibration Hangers: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30° arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Based on Mason Model 30N or approved equal.
5. Type E: Horizontal Thrust Restraints: The horizontal thrust restraint shall consist of a spring element in series with a neoprene pad. The spring diameter shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

deflection. The spring element shall be contained within a steel frame and designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished with one rod and angle brackets for attachment to both the equipment and ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrically on either side of the unit. Based on Mason Model WB or approved equal.

6. Type F: Neoprene Isolation Pads: Neoprene isolation pads shall be single rib or crossed, double rib neoprene in-shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All neoprene pads shall be true neoprene in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 PSI tensile strength, oil resistant, compounds with no color additives. Pads shall be 45 or 65 durometer and designed to permit 60 or 120 psi loading, respectively, at maximum rated deflections. Neoprene in-shear isolation pads shall be provided to meet tabulated minimum operating static deflections without exceeding published maximum static deflections. Use single or, crossed, double rib or laminated composites of both as required. When two pads of ribbed material are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate. Based on Kinetics NPS, NPD, NGS and NGD or approved equal.

B. Bases:

1. Type 1: Structural Steel Base: All perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimensions of the base. Beam depth need not exceed 14" provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of one inch. Based on Mason Model WF or approved equal.
2. Type 2: Inertia Bases:
 - a. The base shall consist of rectangular structural beam or channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. In general, bases shall be a minimum of 1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum concrete reinforcement consisting of half inch bars or angles welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with steel members to hold anchor bolt sleeves when the anchor bolts fall in concrete locations. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base.
 - b. Inertia bases for pumps shall be large enough to support removable metal insulation cover and suction diffusers where they are used.
 - c. Based on Mason Type K or approved equal.
3. Type 3: Curb Mounted Equipment Base: Curb mounted rooftop equipment shall be mounted on vibration isolation bases that fit over the roof curb and under the isolated equipment. The extruded aluminum top member shall overlap the bottom member to provide water runoff independent of the seal. The aluminum members shall house cadmium plated springs having a 1-1/2" minimum deflection with 50% additional travel to solid. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4" so

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

as not to interfere with the spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible ductlike EPDM connection joining the outside perimeter of the aluminum members. Foam or other contact seals are unacceptable at the spring cavity closure. Caulking shall be kept to a minimum. Submittals shall include spring deflections, spring diameters, compressed spring height and solid spring height as well as seal and wind resistance details. Based on Mason Type RSC or approved equal.

- C. Flexible Pipe Connectors:
 - 1. Braided flexible pipe connectors constructed of stainless steel annular corrugated metal surrounded with a woven braid of high tensile stainless steel. Units capable of absorbing pump vibration and noise accept thermal expansion and reduce piping stress due to minor misalignment and pressure variations. Sizes 1/2" through 2" to have carbon steel male pipe thread connections. Sizes 2-1/2" and larger to have carbon steel plate flanges with ASA #150 bolt hole patterns. Sizes through 8" to be suitable for 150 psig working pressure at 200°F. Based on Keflex KSSPC or approved equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All floor mounted equipment shall be installed on a housekeeping pad, in addition to any isolation or inertia base requirement.
- B. Installation of all vibration isolation materials and supplemental equipment bases specified in this section of the specifications shall be accomplished following the manufacturers written instructions.
- C. On completion of installation of all isolation materials and before start up of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.
- D. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.
- E. Adjust all isolators for uniform support.
- F. Readjust all isolators after system start-up to assure constant support.

3.2 INSPECTION

- A. The Contractor shall notify the local representative of the vibration isolation materials manufacturer prior to installing any vibration isolation devices. The Contractor shall seek the representative's guidance in any installation procedures he is unfamiliar with.
- B. The local representative of the vibration isolation materials manufacturer shall conduct periodic inspections of the installation of materials herein specified, and shall report in writing to the Contractor any deviations from good installation practice observed.
- C. On completion of installation of all noise and vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the complete

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

system and report in writing any installation errors, improperly selected isolation devices, or other fault in the system that could affect the performance of the system.

- D. The installing Contractor shall submit a report to the Owner's Representative including the manufacturer's representative's final report indicating all isolation reported as properly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.

3.3 VIBRATION ISOLATION SCHEDULE:

A. Pumps (Upper Level):

1. Base type: "2"
2. Isolator Type: "B"
3. Deflection: .75"
4. Accessories: Flexible pipe connector

B. Piping (Within Mechanical Equipment Room, or within 50' of Mechanical Rooms):

1. Base type: None required.
2. Isolator Type: "D"
3. Deflection: .75"
4. Accessories: Flexible pipe connector at exit to room.

C. Packaged Air Handling Units:

1. Base type: None required.
2. Isolator Type: Internal spring type provided with AHU.
3. Deflection: 2"
4. Accessories: Flexible duct connectors (internal fan isolation and Section 23 33 00 – Flexible duct connectors).

END OF SECTION 23 05 48

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Piping and equipment identification.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated
 - 1. Piping and equipment identification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Piping and Equipment Identification:
 - 1. Communications Technology Corp.
 - 2. Craftmark Identification Systems, Inc.
 - 3. EMED Co., Inc.
 - 4. Florida Marking Products, Inc.
 - 5. Marking Services, Inc.
 - 6. Seton Name Plate Corp.
 - 7. W.H. Brady Co., Signmark Division

2.2 FABRICATION

- A. Piping and Equipment Identification:
 - 1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6" diameter. For external diameters above 8". Marker shall be secured using cable ties for indoor use and stainless steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be overlaminated with Tedlar™ on polyester to prevent ultraviolet to avoid damage and fading. Markers shall identify the pipe contents and direction of flow through 360 degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 – Scheme for the Identification of Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use or approved equal.
 - 2. The marker shall be 1/16 inch thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be ¾ inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
 - 3. Valve tags: Contractors Option:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- a. Indoor:
 - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc or approved equal.
 - 2) 1/16 inch thick plastic, 1-1/2" round, with 1/4 inch high black pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc or approved equal.
- 4. Valve chart frame: Self-closing, satin-finished, extruded aluminum with glass window, 8-1/2 inch by 11 inch chart size.
- 5. 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. Based on Marking Services Inc. Model MS-215 Max-Tex or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 INSTALLATION

- A. Piping and Equipment Identification:
 - 1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
 - 2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
 - 3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
 - 4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings.
 - 5. Provide a minimum of 4 valve charts. Chart information shall indicate job name, Contractor name, date of installation, valve number, valve location, valve type, valve purpose, and system in which installed. Mount framed chart in equipment room, and

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

insert copy of chart in each operating and maintenance manual under separate tabbed section labeled "Valve Chart". Where project drawings include a piping flow schematic, request AutoCad file from Engineer and label all of the valves according to the valve chart and frame in an 18" x 24" frame in main mechanical or pump room.

6. Provide air and water flow diagrams installed in waterproof, laminated frames on the wall in each Mechanical Room. Air flow diagrams shall show locations of dampers, sensors, and exhaust fans associated with the air handling unit. Water flow diagrams shall show shut-off valves and control valve locations.
7. 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.

END OF SECTION 23 05 53

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 80
AIR CONTROL AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Automatic Air Vent

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Division 01 requirements.
- B. Submit schedule indicating make, model, size, etc. by system.
- C. Submit statement of Code compliance where applicable.
- D. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Automatic Air Vent:
 - 1. Armstrong Pump Company
 - 2. Bell & Gossett, Inc.
 - 3. Taco, Inc.

2.2 FABRICATION

- A. Automatic Air Vent: Non-ferrous, automatic air vent rated for 240°F and 150 PSIG. Based on Bell and Gossett Model 87 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturers written instructions.
- B. Install air vents at all high points of system to facilitate air removal for proper flow and heat transfer.

3.2 INSTALLATION

- A. Automatic Air Vent:
 - 1. Install where shown on drawings or standard details.
 - 2. Install 1/2" ball valve and nipple between automatic air vent and system.
 - 3. Provide proper access.
 - 4. Do not install automatic air vent in concealed or non-accessible areas or where

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

5. leakage may cause damage.
Pipe discharge to nearest floor drain.

END OF SECTION 23 05 80

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Checking installation for conformity to design.
- B. Checking each piece of equipment for proper installation and operation.
- C. Balancing air and water distribution systems to provide design fluid quantities.
- D. Measuring and recording of fluid quantities.
- E. Electrical measurement.
- F. Verification of performance of all equipment and sequence of operation of automatic controls.
- G. Checking sound levels and vibration isolators for proper function and measurement and correction where a problem or question of acceptability exists.
- H. Recording and reporting results on sub-contractors standard report forms and on commissioning data sheets where these have been provided.

1.3 REFERENCES

- A. Air Diffusion Council (ADC) 1062R3 Equipment Test Code
- B. Associated Air Balance Council (AABC)
National Standards for Field Measurements and Instrumentation, Total Balance System Balance, Air Distribution - Hydronic Systems, Volume 1.

1.4 SUBMITTALS

- A. Submit complete description of procedures, instrument calibration and qualifications of personnel actually doing testing and balancing on this project prior to beginning of any balancing.
- B. Submit schedules of test data readings in organized, schematic, tabulated format. Include schematic drawing showing location of all readings.
- C. Submit as-built drawings showing locations of all readings.

1.5 QUALITY ASSURANCE

- A. Adjusting, balancing and testing procedures and compilation of test data shall be performed by a Certified Test and Balance Engineer or by personnel trained and supervised by a Certified Test and Balance Engineer.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- B. Test and balance personnel shall be qualified to perform testing and balancing in accordance with AABC or NEBB procedures.

1.6 TOLERANCES

- A. Balance final flow (air and/or water) to within plus or minus 5 percent of specified quantities. Caution is urged on systems where diversity has been taken and the total flow exceeds the equipment capacity. In this case, the system must be sectioned as necessary to get proper terminal flow.

1.7 GENERAL COMMENTS

- A. Water Balance: Readings from venturi flow meters, or automatic pressure independent flow control devices will be given highest priority as to accuracy. Where neither is specified pump curves and chiller or boiler pressure drops are to be correlated to establish flow. Pressure drop across coils or chillers is to be used to proportion flow. Volt and ampere readings will be used as checks. Temperature data will be used only as a performance check and not for balancing.
- B. 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.
- C. 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 WATER BALANCE

- A. Ascertain that piping systems have been cleaned, flushed, drained and properly refilled and that all strainer baskets have been removed, cleaned and properly reinstalled prior to beginning water balancing procedure.
- B. In the event that TAB work is started prior to the completion of the water treatment portion of work, the TAB contractor shall make a random recheck as directed by the Owner's Representative. The results of this re-check shall be included in the final report.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- C. Variable flow pumping systems having two way control valves and using automatic pressure independent system of flow control for secondary hot water heating and chilled water systems.
 - 1. With one pump running and all manual and automatic control valves open, record GPM stamped on each automatic flow control device and read and record the pressure drop across those which have dual pressure taps, as well as across each coil and applicable equipment.
 - 2. With pump running as described above and all manual and automatic control valves open read and record pressure drop across each pump. Also read and record pressure drop at shut off. Plot these points on the submitted pump curves using the sum of the flow control device GPM as the total system flow.
 - 3. Record the pump speed required to get the pressure drop across the flow control valve having the highest pressure drop to 6 PSI. If this is 85% or greater, no pump impeller change will be required. If less than 85%, the pump impeller will have to be trimmed. Advise the Owners Representative before proceeding.
 - 4. Operate lag pump to be sure performance is the same at each step.
 - 5. Manually set pump speed to 20% (minimum speed) and record flow and pressure difference.

3.3 AIR BALANCE

- A. Check system visually and audibly for leakage and proceed with balancing as outlined by AABC or NEBB.
- B. Balance for full flow shall be based on dirty friction loss across the filters. Artificially blank-off sections on a uniform pattern as required to simulate this condition.
- C. Variable Volume Systems:
 - 1. With supply fan running at 100% speed and all terminals calling for full air flow, read and record flow and fan suction and discharge static pressure readings. Pressure readings shall be obtained using procedures outlined in AMCA Publication 203-90 Field Performance Measurement of Fan Systems. Plot on submitted fan curve.
 - 2. Set flow at each terminal for maximum values as indicated in terminal schedule using hand held operators terminal (HHOT) furnished with the terminal controls. Provide actual measured outlet flow to temperature controls sub-contractor for setting calibration constants in DDC controls. Normally diversity is taken in the fan selection. Close other terminals as required to get full flow as required for balancing. Pro-rate terminal flow to diffusers.
 - 3. Set minimum flow to values as indicated in terminal schedule.
 - 4. Where applicable, adjust return fan for specified differential flow. Record fan signal fan speed and other data at full flow and at minimum flow.
 - 5. Record all data on terminals and supply and return fan including voltage and amperage on primary air fans and return fans at full flow.
- 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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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 AIR HANDLING UNIT PERFORMANCE TESTING

- A. Recognizing that it will be unlikely that the performance testing will be done on a design day, cooling and heating coil performance shall be recorded as follows.
 1. With fan delivering design air flow and control valves open to deliver design water flow, read and record entering and leaving drybulb and wetbulb temperatures, air and waterside flow, pressure loss values and water temperatures.
 2. Through the contractor, request performance data from the equipment supplier based on the measured air flow and entering air temperatures and measured water flow and entering water temperature. Submit this data with test data for review.

3.5 CONTROLS ADJUSTMENT

- A. Check the automatic temperature controls to ascertain that the specified sequence of operation is occurring. Record thermostat set point and room conditions in each space. This includes checking each terminal box to ensure that supply air goes to minimum position before heat comes on.
- B. Compare temperature of space (taken with test instrument) to temperature read by thermostat or temperature sensor. Tabulate results.
- C. In cooperation with the controls contractor, set adjustments of automatically operated dampers to operate as specified, indicated, and / or noted.
- D. Check all controls for proper calibrations, and list all controls requiring adjustment by control installers.

3.6 CONTRACTOR'S RESPONSIBILITIES

- A. Final testing and balancing of the HVAC systems shall be performed as specified in this section. It is the responsibility of the Contractor to be completely familiar with all the provisions and responsibilities of the Balancer, and to provide such certification, cooperation, and support required.
- B. The Contractor shall repair all deficiencies noted by the Balancer in a timely manner. The Balancer will notify the contractor in writing, on a daily basis, of any deficiencies discovered and Contractor will notify the Balancer immediately, in writing, upon completion of the repairs. The cost for extra re-testing by the Balancer due to unrepaired items that were certified as repaired, will be the responsibility of the Contractor. The final testing and balancing report will contain no punch list items. All deficiencies will have been corrected prior to submission of the final report. Preliminary reports are not to be submitted to the Owner.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- C. The Contractor shall:
1. Allow adequate time in the construction schedule to perform the Testing and Balancing work.
 2. Notify the Balancer upon commencement of work related to the HVAC system.
 3. Provide required shop drawings and equipment data.
 4. Provide test openings as required for testing and balancing HVAC systems.
 5. Provide updated job schedule and timely notice prior to scheduled events.
 6. Provide test openings and temporary end caps or otherwise seal off ends of ductwork to permit leakage testing prior to installation of diffusers, grilles, and similar devices.
 7. Make preliminary tests to establish adequacy, quality, safety, completed status, and satisfactory operation of HVAC systems and components. The systems shall be free of electrical grounds and short circuits.
 8. Perform duct leakage tests, in the presence of the Balancer, on all supply, return, outside air make-up, and exhaust air systems.
 9. Within the intent of the contract documents, provide, at the request of the Balancer, all equipment, material, supplies, workmen, and supervisions necessary to provide a satisfactory, operating system.
 10. During the test and balance period, operate all HVAC equipment as necessary to permit systems to be tested and balanced as fully operating, functional systems.
 11. Work harmoniously with the Balancer, providing all courtesies normally extended to professional consultants.
 12. Perform all work necessary to make ceiling plenums air-tight and functional.
 13. Remove and replace ceilings as necessary to permit test and balance operations.
 14. Remove and replace equipment, lights, or other items which obstruct testing and balancing operations. Where equipment, lights, or other items will interfere with future adjustments of the HVAC system, such equipment, lights, or other items shall be relocated by the Contractor, as directed by the Architect.
 15. Provide completed start-up forms on each piece of equipment.
 16. Replace belts and drives as required for proper balancing. Drives shall be adjusted and aligned by the Contractor to prevent abnormal belt wear and vibration.
 17. Adjust fan speed as required not to exceed RFLA of motor.
 18. Open all manually adjustable dampers and test dampers for smooth, vibration-free operation.
 19. Verify that all controls are installed and operating in accordance with the sequence of operation.
 20. Before requesting final testing and balancing, submit signed statement that HVAC systems are installed, adjusted, fully lubricated, operating satisfactorily, and are ready for use.
- D. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.

3.7 TEST DATA SCHEDULES

- A. Submit typewritten schedules of test data readings.
- B. Schedules shall record the specified reading, the first reading taken and the final balanced reading for the following items.
- C. Where Commissioning Forms are provided, equipment data shall be recorded on these forms for comparison with submitted design data.
- D. Witness and record the testing of the ductwork for leakage to insure proper sealing. The Balancer shall randomly select sections of the completed duct system for testing. The sections selected shall not exceed more than 20% of the measured linear footage of supply, return, exhaust or plenum duct length. All selected ductwork shall be leak tested in accordance with SMACNA. Maximum allowable leakage at any tested section shall not exceed 2% of the total air. If any of the selected duct sections exceed the specific leakage allowance, those sections shall be repaired by the Contractor and retested by the Balancer. If initial testing exceeds specification allowance, testing of all remaining duct ductwork shall be required at the Contractor's expense. All additional costs for duct leak repair and retesting shall be the responsibility of the Contractor.
- E. Advise Contractor in writing of all ductwork that shall be repaired to reduce air leakage. Retest to confirm minimum allowable leakage. The cost of retest of failed systems will be the responsibility of the Contractor.
- F. In the case of off season performance testing of air handling equipment and refrigeration equipment, include manufacturer's projected performance for comparison.
 1. Motors:
 - a. Designation.
 - b. Nameplate HP, voltage and full load amperes.
 - c. RPM.
 - d. Motor amperes and voltage under operating conditions.
 - e. For belt drive applications, motor amperes and voltage under no load condition.
 2. Fans:
 - a. Designation.
 - b. Nameplate data.
 - c. RPM.
 - d. Static pressure, inlet and discharge.
 - e. CFM from pitot tube traverse of discharge duct.
 - f. Final pitot tube traverse sheets showing all readings.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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.

5. Pumps:
 - a. Designation.
 - b. Nameplate data.
 - c. GPM (unbalanced).
 - d. Pressure, suction and discharge (unbalanced).
 - e. Suction and discharge pressure with discharge valve closed (shut-off).
 - f. GPM (final balance).
 - g. Pressure, suction and discharge (final balance).
 - h. Pressure entering and leaving strainer.

6. Coils - Water:
 - a. Designation.
 - b. Nameplate data (if available).
 - c. Pressure entering strainer valve and leaving flow control device.
 - d. Pressure entering and leaving flow control device where two taps are provided.
 - e. Temperature entering and leaving water.
 - f. Static pressure, entering and leaving air.
 - g. Dry bulb and wet bulb temperature, entering and leaving air (4 readings at quarter points where coils are over 20 sq.ft. F.A.)
 - h. CFM over coil including all final readings used to obtain cfm.
 - i. GPM from flow regulator nameplate.

3.8 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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- D. Conduct tests with natural building heating and/or cooling loads for a minimum 4 hours duration.

END OF SECTION 23 05 93

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Duct Systems Insulation.
- B. Piping Systems Insulation.
- C. Equipment Insulation.
- D. Cold Pipe Hanger Support Blocks.
- E. Accessories.

1.3 QUALITY ASSURANCE

- A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.
- B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.
- C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

- A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.

1.5 GENERAL REQUIREMENTS

- A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.
- B. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.
- B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.
- C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass Insulation:
 - 1. Owens-Corning Fiberglas
 - 2. Knauf Fiberglass
 - 3. CertainTeed
 - 4. Johns Manville
- B. Closed Cell Elastomeric Insulation:
 - 1. Armacell LLC
 - 2. Johns Manville
 - 3. K-Flex
- C. Jackets:
 - 1. Southern Asbestos Company
 - 2. John Mansville
 - 3. Owens-Corning Fiberglas
- D. Foamglass Insulation:
 - 1. Pittsburgh Corning
 - 2. Cell-U-Foam Corp.
 - 3. Owner Approved Equal
- E. Insulation Coatings, Mastics, Adhesives, and Sealants
 - 1. Foster
 - 2. Childers
 - 3. Pittsburgh Corning
 - 4. Armacell

2.2 DUCT INSULATION, EQUIPMENT, AND FIREPROOFING REQUIREMENTS

- A. Refer to the drawings for all insulation requirements.

2.3 MATERIALS

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

A. Duct Insulation:

1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket (ASJ) vapor barrier, maximum vapor permeance of .02 perm/in and puncture resistance of 50 units, minimum density 3.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F mean temperature. Based on Knauf Insulation Board or approved equal.
2. Blanket Fiberglass: Flexible fibrous glass, flame retardant factory laminated foil-skrim-kraft (FSK) vapor barrier, 2" stapling flange, maximum vapor permeance of .02 perm/in., minimum density of 1.5 lb/cf, maximum conductivity per 1" thickness of .28 at 75°F mean temperature. Based on Knauf Duct Wrap or approved equal.

B. Pipe Insulation (to 450F):

1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F, .29 at 200°F and .43 at 400°F mean temperature. Based on Knauf Pipe Insulation or approved equal.
2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000 or approved equal.
3. Foamglas: Rigid, preformed sections of 100% rigid cellular glass complying with ASTM C552 standards, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in. impervious to common acids (except hydrofluoric), non-combustible, 90 PSI compressive strength when capped with hot asphalt, 7.5 #/cu.ft. density, thermal conductivity 0.28 BTU-In./Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas or approved equal.

C. Equipment Insulation:

1. Closed Cell Elastomeric Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 6 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC Armaflex II or approved equal.
2. Foamglas: Sections of 100% rigid cellular glass, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in., impervious to common acids (except hydrofluoric), non-combustible, 100 PSI compressive strength when capped with hot asphalt, 8.5 #/cu.ft. density, thermal conductivity 0.32 BTU-In./Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas or approved equal.

D. Insulation Accessories:

1. Aluminum Pipe Jacket and Fitting Covers: Jacket shall be 0.016" thick (26 gauge) embossed aluminum, sized to provide a 2" (min.) lap joint both longitudinally and circumferentially, with 3/4" min. wide x 0.015" min. (30 gauge) thick draw bands. Fitting covers shall be aluminum, 0.025" (22 gauge), min., thickness.

E. Cold Pipe Hanger Support Blocks: Lightweight, rigid, closed cell material having 100

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

lb/sq.in. compressive strength when capped with hot asphalt according to ASTM C240.
Based on Pittsburgh Corning Foamglas or approved equal.

F. Accessories:

1. Aluminum Pipe Jacket and Fitting Covers: Jacket .016" thick (28 ga.) embossed aluminum sized to provide a minimum 2" lap joint both longitudinal and circumferentially, minimum 3/4 inch x .015 inch thick (30 ga) draw bands. Covers .024 inch thick.
2. PVC pipe jacket and fitting covers used with insulation for pipe, elbows, tees, couplings, 25/50 flame/smoke ratings, suitable for temperatures to 500°F.
3. Glass Cloth Pipe, Duct and Equipment Jacket: Glass lagging cloth, 8 oz/sy treated weight. Secure with elastomeric insulating adhesive on elastomeric insulation, for fiberglass insulation use Childers CP-50AMV1 or Foster 30-36 lagging adhesive.
4. Corner angles shall be minimum 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch heavy kraft paper.
5. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
6. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated or approved equal.
7. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
8. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex or Foster 30-64 elastomeric finish or approved equal.
9. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
10. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Foster 85-75, Childers CP-82 or Armaflex 520 adhesive or approved equal.
11. Vapor Barrier Coating: Air drying flexible water based coating used for applying a vapor barrier coating with reinforcing mesh at all below ambient piping/equipment insulated elbows, fittings, and valves. All vapor retarder film (ASJ) seams on below ambient piping/equipment shall also be vapor sealed with vapor barrier coating. Suitable for temperatures to -20F and 180°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08 as tested by ASTM E96, Procedure A at 45 mils dry. Childers CP-34 Vapor Retardant coating, Foster 30-65 Vapor Fas® Coating, Marathon Industries, Inc. 590 LO-PERM, Vimasco Corp. 749 Vapor-Blok, or approved equal.
12. Insulation Joint Sealant: Fire- and water-resistant, flexible, sealant. Used in all cellular glass joints on below ambient piping/equipment. Childers CP-76 Chil Byl, CP-70 Chil Joint, Foster 95-50 Flextra, Foster 30-45 Foamseal, Pittsburgh Corning 444 or approved equal.
13. Acrylic Finish and Vapor Barrier Coatings:
 - a. Elastomeric Insulations: acrylic coating, air drying flexible water based finish used for finishing flexible elastomeric insulation. Suitable for coating temperatures to 200°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex or Foster 30-64 elastomeric finish or approved equal.
 - b. Foamglass Insulation: Air drying flexible water based coating used for applying a vapor barrier seal over microscopic cracks that develop in the 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. Maximum Perm rating of 0.08 as tested by

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

ASTM E96, Procedure A at 45 mils dry. Childers CP-34 Vapor Retardant coating, Foster 30-65 Vapor Fas® Coating, Marathon Industries, Inc. 590 LO-PERM, Vimasco Corp. 749 Vapor-Blok, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install all insulation in strict accordance with the manufacturers written installation instructions.
- B. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.
- C. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.
- D. Insulation shall not be applied on any piping or duct system requiring testing until testing is completed and approved by Owner's Representative.
- E. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust or grease.
- F. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Owner's Representative shall be the final judge of acceptance of workmanship.
- G. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".
- H. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.
- I. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.
- J. Insulation shall be protected from moisture and weather during storage and installation.
- K. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Owner's Representative is satisfied that there is no longer any inferior insulation installed on this project.
- L. Insulation, fabric and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.
- M. The insulation subcontractor is responsible for proper material storage at the work site.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- N. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.
- O. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns and walls have been provided.
- P. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.
- Q. Where an insulated pipe or ductwork passes through a sleeve or opening in a non-rated partition, the full specified thickness of the insulation shall pass through the sleeve or opening. Where an insulated pipe or ductwork passes through a rated partition, the insulation shall be stopped at the partition. The void between the pipe and the sleeve shall be sealed with an approved fire-stopping material, and the insulation trimmed and sealed to the partition sufficient to cover the sleeve.
- R. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.
- S. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.
- T. The insulation subcontractor shall be responsible for his own safety program at the work site, and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.
- U. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

3.2 INSTALLATION

- A. Duct Insulation:
 - 1. General:
 - a. Insulate or internally line all flexible duct connectors equal to or greater than adjacent insulation thickness.
 - b. The tops of all diffusers shall be insulated same as connecting ductwork to prevent condensation.
 - c. Duct insulation at fire dampers shall be extended over supporting angle iron and sealed to wall.
 - 2. Rigid Fiberglass Insulation:
 - a. Use boards in largest possible size to minimize seams. Do not use "scraps".
 - b. Shall be installed in all non-public exposed areas up to 10'-0" above finished floor.
 - c. Provide corner angles where insulation is subject to harm.
 - d. All fasteners shall be non-corroding.
 - e. The insulation shall be applied by use of cup head weld pins. Such 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- round vapor seal patch that matches the jacket on the ASJ board. On cold ducts, these shall be coated so as to not cause condensation.
- f. Ducts having sharp bends shall have the insulation scored as required to conform to the curved surfaces to provide a neat and acceptable appearance when finished.
 - g. Insulation edges and joints shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh.
 - h. Generally, rigid fiberglass material will only be used in finished or exposed areas, and it is intended that the finish present a neat and uniform appearance as to color and workmanship.
 - i. In finished areas, molded glass fiber insulation shall be used to insulate round ducts where commercially available sizes can be used.
 - j. Fittings on round ducts in finished areas shall be covered with pre-molded fiberglass fitting insulators equal to Insul-Cooustic where sizes are available. For sizes where pre-molded fittings are not available use miter-cut segments of molded pipe insulation, wired in place, with all joints sealed with adhesive and smoothed out with a coat of insulating cement.
 - k. On cold ducts, the fittings shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh. Hot ducts shall be finished in a similar manner, except the mastic need be of the weather barrier breather mastic type. Foster 46-50 Weatherite and Childers CP-10 Vi Cryl, Pittsburgh Corning 404 or approved equal.
3. Blanket Fiberglass Insulation:
- a. Insulation shall be tightly wrapped on the ductwork with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. Joints shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh. Additionally secure insulation to bottom of rectangular ducts over 24 inches wide with weld pins at no more than 18 inches on center.
 - b. Insulation shall be butted with facing overlapping all joints shall be finished with two coats of an approved vapor barrier coating, reinforced with reinforcing mesh extending 2 inches onto adjacent insulation. One coat of coating shall be applied to the insulation prior to the application of the reinforcing mesh, which shall be embedded in the coating to ensure complete adhesion of the mesh. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier coating.
- B. Pipe Insulation:
- 1. General:
 - a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness. Chilled water piping, 3" and over shall have a section of foamglas insulation

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

installed between the pipe and shield. 3 and 4" to be 12" long, 5" and 6" to be 18" long and 8" and over, 24" long. If the possibility exists that the hanger may conduct the temperature of the conveyed medium and thus cause condensation or personal injury due to high temperature, the hanger shall also be insulated. Joints between foamglas and pipe insulation shall be properly sealed with insulation joint sealant on all longitudinal and butt joints.

- b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.
 - c. The insulation at threaded unions in steam and hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives. Foster 30-36, Childers CP-50AMV1 or approved equal.
 - d. Insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.
 - e. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.
 - f. Cover fittings, flanges, unions, valves, anchors, and accessories with pre-molded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Apply vapor barrier coating and reinforcing mesh in two coats to a minimum dry thickness of 32 mils on all below ambient piping. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of pre-molded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.
 - g. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
 - h. Seal all raw edges of insulation with vapor barrier coating or lagging adhesive.
 - i. For piping supported by hangers outdoors, apply a rainshield to prevent water entry.
3. Closed Cell Elastomeric:
- a. All joints shall be sealed with adhesives.
 - b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.
 - c. Finish:
 - 1) Concealed Indoors: No additional finish.
 - 2) Exposed Indoors: Provide PVC jacket over all insulation.
 - 3) Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.
 - 4) Outdoors: Provide aluminum pipe jacket.
4. Foamglas:
- a. Below ambient piping: All joints, both longitudinal and circumferential shall be sealed with an insulation joint sealant.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- b. Thickness shown for refrigeration pipe to be obtained by use of two layers of insulation with staggered joints.
 - c. Above ambient piping finish: Weather barrier breather mastic. Foster 46-50, Childers CP-10 or Pittcote 404 or approved equal
 - d. Below ambient piping finish:
 - 1) Before PVC jacket is used, seal all insulated elbows, fittings, and valves with vapor barrier coating and reinforcing mesh.
 - 2) Exposed Indoors: Provide PVC jacket over all insulation that shall be sealed with an acrylic latex finish.
 - 3) Concealed: Provide PVC jacket over fittings fabricated from insulation sections or sheet. Provide ASJ over all other. Vapor seal ASJ with vapor barrier coating.
 - 4) Exposed Outdoors: Provide acrylic latex finish and aluminum pipe jacket.
- C. Equipment Insulation:
- 1. Removable Covers:
 - a. Equipment specified to have removable covers shall have insulation as specified in Paragraph 2.4, fastened to the inside surfaces of a 20 gauge galvanized sheet metal equipment cover.
 - b. The covers shall be of a sectionalized design, and shall be custom-fitted around each piece of equipment. For ease of removal, joints between sections shall coincide with the splits or joints in the equipment. Joints between sections of the cover shall be held together with quick-connect trunk latches, and shall be gasketed to form a vapor-tite seal cover (for the passage of pipes, etc.) shall be provided with closed cell elastomeric collars to ensure a tight fit.
 - c. The box shall be fitted around each piece of equipment and split for removal to coincide with the split in the casing. The sections of the box shall be held together with quick disconnect trunk latches. Joints between box sections shall be gasketed to form a vapor seal. Void spaces in the box shall be packed with flexible fiberglass insulation. Openings around pump casing shall be provided with closed cell elastomeric collar to ensure tight fit.
 - d. Provide acrylic latex finish.
 - e. Coordinate the piping of the drain, vent, gauge, and control lines to exit through the base or back section of the removable cover. The insulation of these pipes shall be totally independent of the removable cover.
- D. Cold Pipe Hanger Support Blocks:
- 1. Provide on all chilled fluid systems pipe hangers and supports.
 - 2. Apply Foster 46-50, Childers CP-10 or Pittcote 404 acrylic latex mastic filler over insulation and on ends.
 - 3. Apply Pittseal 444, Foster 95-44 Elastolar, Foster 95-50 or Childers CP-76 Chil Byl joint and penetration sealant at joint between foamglas and adjacent insulation.
 - 4. Provide vapor barrier system to match the vapor barrier on the adjacent system.
 - 5. Provide 20 gauge (min.) galvanized shield between the insulation and the hanger or support.
- E. Aluminum Pipe Jacket:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Provide aluminum jacket over all exposed pipe insulation located outdoors.
2. Align all seams.
3. Securing shall be with 3/4" wide draw bands. Maximum band spacing 18" on center.
4. All openings and voids shall be sealed air and water tight with metal jacketing sealant Foster 95-44 Elastolar or Childers CP-76 Chil Byl or approved equal.

F. PVC Jacket:

1. Provide PVC sheet jacket over all exposed, indoor piping or insulation.
2. Provide PVC pipe jacket over all exposed, indoor foamglas or elastomeric pipe insulation.
3. Provide PVC fitting covers over all fittings fabricated from insulation sections or sheet material.
4. PVC pipe jacket shall be applied with special attention given to achieving positive seal at all longitudinal and circumferential joints using a welding solvent on the longitudinal joint as recommended by the manufacturer. Slip joints to have 4" minimum lap and no welding solvent.

G. Flexible Acrylic Latex:

1. Apply two coats to glass cloth jacket, concealed foamglas and closed cell elastomeric insulation.
2. Refer to Division 9 for color to be used. If no instructions are given, provide a white finish.

3.3 MISCELLANEOUS ITEMS

- A. General: Provide insulation of any portion of a system or piece of equipment not previously discussed where ambient operating conditions will allow condensation to occur or whose surface temperature exceeds 115°F. Insulation materials and method shall be as directed by the Designer.
- B. Final Inspection: At final inspection, the finished surfaces of all exposed insulation shall be clean and without stains or blemishes. Repair and clean the insulation surfaces and, if necessary, to obtain a new appearance, shall coat discolored surfaces with off-white latex water-base semi-gloss paint or lagging adhesive, without a change in the contract price.

END OF SECTION 23 07 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 09 00
BUILDING AUTOMATION SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. All work of this Division shall be coordinated and provided by the single Building Automation System (BAS) Contractor.
- B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.
- C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.
- D. If the BAS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.
- E. Refer to attached requirements from the Orange County Information Systems and Services (ISS) division for all Orange County hardware, software, and network requirements.

1.2 DEFINITIONS

- A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
- B. Binary: A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level.
- C. Building Automation System (BAS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BAS Contractor and to be interfaced to the associated work of other related trades.
- D. BAS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer and ongoing service provider for the BAS work.
- E. Control Sequence: An BAS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
- F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BAS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
- G. BAS Network: The total digital on-line real-time interconnected configuration of BAS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- H. Node: A digitally programmable entity existing on the BAS network.
- I. BAS Integration: The complete functional and operational interconnection and interfacing of all BAS work elements and nodes in compliance with all applicable codes, standards and ordinances so as to provide a single coherent BAS as required by this Division.
- J. Provide: The term "Provide" and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.
- K. Furnish: The term "Furnish" and its derivatives when used in this Division shall mean supply at the BAS Contractor's cost to the designated third party trade contractor for installation. BAS Contractor shall connect furnished items to the BAS, calibrate, test, commission, warrant and document.
- L. Wiring: The term "Wiring" and its derivatives when used in this Division shall mean provide the BAS wiring and terminations.
- M. Install: The term "Install" and its derivatives when used in this Division shall mean receive at the jobsite and mount.
- N. Protocol: The term "protocol" and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BAS network nodes.
- O. Software: The term "software" and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BAS industry for real-time, on-line, integrated BAS configurations.
- P. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.
- Q. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.
- R. The following abbreviations and acronyms may be used in describing the work of this Division:
- | | | |
|--------|---|---|
| ADC | - | Analog to Digital Converter |
| AI | - | Analog Input |
| AN | - | Application Node |
| ANSI | - | American National Standards Institute |
| AO | - | Analog Output |
| ASCII | - | American Standard Code for Information Interchange |
| ASHRAE | | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| AWG | - | American Wire Gauge |
| CPU | - | Central Processing Unit |
| CRT | - | Cathode Ray Tube |
| DAC | - | Digital to Analog Converter |

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

DDC	-	Direct Digital Control
DI	-	Digital Input
DO	-	Digital Output
EEPROM	-	Electronically Erasable Programmable Read Only Memory
EMI	-	Electromagnetic Interference
FAS	-	Fire Alarm Detection and Annunciation System
GUI	-	Graphical User Interface
HOA	-	Hand-Off-Auto
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers
I/O	-	Input/Output
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not In Contract
NO	-	Normally Open
OWS	-	Operator Workstation
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer
RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
RTD	-	Resistance Temperature Device
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
XVGA	-	Extended Video Graphics Adapter
TBA	-	To Be Advised
TCP/IP	-	Transmission Control Protocol/Internet Protocol
TTD	-	Thermistor Temperature Device
UPS	-	Uninterruptible Power Supply
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume
VDC	-	Volts, Direct Current
WAN	-	Wide Area Network

1.3 BAS DESCRIPTION

- A. The Building Automation System (BAS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BAS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

- B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BAS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- C. Where necessary and as dictated elsewhere in these Specifications, Servers shall be used for the purpose of providing a location for extensive archiving of system configuration data, and historical data such as trend data and operator transactions. All data stored will be through the use of a standard data base platform Microsoft SQL Server as dictated elsewhere in this specification.
- D. The work of the single BAS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.
- E. The BAS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BAS.
- F. 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.
- G. Manage and coordinate the BAS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- H. The BAS as provided shall incorporate, at minimum, the following integrated features, functions and services:
 - 1. Operator information, alarm management and control functions.
 - 2. Enterprise-level information and control access.
 - 3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
 - 4. Diagnostic monitoring and reporting of BAS functions.
 - 5. Offsite monitoring and management access by IP address.
 - 6. Energy management
 - 7. Standard applications for terminal HVAC systems.
 - 8. Indoor Air Quality monitoring and control

1.4 QUALITY ASSURANCE

- A. General
 - 1. The Building Automation 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 Automation Systems.
 - 2. The BAS Contractor shall be a recognized national manufacturer, installer and service provider of BAS.
 - 3. The BAS 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 BAS business

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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 Automation System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Automation Systems, and shall be the manufacturer's latest standard of design at the time of bid.
6. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system both existing and new.
7. The Building Automation System contractor shall provide the Owner with 24 months of future software system upgrades as part of their package. The upgrade period shall begin once the final completion has been signed off by the engineer of record for each project.

B. Workplace Safety and Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BAS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades shall comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BAS Project Management. The designated Project Manger shall be empowered to make technical, scheduling and related decisions on behalf of the BAS Contractor. At a minimum, the Project Manager shall:
 - a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
 - b. Manage the financial aspects of the BAS Contract.
 - c. Coordinate as necessary with other trades.
 - d. Be responsible for the work and actions of the BAS workforce on site.

1.5 References

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- A. All work shall conform to the following Codes and Standards, as applicable:
1. National Fire Protection Association (NFPA) Standards.
 2. National Electric Code (NEC) and applicable local Electric Code.
 3. Underwriters Laboratories (UL) listing and labels.
 4. UL 864 UUKL Smoke Control
 5. UL 268 Smoke Detectors.
 6. UL 916 Energy Management
 7. NFPA 70 - National Electrical Code.
 8. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
 9. NFPA 92A and 92B Smoke Purge/Control Equipment.
 10. Factory Mutual (FM).
 11. American National Standards Institute (ANSI).
 12. National Electric Manufacturer's Association (NEMA).
 13. American Society of Mechanical Engineers (ASME).
 14. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) [user note: add ASHRAE 62 IAQ as applicable].
 15. Air Movement and Control Association (AMCA).
 16. Institute of Electrical and Electronic Engineers (IEEE).
 17. American Standard Code for Information Interchange (ASCII).
 18. Electronics Industries Association (EIA).
 19. Occupational Safety and Health Administration (OSHA).
 20. American Society for Testing and Materials (ASTM).
 21. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
 22. Americans Disability Act (ADA)
 - 24 ANSI/ASHRAE Standard 195-2004 (BACnet)
- B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
- C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.6 Work By Others

- A. The demarcation of work and responsibilities between the BAS Contractor and other related trades shall be as outlined in the BAS RESPONSIBILITY MATRIX

BAS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	Low Volt. WIRING/TUBE	LINE POWER
BAS low voltage and communication wiring	BAS	BAS	BAS	N/A
BAS conduits and raceway	BAS	BAS	BAS	BAS
BAS Current Switches.	BAS	BAS	BAS	N/A
BAS Control Relays	BAS	BAS	BAS	N/A
Smoke Detectors	26	26	26	26
Fire/Smoke Dampers	23	23	26	26
Fire Dampers	23	23	N/A	N/A
Fire Alarm shutdown relay interlock wiring	26	26	26	26
Fire Alarm smoke control relay interlock wiring	26	26	BAS	26

1.7 Submittals

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

A. Shop Drawings, Product Data, and Samples

1. The BAS contractor shall submit its qualifications to Orange County's Representative after bidding has been completed but prior to the submittal of shop drawings. These qualifications shall be submitted within 15 days of contract award.
2. Once the BAS contractor receives approval from the Owner for their qualifications, the BAS contractor shall submit a list of all shop drawings with submittals dates within 45 days of contract award.
3. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
4. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BAS work.
5. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BAS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
6. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
7. The BAS Contractor shall correct any errors or omissions noted in the first review.
8. At a minimum, submit the following:
 - a. BAS network architecture diagrams including all nodes and interconnections.
 - b. Systems schematics, sequences and flow diagrams.
 - c. Points schedule for each point in the BAS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
 - d. Samples of Graphic Display screen types and associated menus. Include proposed floor plans for graphical representation.
 - e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
 - f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
 - g. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
 - h. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
 - i. Details of all BAS interfaces and connections to the work of other trades.
 - j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 Record Documentation

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BAS provided:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- 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. Manufacturer's product data sheets or catalog pages for all products including software.
 - d. System Operator's manuals.
 - e. Archive copy of all site-specific databases and sequences.
 - f. BAS network diagrams.
 - g. Interfaces to all third-party products and work by other trades.
2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 Warranty

A. Standard Material and Labor Warranty:

1. Provide a two-year labor and material warranty on the BAS.
2. If within twenty-four (24) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the cost of the BAS Contractor.
3. Maintain an adequate supply of materials within 50 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BAS Contractor's normal business hours.

PART 2 – PRODUCTS

2.1 General Description

- A. The Building Automation System (BAS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BAS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks. The BAS shall be compatible for use with virtual server technology.
- B. The Building Automation System shall consist of the following:
1. Standalone System Controller
 2. Equipment Controller(s)
 3. Input/Output Module(s)
 4. Local Display Device(s)
 5. Portable Operator's Terminal(s)
 6. Distributed User Interface(s)
 7. Network processing, data storage and communications equipment
 8. Other components required for a complete and working BAS

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
 - 1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
 - 2. The System shall maintain all settings and overrides through a system reboot.
- E. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
- F. The scope of work shall include an upgraded Graphical User Interface (GUI) at the front end for the new added equipment, similar to the Phase I Hall D AHU work.
- G. Acceptable Manufacturers (NO SUBSTITUTIONS)
 - 1. Work shall be an extension of the existing Honeywell system currently installed in West Concourse D.

2.2 Input Devices

A. 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 or approved substitution.
 - 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%).

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

◇ Acceptable manufacturers: Veris Industries or approved substitution.

B. Status and Safety Switches

1. General Requirements

- a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BAS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

- a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
- b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
- c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
- d. Acceptable manufacturers: Veris Industries or approved substitution.

2.3 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

- d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
- e. Acceptable manufacturers: Belimo or approved substitution.

B. Control Dampers

1. The BAS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BAS Contractor or as specifically indicated on the Drawings.
2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Ruskin CD50, Vent Products 5650 or approved substitution.
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, Vent Products 5800 or approved substitution.
7. Multiple section dampers may be jack-shafted to allow mounting of direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

1. Control Pilot Relays
 - a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 - b. Mounting Bases shall be snap-mount.
 - c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 - d. Contacts shall be rated for 10 amps at 120VAC.
 - e. Relays shall have an integral indicator light and check button.
 - f. Acceptable manufacturers: Lectro or approved substitution.

PART 3 – PERFORMANCE / EXECUTION

3.1 Installation Practices

A. BAS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation System, as herein specified, shall be provided by the BAS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring
 - a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
 - b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit shall be located at the panel terminations. Avoid grounding loops.

B. BAS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Automation System shall be taken from panel boards and circuit breakers provided by Division 26.
2. Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BAS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size shall be 1/2".
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Owner.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide fire stopping for all penetrations used by dedicated BAS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

E. BAS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BAS Panel Installation

1. The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BAS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BAS in accessible local control panels wherever possible.

H. HVAC Output Devices

1. All output devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke.
3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.

3.2 Sequence of Operations – Refer to Construction Documents.

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,

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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

- 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.
- The DMZ should access data repositories in the internal OCGBCC network using SQL database calls.

5.0 Enforcement: Any server found within the OCGBCC DMZ that does not meet the above criteria shall be immediately disconnected from the OCGBCC DMZ. Any employee found to have violated this policy may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions:

<u>Term</u>	<u>Definition</u>
Bank Information	Checking account numbers, credit card numbers, or any unique number from a bank institution.
HTTP	HyperText Transfer Protocol – The underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions web servers and browsers should take in response to various commands.
HTTPS	HyperText Transfer Protocol over Secure Socket Layer (SSL) – By convention, URLs that require an SSL connection start with https: instead of just http:.
FTP	File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.
SMTP	Simple Mail Transfer Protocol – A protocol for sending e-mail messages between servers. In addition, SMTP is generally used to send messages from a mail client to a mail server.
IMAPS	Internet Message Access Protocol – A protocol for retrieving e-mail messages. With IMAP4, you can search through your e-mail messages for keywords while the messages are still on mail server and, then, choose which messages to download to your machine.
LDAP	Lightweight Directory Access Protocol – A set of protocols for accessing information directories.
DNS	Domain Name System (or Service or Server) – An Internet service that translates domain names into IP addresses. Because domain names are alphabetic, they're

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- 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:
- 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.
 - SSL certificates issued to servers and applications used by internal OCGBCC resources should be issued by OCGBCC's Certification Authority.
- 5.0 Enforcement : Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.
- 6.0 Definitions:

<u>Term</u>	<u>Definition</u>
Encryption	Transforming understandable data into a form that is incomprehensible and that looks like random noise.
Hashing	An algorithm that takes an entire message and, through process of shuffling, manipulating, and processing the bytes using logical operations, generates a small message digest of the data.
DMZ	De-Militarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.
Certification Authority (CA)	In cryptography, a certificate authority or certification authority (CA) is an entity which issues digital certificates for use by other parties.

ATTACHMENT III
ANTIVIRUS STANDARDS

- 1.0 Purpose: The purpose of this document is to establish requirements which must be met by all computers connected to the Orange County Government Board of County Commissioners (OCGBCC) network to ensure effective virus detection and prevention.
- 2.0 Scope: This document applies to all OCGGCC 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 Policies:
- 3.1 Virus Software – Servers: Trend Micro Server Protect or Trend Micro OfficeScan shall be installed and enabled on all OCGGCC 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 OCGGCC 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 OCGGCC 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:

<u>Term</u>	<u>Definition</u>
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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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 OCGBC.
- 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 OCGBC 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 OCGBC.
 - 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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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, and Settings: Any and all creations, removals or modifications to IIS Settings, Virtual Directories, Application Directories, and Application Pools shall require the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

3.4.7 Other:

- Shares are not allowed on any directory accessible via web browser. Microsoft Windows web servers and any web application shall not be installed on the same drive as the host operating system.
- Executable files (.exe, .com, .bat, .dll, etc) shall not be placed into directories accessible via a web browser without the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISSESU).

4.0 Guidelines: It is recommended that all web applications use the enterprise FTP and SMTP servers for all FTP/SMTP traffic.

5.0 Enforcement: Any web server not meeting the above criteria may be immediately disconnected from the OCGbcc network. Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions:

<u>Term</u>	<u>Definition</u>
FTP	File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring Web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.
WebDav	Web-based Distributed Authoring and Versioning – Extensions to HTTP that allows users to collaboratively edit and manage files on remote Web servers.
Front Page Extensions	A series of scripts that can be employed using Microsoft FrontPage, a visual HTML editor.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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.

END OF SECTION 23 09 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 09 93
SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Provide all labor, material, documentation and services required for the implementation of the Sequences of Operation detailed herein.

1.3 RELATED WORK

- A. Section 23 09 00 - Building Automation System (BAS).

1.4 APPLICABLE PROVISION

- A. Were modulation of a valve or damper is referred to then it shall mean the direct digital control of the valve or damper based on a control algorithm resident in the BAS software at the remote field panel. Unless noted otherwise the control algorithm shall be PID control. Optimum loop response shall be ensured by the use of a built in automatic loop tuner.
- B. An Operator having the required level of password access shall be able to modify the Operator changeable or definable parameter(s) on-line from an I/O device such that the monitoring and control functions of the BAS shall not be affected during the period of the change. The mechanism by which the change is made shall be simple and shall be adequately described in the Operator's manuals. Where setpoints for control parameters such as setpoint or changeover temperatures, humidities, or times are referred to in this Section they shall be Operator changeable on-line.
- C. Where the sequences refer to the start/stop of a system this shall be initiated either by an Operator manually entered command or automatically by a software routine such as "Optimum Stop/Start", "Power Demand Control", "Programmed Stop/Start", etc. or via an interlock in the sequences of operation to other equipment or event(s).
- D. When the motor controller is equipped with a HOA the motors shall only be controlled by the BAS when the HOA switch is in the auto position.
- E. Firestats, freezestats, smoke and fire detectors and interlocked dampers shall be wired to shutdown motors when the HOA switch is in both the hand and auto positions. It shall not be possible for the BAS to override these or any other safety devices or any fire alarm system control functions, except in the case of an engineered smoke control system in which case freeze protection safeties shall be overridden.
- F. Refer to the Point Definition Sheets and System Schematics, which form part of these Contract Documents, to facilitate the interpretation of the sequences of operation as defined herein.
- G. Provide additional I/O points, whether or not such points are indicated in the Point Definition Sheets, if they are required in order to attain the requirements of the Contract Documents.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- H. Where fans and dampers are to be interlocked, provide hardwire interlocks between the motor terminal strip and damper such that the damper shall be driven open when the motor is required to start. Motor start-up shall not occur until the damper end switch indicates the damper is in the full open position.
- I. Where fans and dampers are hardwire interlocked, the interlocks shall apply in both the "hand" and "auto" positions of the HOA switch at the motor controller.
- J. Where there are fans not identified within the sequence of operation, point definition sheets or schematic drawings that provide supply and/or exhaust air that are not controlled via a thermostat, they shall be hardwire interlocked to the controlling device. The supply fans shall be hardwire interlocked with their associated exhaust fan (if applicable) to operate simultaneously. The dampers shall be hardwire interlocked with the fans via end switches such that the fans cannot operate when the damper is not fully open. The damper status shall not be monitored by the BAS. If the supply or exhaust fan serves a riser with multiple dampers, the end switches of the riser dampers shall be wired in parallel as a group then wired in series with the fan's associated damper end switch to prevent the fan from operating unless both the fan's damper is open and at least one of the riser dampers are open.
- K. The point list is provided for convenience and is not intended to be all-inclusive. All points required to provide the Sequence of Operation shall be included as if listed.
- L. All wiring required to provide the Sequence of Operation shall be included.

1.5 ABBREVIATIONS

AFD	Adjustable Frequency Drive
AUX	Starter Auxiliary Contact
AI	Analog Input
AO	Analog Output
CFM	Air Flow in CFM from Air Monitor
CSR	Current Sensing Relay
D	Damper Operation
DI	Digital Input
DO	Digital Output
DP	Differential Pressure
ES	End Switch
Fa	Failure Alarm
FR	Freezestat
FS	Flow Switch
H	Humidity Sensor
Ha	High Static Pressure Alarm
IAQ	Indoor Air Quality
IGV	Inlet Guide Vanes
La	Low Static Pressure Alarm
Ma	Maintenance Alarm
Pd	Discharge Static Pressure
Pdd	Downduct Static Pressure
Pds	Discharge Static Pressure Safety
Ps	Suction Static Pressure
Pss	Suction Static Pressure Safety
R	Relay
Sa	Safety Alarm/Shut-down
SD	Smoke Detector
DP	Static Pressure Sensor
SR	Damper Smoke Rated

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SS	Start-Stop
T	Temperature Sensor
Ta	Temperature Alarm
V	Valve Operator
VP	Virtual Point
X	Hardwired Item

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

- A. Refer to the drawings for the Sequence of Operations.

END OF SECTION 23 09 93

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Chilled Water (CHS/CHR) Piping.
- B. Equipment Drain (D) Piping.
- C. A/C Unit Condensate Drain (CD) Piping.

1.3 DEFINITIONS

- A. The pipe sizes given in this document shall be construed as nominal pipe sizes.

1.4 QUALITY ASSURANCE

- A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.
- B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:
 - 1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
 - 2. 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.
- E. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit specified.
- F. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. American National Standards Institute (ANSI) Standards
2. American Petroleum Institute (API) Specification
3. American Society of Mechanical Engineers (ASME) Publications
4. American Society for Testing and Materials (ASTM) Publications
5. American Welding Society (AWS) Publication
6. American Water Works Association (AWWA) Standards
8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Underwriters Laboratories (UL)

1.6 SUBMITTALS

- A. All submittals shall be made in accordance with Division 1 requirements.
- B. Materials List: Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipefittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.
 1. Grooved joint couplings and fitting shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.
- C. Welding Qualifications: Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.
- D. Welding Inspection Reports: Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Chilled Water (CHS/CHR) Piping
System Design Pressure: To 150 psig.
 1. Piping, 1/4" thru 2": Contractor's option:
 - a. Type L Hard-drawn Copper Tubing: ASTM B88.
 - b. Schedule 40 carbon steel, seamless; ASTM A-106, Grade B, Type S.
 - c. Schedule 10S stainless steel, ASTM A-312, Type 304/304L.
 2. Piping, 2-1/2" thru 10": Schedule 40 carbon steel, seamless or electric resistance welded, ASTM A-53, Grade B, Type S or ERW.
 3. Pipe Fittings: 1/2" thru 2": Contractor's option:
 - a. Wrought Copper, ANSI B16.22.
 - b. 150lb. malleable iron threaded; ASTM A-197.
 - c. Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation.
 - d. Stainless steel fittings shall be precision, cold drawn, stainless steel with elastomer O-ring seals, suitable for working pressure to 500-psig (3450-kPa). Victaulic Vic-Press.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

6. Pipe fittings 2-1/2" and larger: Schedule to match mating pipe, carbon steel, butt weld type, ASTM A-234. Weld-o-lets and thread-o-lets will be limited to 2 pipe sizes smaller than the pipe to which they are connected.
 7. Brazing: Contractors Option:
 - a. 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
 - b. 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
 - c. 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal
 8. Unions: 1/2" thru 2": Contractor's option:
 - a. Wrought Copper, Pressure Class 150, w/solder ends.
 - b. Malleable Iron, Pressure Class 150, w/ threaded ends, ANSI B 13.39.
 - c. 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.
 9. Flanges: 150 lb. rated forged carbon steel; weld neck type, with raised face, bored to match the mating pipe I.D.; ASTM A-181, Grade 2, or ASTM A-105, Grade 2.
 10. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
 11. Gaskets: Full faced style, 1/8"thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104, Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3000 or acceptable equivalent.
 12. Mechanical joints employing grooved-end pipe may be used on this piping system. See Paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.
- B. Equipment Drain (D) Piping
System Design Pressure: 10 psig.
1. Piping, 1/4" thru 1": Type L Hard-drawn Copper Tubing: ASTM B88.
 2. Piping, 1" thru 2": Schedule 40 carbon steel, seamless, galvanized, ASTM A-106, Grade B, Type S.
 3. Piping, 2-1/2" thru 10": Schedule 40 carbon steel, seamless or electric resistance welded, galvanized, ASTM A-53, Grade B, Type S or ERW.
 4. Pipe Fittings, 1/4" thru 1": Wrought Copper, ANSI B16.22.
 5. Pipe Fittings, 1-1/2" and larger: 125 lb. rated galvanized malleable iron, threaded type, ASTM A-197.
 6. Solder: Lead-free, 460/630 F melting range, 90% Tin, 1/2% Silver, 5% Antimony, balance Copper. (Based on J.W. Harris Co. "BRIGHT" or equal).
 7. Unions: 1/4" thru 1": Wrought Copper, Pressure Class 150, w/solder ends.
 8. Unions: 1" thru 2": Malleable Iron, Pressure Class 150, w/ threaded ends, ANSI B 16.39. 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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

9. Flanges: 150 lb. forged carbon steel, threaded type, with raised face, bored to match the mating pipe I.D.; ANSI B16.3.
10. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
11. Gaskets: Full faced style, 1/8" thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104, Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.
12. Mechanical joints, grooved-end type, may be used on 2-1/2" IPS and larger. See paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.

C. 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, 460/630 F melting range, 90% Tin, 1/2% Silver, 5% Antimony, balance Copper. (Based on J.W. Harris Co. "BRIGHT").
 - 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.

2.3 MECHANICAL JOINT SYSTEMS

A. General:

1. All couplings, fittings, and gaskets shall be the products of a single manufacturer.
2. Valve ends shall be compatible with the couplings used on the connecting piping.
3. All exposed piping shall be cleaned, removing all rust, primed and painted black. At substantial completion all exposed piping shall be free of rust and in a "like new condition".
4. All grooved joint fittings, couplings and valves shall be provided by a single

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- manufacturer.
5. The grooving tools shall be of the same manufacturer as the grooved components.
 6. Fittings:
 - a. Steel Piping: Fittings shall be manufactured of ductile iron per ASTM A536; wrought steel per ASTM A234; or factory-fabricated from carbon steel pipe conforming to ASTM A53.
 - b. Copper-Tubing: ASME B16.22 wrought copper or ASME B16.18 cast bronze, manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.) Victaulic Copper-Connection.
 7. The grooved coupling manufacturer's factory-trained representative shall provide on-site training for the contractor's field personnel in the use of the grooving tools and installation of grooved joint products. The representative shall periodically visit the job site to review best-practices are being followed and provide a report to the Owner and engineer of their visit. (A distributor's representative is NOT considered qualified to conduct the train or job site inspections).
- B. Pipe Wall Thickness (Schedule Number):
1. Where rolled groove joints are used, the pipe wall thickness may, in some cases, be decreased below that specified for the particular fluid system. In all cases, the minimum pipe wall thickness shall be in accordance with ANSI/ASME B31.9, Chapter II, using 150% of the system operating pressure as the design pressure.
 2. Pipe having cut (machined) grooves shall have a nominal wall thickness of not less than the wall thickness specified for Schedule 40 pipe of the particular pipe size.
 3. Non-metallic pipe shall not be joined with grooved-end pipe mechanical joints.
- C. Couplings:
1. Mechanical joint couplings shall be of the external type, for use with cut or rolled-groove end pipes, fittings, and valves.
 2. Couplings shall be self-centering, and shall engage and lock-in-place the grooved-end pipes, fittings, and gaskets.
 3. All couplings shall be of the rigid style. Flexible couplings shall not be used without the written approval of the Engineer.
 4. Couplings shall be Ductile Iron, ASTM A536; and shall be designed for not less than 250 psig at 230 Deg. F.
 5. The coupling assembly shall be held together by two or more track-head, oval-neck steel bolts, ASTM A449 and A183.
 6. Manufactured in two segments.
 7. Couplings shall comply with ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
 8. Steel Piping:
 - a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, with Victaulic Style 107H/107N (Quick-Vic™) or approved equal, Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C).
 - b. Flexible Type: Use in locations where vibration attenuation and stress

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source. Victaulic Style 177 (Quick-Vic™), Installation ready flexible coupling.
- c. Victaulic AGS Mechanical Couplings, 14 inch (DN350) through 60 inch (DN1500): Couplings shall consist of two ASTM A-536 ductile iron housing segments with lead-in chamfer on housing key and a wide-width elastomer pressure responsive gasket. Victaulic Style W07 AGS Rigid and Style W77 AGS Flexible Coupling.
9. Stainless Steel: Victaulic Style 89 (rigid type, housings engage the bottom of the groove) and Style W89, AGS series two-segment rigid coupling.
 10. Copper-Tubing: Victaulic Style 607H, Installation-Ready coupling with offsetting, angle-pattern, bolt pads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
 - a. Unions and flanges for servicing and disconnect are not required in installations with grooved mechanical joint couplings. (The couplings shall serve as disconnect points.)
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.

21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions, waterways or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Hydronic HVAC Systems Additional Requirements:

1. Provide a 3/4 inch drain valve and a capped hose nipple at each low point in each system, and where indicated.
2. Provide, at each high point in each system, and where indicated, an air collection chamber and a manual air vent consisting of a capped 6-inch long section of 2-inch pipe and a 1/8 inch loose key manual air vent. Drill and tap the pipe cap to accept the air vent.
3. On liquid systems, make branch connections to top of mains for up-feed arrangement, and to bottom of mains for down-feed arrangement, except where main and branch line are of equal size the branch connection may be made to the side of the main for both up-feed and down-feed applications.
4. 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.
5. Slope piping 1 inch per 40 ft, in the direction of flow.

C. Mechanical Joint System Additional Requirements:

1. Install in strict accordance with the manufacturers written installation instructions.
2. Coordinate with Section 23 07 00 HVAC Insulation to ensure full thickness insulation at mechanical joints.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:

1. All pipe welding shall be performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirements for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
2. The Inspection Company performing the examination shall certify in writing that

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.
 4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.
- C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".
- D. Soldering:
1. Joints in copper tubing shall be made with solder- type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

3.3 TESTING OF PIPING SYSTEMS:

- A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
 2. HVAC related systems shall be tested with water at 1-1/2 times the system working pressure, but not less than 100 psig. Joints will be visually examined for leaks.
 3. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
- B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
- C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.
- D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.
- F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
- G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
- H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
- I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
- J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION 23 21 13

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. End Suction, Base Mounted Pumps.

1.3 QUALITY ASSURANCE

- A. Maximum suction velocity shall be less than 10 FPS. Pump discharge velocity shall be less than to 14 FPS
- B. Pump selections shall be no more than 5% less than the scheduled pump efficiency.
- C. Maximum impeller diameter shall not exceed 85% of the cutwater diameter.
- D. Pump motors shall be NEMA Premium™ Efficiency. Motors for pumps with variable speed drive must have Class F insulation.
- E. Pumps shall be factory tested, thoroughly cleaned and painted. Discharge and suction shall be factory covered to protect the volute/impeller from dirt and damage during shipment and storage.
- F. Pumps shall be constructed with materials and standards which have been tested or proven and have published test data available if requested, stating that these materials and standards have been found acceptable for use in pump manufacturing by one or more of the following:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. International Organization for Standardization (ISO)
 - 3. American National Standards Institute (ANSI)
 - 4. National Electrical Manufacturers Association (NEMA)
- G. Provide full two year on-site parts and labor warranty including travel time and expense. Warranty period shall begin at date of substantial completion.
- H. Provide shaft grounding rings on all pump motors driven by a VFD. Typically to an AEGIS – SGR.

1.4 SUBMITTALS

- A. Submit dimensioned performance and product data for acceptance.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.
- D. Additional submittal requirements:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Submit pump curves with pump operating point plotted, brake horsepower and pump efficiency indicated on curve.
2. Where two or more pumps are operating in parallel, submit combined pump curve with all pump operating points plotted, system curve indicated and brake horsepower and pump efficiency indicated on curve.
3. Where pumps are used in open type systems (i.e. condenser water) submit net positive suction head curve (NPSH) with the system requirements plotted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. End Suction, Base Mounted Pumps:

1. Armstrong Pump Company
2. Aurora
3. Bell & Gossett
4. Patterson Pump Company
5. Peerless
6. Sulzer Pumps
7. Taco
8. Weinman

2.2 EQUIPMENT

A. End Suction, Base Mounted Pumps:

1. Type: Centrifugal, single stage, end suction, back pull out design, base mounted, flexible coupled.
2. Casing: Cast iron, vertical split case, end suction, rated for 175 psi, suction and discharge gauge tapping, casing taped for air vent, 125 psi ANSI flanged suction and discharge.
3. Impeller: Bronze fully enclosed, keyed to shaft and secured with locknut, hydraulically and dynamically balanced.
4. Shaft: Steel with aluminum bronze or stainless steel sleeve thru seal chamber.
5. Seals: Carbon rotating against a stationary ceramic seat.
6. Bearings: Regreaseable ball bearings.
7. Drive: Coupled with a T.B. Woods Sure-Flex® flexible shock arresting coupling, and OSHA approved coupling guard. Coupling for variable speed drive applications shall be T.B. Woods Dura-Flex® shock arresting coupling and OSHA approved coupling guard or approved equal.
8. Motor: Outdoor applications shall have a TEFC (Totally Enclosed Fan Cooled) motor and indoor locations shall have an open drip-proof motor; voltage and horsepower as scheduled.
9. Range: 20°F to 225°F.
10. Base: Heavy structural steel welded or cast iron frame with mounts for motor pump and flexible coupler, open area for non-shrinking grout.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with manufacturers written instructions.

3.2 INSTALLATION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- A. End Suction, Base Mounted Pumps:
1. Install on concrete base weighing a minimum of 2-1/2 times the weight of the pump, level pump base and grout base, with non-shrinking grout.
 2. Support pipe and valve assembly independent of pump housing.
 3. Install manual air vent at top of volute casing.
 4. Verify pump alignment after pump is mounted and prior to start up.
 5. Provide a suction diffuser unless 5 straight diameters of pipe is shown entering the pump suction.

END OF SECTION 23 21 23

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Pre-Operation Cleaning of each System.
- B. Initial Water Analysis and Recommendations.

1.3 SYSTEMS TO BE TREATED

- A. Chilled Water (CHS/CHR).

1.4 QUALITY ASSURANCE

- A. The pre-cleaning and chemical charging shall be by or supervised by personnel trained in the field of water treatment. Chemicals shall be charged into the system within 24 hours of flushing and during circulation.
- B. All chemicals shall be compatible with system materials of construction and shall comply with all applicable EPA and regulatory agency standards.
- C. After completion of the system water treatment, the contractor shall provide a water analysis and certify in writing to the Owners Representative that the system or systems have been properly flushed, cleaned and charged with the proper chemical concentration and that the Owner has been instructed in proper maintenance procedures.

1.5 SUBMITTALS

- A. Refer to attached excerpt from Exhibit C for Chilled Water Service Agreement from OUCooling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design - Nalco (Refer to attached excerpt from Exhibit C for Chilled Water Service Agreement from OUCooling).

2.2 PIPING SYSTEMS AND WATER TREATMENT SYSTEMS

- A. Chilled Water (CHS/CHR) : Closed Loop

2.3 WATER TREATMENT REQUIREMENTS - Refer to attached excerpt from Exhibit C for Chilled Water Service Agreement from OUCooling.

PART 3 - EXECUTION

3.1 GENERAL

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- A. All products shall be installed or services performed in strict accordance with the manufactures written installation/procedure instructions.
- B. The contractor shall be responsible for pre-operational chemical cleaning and flushing of the entire West Concourse D chilled water system piping including branch piping to individual fan coil units, air handlers, instrumentation connections, drains, vents, and dead end runs prior to the initiation of chilled water service by OUC. Refer to attached excerpt from Exhibit C for Chilled Water Service Agreement from OUCooling for full requirements. A flow rate resulting in a minimum velocity of 6 ft/sec shall be maintained to ensure that the cleaning chemicals will work properly.
- C. Flushing sequence for new piping:
 - 1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping, unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 6 feet per second, if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's pump. Flush until clean as approved by the Engineer of Record and OUC.
 - 2. Cleaning: Using products supplied, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 6 feet per second. Circulate each section for not less than four hours. Drain and prepare for final flushing.
 - 3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour. Blowdown and drain system entirely.
- D. Install chemicals required for treatment of each system within 24 hours of completion of cleaning prior to start-up and operation of the system. Contractor shall measure the water quantity required to fill system and provide this information to water treatment equipment supplier and tabulate this data in the operation and maintenance manuals.

END OF SECTION 23 25 00

These requirements are described in detail in Section IV. The Customer shall establish a Chilled Water Billing Account prior to the initiation of chilled water service.

IV. Cleaning and Flushing Requirements

OUC requires compliance with the following minimum cleaning and flushing procedures. These procedures are necessary to ensure the proper operation of the Customer's chilled water system and to prevent contamination of the OUC Chilled Water System and equipment. These requirements are based on typical and accepted industry practices. It shall be the Customer's ultimate responsibility to communicate these requirements to the building design engineers and construction contractors. It is recommended that the Customer contact OUC Chilled Water Services and Metering representatives during the initial phases of design and prior to construction to discuss and coordinate the required activities.

Recirculating cleaning chemical through OUC metering and heat exchanger equipment is prohibited. The Customer shall install the necessary bypass piping, valves, and flushing connections.

OUC WILL NOT INITIATE CHILLED WATER SERVICE UNTIL THE FOLLOWING REQUIREMENTS ARE MET:

- Specifications and requirements of the Chilled Water Service Agreement and Chilled Water Metering Agreement (if applicable) are met.
- The Customer's chilled water piping system has passed local permitting authority inspection.
- The Customer or Customer's Contractor has established a Chilled Water Billing Account with OUC.
- The Chilled Water System Cleanliness and Treatment Certification Documentation has been signed by the General Contractor Superintendent and has been submitted to OUC for review and acceptance.
- The Building Chilled Water System is filled with clean water. If heat exchangers are used, the building chilled water system shall be treated to maintain required chemistry parameters.
- If the Customer desires to place the building chilled water system into service in phases, provisions for cleaning and flushing the later phases must have been made and approved by OUC. Provisions for flushing for later phases must be determined prior to construction.

CLEANING PROCEDURE:

1. The Customer shall be responsible for pre-operational chemical cleaning and flushing of **the entire** building chilled water system piping including branch piping to individual fan coil units, air handlers, instrumentation connections, drains, vents, and dead end runs prior to the initiation of chilled water service by OUC. The Customer shall utilize the services of a qualified chemical treatment contractor to supply chemicals, conduct chemical additions, monitoring, and treatment certification. If heat exchangers are installed for de-coupling, they shall be by-passed during the cleaning and flushing process. The Customer shall use clean potable water from the local domestic water supply for all cleaning, flushing and filling operations.
2. The Customer shall not allow untreated water to remain in any carbon steel/black iron chilled water piping longer than 24 hours. If 24 hours has elapsed prior to the initiation of chilled water service, all affected piping shall be treated with corrosion inhibitor or completely drained. The piping to

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

be placed into service shall be completely full of clean or properly treated potable water prior to initiation of chilled water service. Corrosion inhibitor is already added to the OUC Chilled Water System. It may not be necessary for the Customer to add corrosion inhibitor if all requirements are met so there is no delay between the completion of the cleaning and flushing process and the initiation of chilled water service (this does not apply for projects using heat exchangers).

3. The Customer shall be responsible for ensuring all startup strainers are in place on the building chilled water pumps as well as any other startup strainers recommended by HVAC component manufacturers. The Customer shall be responsible for removing all startup strainers and cleaning and inspecting permanent strainers.
 - a. OUC recommends that components that are prone to fouling such as, but not limited to, coils, control valves, and balance valves be removed/bypassed during the initial flushing process. This is a requirement should submeters be installed.
 - b. OUC recommends that startup strainers installed on the building chilled water pump suction diffusers remain in place until the entire building chilled water system has been placed into service and is completely supplied via the OUC Chilled Water System under full flow conditions. The startup strainers should be cleaned and inspected frequently until removed. The Customer is responsible for the cleaning, inspecting, and removal of the startup strainers.
4. Complete circulation of the chilled water system must be achieved during the cleaning and flushing procedure. A flow rate resulting in a minimum velocity of 4 ft/sec shall be maintained to ensure that the cleaning chemicals will work properly.
 - a. All manual, motorized (electrical and pneumatic), and thermostatic operated valves if installed shall be fully open during the circulation process. All dead end runs shall be looped together with piping not less than 1/3 the size of the dead end run. This loop piping shall remain in place until cleaning is complete and the chilled water system is certified as clean.
5. A minimum of 1-1/2" ball valve is to be permanently installed in the low point of chilled water system for the purpose of flushing the system as necessary and described elsewhere. Upon completion of all flushing, the drain valve shall be plugged to prevent drainage of the system during operation.
6. Cleaning Chemical: The chemical used for cleaning shall be a detergent and dispersant designed to remove deposition from construction, such as pipe dope, loose grease and oils, most loose mill scale, and other extraneous materials. The pre-cleaning detergent shall contain effective penetrants, emulsifiers, peptizers, dispersants, wetting agents, corrosion inhibitors to protect metals that are reactive in an alkaline environment, and shall be safe to handle and use. Effectiveness of the product shall be such that the water need only be at ambient temperatures.
 - a. The cleaning chemical shall be **Nalco 2567** or OUC approved equal. **The Customer shall submit in writing the proposed alternate chemical to OUC Chilled Water Services.**
 - b. Add cleaning chemical treatment manufacturer's recommended dosages of chemicals based on the building system volume.
 - c. **Circulate** cleaning chemical for **48 hours**.
 - d. The building chilled water system shall then be drained from the lowest point in the system with make-up water fed to the system on a continuous basis. During the draining process, the building chilled water circulating pumps shall be in continuous operation to prevent settling of debris loosened by the pre-cleaning detergent.
 - e. Circulation and draining shall continue until the total alkalinity, conductivity, clarity, and pH of the water in the building chilled water system is equal to the make-up water used for filling.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- f. The Customer is cautioned to ensure temperature and pressure in the system during flushing does not cause rupture disc or relief valves, etc., to open as a result of increased temperature in the chilled water system, as a result of the recirculation process.

7. Clean and inspect all strainers. Replace damaged strainers.

Certification: After the system is cleaned and flushed, the Customer shall submit **Chilled Water System Cleanliness and Treatment Certification Documentation** to OUC for review and acceptance. This documentation shall be prepared by a qualified chemical cleaning/treatment contractor.

The Customer shall provide documentation of the Cleanliness and Treatment consisting of the following:

- Name of chemical cleaning contractor
- Estimated system volume
- Location of sample points.
- Chemical manufacturer & type including amounts.
- Date/Time chemical cleaning is initiated and completed.
- pH, total alkalinity, and conductivity of makeup water.
- pH, total alkalinity, conductivity, Fe concentration (less than 1 ppm), and clarity of chilled water system after flushing.

The Customer's Contractor Superintendent shall sign the Certification. OUC shall maintain the right to independently verify the condition of the chilled water within the premises. OUC will submit sample results of the OUC chilled water system upon request.

8. **If carbon steel/black iron piping is not ready for operation within 24 hours of the initiation of OUC Chilled Water Service, the Customer shall either treat the affected portions of the system with 25-100 ppm Nalco 2513 (NO SUBSTITUTES) corrosion inhibitor or completely drain the affected portions of the system.** Service to portions of the system that have been cleaned and flushed and are ready to be placed into operation can be initiated if the out of service piping is isolated with all isolation valves locked in the closed position and all other requirements for the initiation of chilled water service are met.
9. Should the Customer desire to place the building chilled water system's main supply and return headers into operation in **phases**, the Customer shall provide means to isolate the operational phases from the phases under construction. **Cross contamination of dirty water and cleaning chemicals shall not be permitted.** The Customer is responsible for cleaning each phase in accordance with the requirements herein including separate certification documents for each phase.
- a. If branch piping for future individual fan coil units and/or air handlers are not to be placed into service immediately, the Customer shall lock closed the isolation valves. The Customer shall contact OUC Chilled Water Services to coordinate placing the individual units into service. If the affected piping is not corrosion resistant, it shall be drained or treated with corrosion inhibitor.
- b.
- c. The Customer shall conduct a thorough flush of the branch piping with clean potable water. **DO NOT FLUSH NEW PIPING VIA THE CHILLED WATER SYSTEM.** If Chilled Water Meters are to be installed, a spool piece in place of the meter shall be installed during the flushing process. The Customer shall flush until the exiting water is clear. The new piping shall be treated with Nalco 2513 corrosion inhibitor or drained if it is to be left idle for greater than 24 hours.

- d. **For installations without heat exchangers, OUC will allow filling of new piping via the OUC Chilled Water System only for small sections of branch piping that have been properly flushed with clean domestic water. It is assumed the building chilled water system supply and return headers are already in service and the sections of piping have been left idle until the required tenant configuration has been determined. The Customer shall contact OUC Chilled Water Services prior to filling the new piping via the building chilled water system. Any in service piping that has been deadheaded shall be momentarily flushed via the building chilled water system to remove accumulated sediment and debris.**

V. Building HVAC Components & Controls Recommendations

OUC strongly recommends the use of high quality components to ensure the building HVAC chilled water system performs as required and is compatible with district cooling. Special consideration must be given to ensure that the building system is designed to maintain a minimum 15 degree F delta T as well as adequate cooling for temperature and humidity control.

- Use 18 degree F delta T rated coils in fan coil units and air-handlers.
- Use 2-way control valves and pressure independent flow limiting devices, or a single device which accomplishes the same result to ensure that manual balancing or bypass of cold chilled water around any fan coil/air handling unit cooling coil is eliminated.
- Use 3-way control valves only as necessary to ensure minimum pump flow and/or building supply header temperature requirements. Ensure chilled water meter (if applicable) is installed relative to the 3-way valve on piping for fan- coil/air handling unit so that only actual consumption is measured.
- Control valve bodies should be rated for at least 150 psi if building system is coupled directly to the OUC Chilled Water District. A pressure-reducing valve may be required due to OUC's higher operating pressures.
- Do not use PVC piping for chilled water under any circumstances.

END OF SECTION 23 25 00A

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 31 01
SHOP FABRICATED DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Galvanized Steel Rectangular Ductwork.

1.3 QUALITY ASSURANCE

- A. All ductwork shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.
- B. All ductwork shall be fabricated to withstand the pressure and velocity required on this project.
- C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.
- D. All ductwork shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.
- E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

1.4 SUBMITTALS

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

1.5 SHOP DRAWINGS

- A. Shop Drawings: Provide shop drawings of sheet metal ductwork as follows:
 - 1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.
 - 2. Show duct sizes.
 - 3. Show fitting details.
 - 4. Show lighting and ceiling diffusers.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- B. Shop Drawings for Field Erected Casings: Submit shop drawings for air handling unit casings, field erected casings and plenums.
 - 1. Draw to scale of 1/2 inch to 1 foot on the same size sheets as the contract drawings.
 - 2. Show plan, sections, elevations and details of all joints and casings.
 - 3. Detail access doors and hardware.
 - 4. Detail coil, damper, humidifier, filter and fan installations. Provide access doors.
- C. Floor Plans: Provide sheet metal floor plans drawn to the same scale as the contract drawings.
 - 1. Use contract drawing sheet size.
 - 2. Show on each floor plan the floor penetrations, fire dampers and access doors, ducts with sized and bottom elevations, terminal types and air quantities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Ductwork:
 - 1. Interior, exposed or concealed: Hot rolled steel continuously annealed and hot dipped galvanized sheet or coil, minimum G-90, 0.90 oz/sf coating suitable for forming without flaking or peeling, suitable for welding or soldering. Zinc coating shall not be impaired from double seaming, breaking or roll forming. 14 ga. and lighter conforming to ASTM A653. 13 ga and heavier conforming to ASTM A653.
 - 2. Exterior or Areas Requiring Painting: Hot rolled steel continuously annealed and hot dipped galvanized sheet or coil, minimum G-90, 0.90 oz/sf (.001 inch thick/side) coating with a mill applied phosphate film suitable for insulating the paint from the drying action of the zinc, capable of forming without flaking or peeling, suitable for welding or soldering. Zinc coating shall not be impaired from double seaming, breaking or roll forming. 14 ga. and lighter conforming to ASTM A653. 13 ga. and heavier conforming to ASTM A653.
- B. Duct Sealants: Provide sealants with a maximum 25 flame spread, and maximum 50 smoke in the dry state, conforming to ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials", and fire resistive and non-flammable in accordance with ASTM D 93, "Standard Test Methods for Flash Point" by "Pensky-Martens Closed Tester", when wet.

2.2 FABRICATION

- A. Galvanized Steel Ductwork:
 - 1. Fabricate ductwork as indicated on the drawings. Sizes given are inside clear dimensions. 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;

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

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 23. Including but not limited to fire, smoke

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

and/or balancing dampers, access and mounting for control devices, air flow measuring stations, etc. as apply to this project.

- F. All ducts passing through partitions or walls shall pass through at a 90 degree angle. The duct shall be sleeved with the space between the sleeve and duct properly sealed with firestopping material under Division 7 Firestopping. The sleeve shall be permanently affixed to the wall (see Section 23 05 29: Hangers and Supports for HVAC Systems for sleeve specifications).
- G. Coordinate the proper duct pressure classification with the systems served and to construct the ductwork to withstand these pressures. (See 3.6 Schedules; System Pressure Classification and Duct Material Schedules.)
- H. All ducts located outdoors and not of welded construction shall have seams and transverse joints sealed water tight with duct sealer, arranged to shed water and finished with insulating duct coating as specified in Section 23 33 00 Air Duct Accessories.

3.2 CLEANING AND PROTECTION

- A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of duct, debris or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork system, the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.

3.3 DUCT SEALING REQUIREMENTS

- A. All ducts shall have SMACNA Seal Class A (all transverse joints, longitudinal seams and duct wall penetrations).

3.4 LEAK TESTING

- A. Ductwork rated at over 3" positive pressure shall be leak tested using a test rig as described in the SMACNA Balancing Manual.
- B. Test ductwork that is rated over 3" positive pressure at 25% above specified operating pressure. Ductwork to be tested in segments and CFM leakage shall be limited to 5% of the system airflow for that section.
- C. Leaks must be located and sealed. All audible leaks, regardless of size, must be sealed.
- D. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.

ORANGE COUNTY CONVENTION CENTER
 WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.
4. Refer to specification section 23 05 93 for more information.

3.5 INSTALLATION

A. Galvanized Steel Ductwork:

1. Install ductwork as indicated on the drawings. If any conflict occurs notify the Owner's Representative prior to any extensive rerouting.
2. Install ductwork to allow clearance for the installation of duct insulation.

3.6 SCHEDULES

A. System Pressure Classification and Duct Material Schedule for Shop Fabricated Ductwork:

	<u>System</u>	<u>Section</u>	<u>Maximum Pressure</u>	<u>Duct Material</u>
1.	Outside Air 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	Terminal to Return Air Fan	4" neg.	A
8.	Return	All AHU Return	1" neg.	A

Schedule Legend:

Duct Material

A Galvanized Steel

END OF SECTION 23 31 01

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Duct access doors.
- B. Fire dampers.
- C. Smoke dampers.
- D. Smoke/Fire dampers.
- E. Volume dampers.
- F. Flexible duct connectors.
- G. Hardware cloth.
- H. Install miscellaneous control devices.

1.3 QUALITY ASSURANCE

- A. All products provided for enhancement of Life Safety shall be UL listed and bear the appropriate label stating compliance.
- B. All Products to have a Florida Product Approval Number, as required by the Florida Building Code (FAC 9N-3).
- C. All products located in the conditioned air stream or located in return air plenums shall conform to the NFPA 90A Flame/Smoke/Fuel Contribution of 25/50/0 and all other applicable requirements of NFPA 90A.
- D. Smoke and Smoke/Fire dampers shall be provided with a 60 month from the date of shipment parts only warranty, including freight for all components, including damper operators.

1.4 SUBMITTALS

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- A. Duct Access Doors:
 - 1. Air Balance, Inc.
 - 2. Cesco Products
 - 3. Greenheck, Inc.
 - 4. Nailor Industries, Inc.
 - 5. Prefco Products, Inc.
 - 6. Ruskin Manufacturing, Co.
 - 7. Pottorff

- B. Fire Dampers:
 - 1. Air Balance, Inc.
 - 2. Cesco Products
 - 3. Greenheck, Inc.
 - 4. Nailor Industries, Inc.
 - 5. Prefco Products, Inc.
 - 6. Ruskin Manufacturing, Co.
 - 7. Pottorff

- C. Smoke Dampers:
 - 1. Air Balance, Inc.
 - 2. Cesco Products
 - 3. Greenheck, Inc.
 - 4. Nailor Industries, Inc.
 - 5. Prefco Products, Inc.
 - 6. Ruskin Manufacturing, Co.
 - 7. Pottorff

- D. Smoke/Fire Dampers:
 - 1. Air Balance, Inc.
 - 2. Cesco Products
 - 3. Greenheck, Inc.
 - 4. Nailor Industries, Inc.
 - 5. Prefco Products, Inc.
 - 6. Ruskin Manufacturing, Co.
 - 7. Pottorff

- E. Volume Dampers:
 - 1. Air Balance, Inc.
 - 2. Arrow United Industries, Inc.
 - 3. Cesco Products
 - 4. Greenheck, Inc.
 - 5. Nailor Industries, Inc.
 - 6. Prefco Products, Inc.
 - 7. Ruskin Manufacturing, Co.
 - 8. Pottorff

- F. Flexible Duct Connectors:
 - 1. Ductmate Industries, Inc.
 - 2. Duro-Dyne

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3. Elgen
4. Ventfabric

G. Hardware Cloth:

1. McNichols Co.
2. Or approved equal

2.2 FABRICATION

A. Duct Access Doors:

1. Low Pressure Ductwork:

- a. Rating up to 2" wg positive or negative.
- b. Frame: Minimum 22 gauge galvanized steel or aluminum, minimum 5/8" knock over edge, neoprene gasket between frame and duct and frame and door.
- c. Door: Minimum 24 gauge galvanized steel or aluminum, continuous hinge and cam latches or minimum 2 cam latches, double wall construction, fiberglass insulated thickness to match ductwork.
- d. Based on Ruskin Manufacturing Co. ADH24 or approved equal.

2. High Pressure Ductwork:

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

B. Fire Dampers:

1. Rating: 1-1/2 hours (UL approved for installation in 2 hour walls).
2. Construction: Minimum 24 gauge galvanized steel frame suitable for connection to ductwork without transition, minimum 24 gauge galvanized steel curtain type blades located out of the airstream, thickness coordinated with wall construction. Where an active smoke control system exists (Refer to Section 23 09 93) the damper shall be capable of closing in an airstream moving at a minimum of 2000 feet per minute and operating at 4" w.g. pressure (dynamic damper).
3. Sleeves: UL listed minimum gauge galvanized steel with welded construction corners. Rollformed sleeves will not be acceptable unless contractor guarantees in writing to seal voids in sleeve with UL approved sealer to limit air leakage. Length of sleeve shall be coordinated with the wall or floor.
4. Operation: Stainless steel constant force closure spring.
5. Link Setting: 160 or 165°F.
6. Based on Ruskin Manufacturing Co. IBD2 Style B. (Static Systems) or approved equal.
Based on Ruskin Manufacturing Co., DIBD2 Style B. (Active smoke control systems only) or approved equal.

C. Smoke Dampers:

1. Low and Medium Pressure Ductwork:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- a. UL labeled under UL 555S low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000°F for 1 hour (non-degradable). Classified for both horizontal and vertical mounting.
 - b. Construction:
 - 1) Frame 16 galvanized steel.
 - 2) Damper Blades: 14 gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free silicone rubber edge type for a smoke seal to 450°F incorporated into blade and frame shapes. Blade shall be suitable for installation in systems with a maximum velocity of 4,000 FPM and 8" w.g. pressure at closure.
 - c. Damper operation by means of an electric actuator 120V AC, 24V AC or signal from smoke detector alarm circuit. Electric motor actuator to be UL listed with damper assembly for power open, spring closed operation with a maximum travel time of 15 seconds. Motor furnished with all connecting linkage and mounting hardware.
 - d. Damper and actuator shall be provided with a 60 month warranty as described in Paragraph 1.3.C.
 - e. Based on Ruskin Manufacturing Co., SD60-II or approved equal.
- D. Smoke/Fire Dampers:
- 1. Low and Medium Pressure Ductwork:
 - a. UL labeled under the following standards:
 - 1) UL 555 - 1-1/2 hr. fire endurance.
 - 2) UL 555S - Low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000°F for 1 hour (non-degradable).
 - 3) Classified for both horizontal and vertical mounting.
 - b. Construction: Single damper designed and rated for combination smoke/fire duty.
 - 1) Frame: 16 ga. galvanized steel.
 - 2) Damper Blades: 14 gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free inflatable silicone coated fiberglass material to maintain smoke leakage rating to a minimum of 450°F and galvanized steel for flame seal to 1900°F. Blade shall be suitable for installation in systems with a maximum velocity of 2,000 FPM and 4" w.g. pressure at closure.
 - 3) Duct sleeve provided by others.
 - c. Operation:
 - 1) Smoke/fire damper operation by means of an integral resettable and re-useable UL listed electric-ambient temperature link, UL listed releasing device and mechanical lock assembly. Link activated by either electric, 120V AC or 24V AC signal from smoke detector alarm circuit or 350°F duct ambient temperature. Damper shall be capable of being reopened by remote signal when the duct temperature drops to 150°F. Electric motor actuator shall be UL

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

listed with the damper assembly for power open/spring closed operation. Motor actuator shall be factory furnished with all connecting linkage and mounting hardware and shall be factory tested for proper operation.

- 2) Damper and actuator shall be provided with a 60 month warranty as described in Paragraph 1.3.C.
- 3) Based on Ruskin Manufacturing, Co., FSD60-2 or approved equal.

E. Volume Dampers:

1. Provide volume dampers where indicated and construct as follows:

- a. Provide single blades to a maximum of 10 inch blade width.
- b. Provide inside end synthetic bearings and locking quadrants with wing nuts.
- c. Friction locks are not permitted.
- d. Break damper blades on both edges for stiffness.
- e. Provide multi-blades on dampers 12 inches and larger with inside pins and molded synthetic bearings, and 2 inches wide by 1/8 inch thick structural galvanized channel frame.
- f. Provide galvanized connecting bar with molded synthetic bearings on multi-blade dampers.
- g. Provide stand off bracket for installation in externally insulated duct.
- h. Based on Ruskin Manufacturing, Co. MD35 for rectangular ducts (MDSR25 for round ducts) with velocities up to 1500 feet per minute or approved equal.
- i. Based on Ruskin Manufacturing, Co. CD30AF1 for rectangular ducts (CDR82 for round ducts) with velocities over 1501 feet per minute or approved equal.

F. 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 or approved equal.

G. Hardware Cloth: 4 mesh galvanized steel, plain weave with .035 wire.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install all products in strict accordance with the manufacturer's written installation instructions.
- B. Coordinate the installation of products provided within other sections of Division 23 including but not limited to control dampers, airflow measuring stations, etc.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3.2 INSTALLATION

A. Duct Access Doors:

1. Coordinate the proper class access door with the system requirements.
2. Duct access doors shall be mounted so as to allow maximum access and/or door swing while also providing easy access from the floor or other personal accessible structures.
3. Duct access doors shall be provided wherever required for proper maintenance of equipment, access to duct mounted control devices, or visual inspection and setting of dampers, etc. All doors, due to the small scale of the drawings, may not be shown, it is the contractor's responsibility to coordinate with all trades concerned to provide the necessary quantity and properly locate all doors.

B. Fire Dampers:

1. Fire dampers shall be provided where indicated.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. All fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
4. The fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly sealed with fire barrier material. (Refer to Division 7)
5. Ductwork shall be attached to the fire damper by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all fire damper locations.

C. Smoke Dampers:

1. Provided where indicated. See combination smoke/fire damper for assemblies in fire rated barriers.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. Provide access doors or access sections at all damper locations.
4. Coordinate the provision of the smoke damper actuator with the automatic temperature control and fire alarm system and ensure adequate space for the mounting of the actuator during installation of the damper and ductwork.

D. Smoke/Fire Damper:

1. Provided where indicated. All smoke dampers in fire rated barriers to be combination type.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. All smoke/fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
4. The smoke/fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly sealed with fire barrier material. (Refer to Division 7)
5. Ductwork shall be attached to the smoke/fire damper by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all smoke/fire damper locations.
7. Coordinate the provision of the smoke damper actuator with the Building Control

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

System and assure adequate space for the mounting of the actuator during installation of the smoke/fire damper and ductwork.

8. If pneumatic actuator is provided, all control tubing outside of the rated shaft shall be copper with 95-5 solder.
- E. Volume Dampers: Install at branch take-offs.
1. Install a 24" long yellow strip of material to each damper handle for easy visual location. These strips must be in place prior to Substantial acceptance.
- F. 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.
- G. Hardware Cloth: Install over all open ended ducts. Provide sheetmetal pocket over raw edges and secure with sheetmetal screws through the metal edge cover.
- H. Install Miscellaneous Control Devices:
1. Install dampers furnished under Section 23 09 00. Provide necessary blank off sections where dampers are installed in factory fabricated mixing box openings.
 2. Install air flow measuring stations furnished under Section 23 09 00. Coordinate size and location with proper access before approving release of units for fabrication and shipment.
 3. Install duct smoke detectors provided under Division 26.

3.3 SCHEDULES

A. Access Door Schedule:

1. Square or Rectangular Duct work:

Access Door Mounting

	<u>Surface Max. Dim.</u>	<u>Access Door Size</u>
1.	6"	12" long Remov. Section
2.	7" to 8"	6" x 6"
3.	9" to 12"	8" x 8"
4.	13" to 18"	12" x 12"
5.	19" and up	16" x 16"
6.	Special Situations	See Plans

B. Flexible Duct Connector Schedule

1. Indoor and Outdoor Material Width Schedule

	<u>Duct Size</u> <u>(Max. Dim.)</u>	<u>Pressure</u> <u>(Max.)</u>	<u>Width</u>
a.	12" and less	positive	3"
b.	13" and up	positive	6"

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

c.	12" and less	negative	3"
d.	13" and up	negative	3"

END OF SECTION 23 33 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

1.2 WORK INCLUDED

- A. Extended Surface, Rigid Cell, Panel Type Filters.
- B. Extended Surface, Pleated, Panel Type Pre Filters.

1.3 QUALITY ASSURANCE

- A. High efficiency filter efficiency to be rated as per ASHRAE Standard 52-76 (atmospheric dust). The manufacturer shall guarantee filter performance to be as stated in their literature within tolerances conforming to Section 7.4 of ARI Standard 850-78. Representative filters shall have been tested by an independent, commercially operated test laboratory. The independent test laboratory report shall be available upon request to the specifying engineer and/or owner.
- B. Filter testing to be in accordance with UL Standard 900.

1.4 SUBMITTALS

- A. Submission for acceptance is not required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Extended Surface, Rigid Cell, Panel Type Filters:
 - 1. Airguard.
 - 2. American Air Filters.
 - 3. Camfil-Farr (30/30)
 - 4. Farr.
 - 5. Flanders Filters, Inc. (Pre-Pleat HV)
 - 6. Glasfloss Industries, Inc.
 - 7. Purolator Products Air Filtrtion Co.
 - 8. Tri-Dim Filter Corporation.
- B. Extended Surface, Pleated, Panel Type Pre Filters:
 - 1. Airguard.
 - 2. American Air Filters.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3. Camfil-Farr (30/30)
4. Farr.
5. Flanders Filters, Inc. (Pre-Pleat HV)
6. Glasfloss Industries, Inc.
7. Purolator Products Air Filtration Co.
8. Tri-Dim Filter Corporation.

2.2 FABRICATION

A. Extended Surface, Rigid Cell, Panel Type Filters:

1. Extended surface rigid cell, 100% synthetic media
2. High-impact plastic frame panels.
3. 4" thick, MERV 14, UL Standard 900 approved, maximum face velocity 500 FPM.
4. Initial maximum air friction at 500 FPM equals .30. Air friction at change-out equals 1.00" w.g.
5. Based on Airguard Legacy or approved equal.

B. Extended Surface, Pleated, Panel Type Pre Filters:

1. Extended surface pleated, cotton/synthetic fiber media, cardboard frame, wire support grid, dry type.
2. Dry filtering principal.
3. 2" thick, 25% average efficiency, UL Class 2 approved, maximum face velocity 500 FPM.
4. Initial maximum air friction at 500 FPM equals .30. Air friction at change-out equals 1.00" w.g.
5. Based on AAF AM-Air 300 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Install filters and filter gauges in strict accordance with manufacturer's recommendations. Provide separate gauge tap and valving so that pressure drop can be measured individually across prefilter and final filters.
- B. Particular attention to prevent air bypass through filter support system.
- C. Do not operate fan systems without final filters in place.
- D. Provide one extra set of final filters.

END OF SECTION 23 41 00

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 73 00
PACKAGED AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Packaged Air Handling Units.

1.3 QUALITY ASSURANCE

- A. This equipment shall be furnished to the Contractor, by the Owner. This specification section is included for reference only.
- B. All electrical components shall be listed and labeled by U.L., ETL or a Nationally Recognized Testing Laboratory (NRTL), listed and labeled.
- C. Unit performance shall be certified in accordance with ARI Standard 430 for central station air handling units.
- D. Coil performance shall be certified in accordance with ARI Standard 410.
- E. All components in the conditioned air stream shall conform to the NFPA-90A Flame/Smoke/Fire Contribution Rating of 25/50/0.
- F. All electrical devices shall conform to NEMA standards.
- G. All wiring shall conform to the NEC.
- G. When connected to a 277/480 VAC system, the heating coil shall be listed and labeled at 277 VAC or 480 VAC for single phase or three phase units respectively, regardless of the voltage scheduled on the drawings.
- H. 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 guide lines of the manufacturer's written installation instructions and that its performance meets or exceeds the operating characteristics, specified and/or scheduled.
- I. In accepting this Contract, the air handling unit manufacturer shall guarantee their units to give capacities not less than the capacities specified with the conditions as specified, without the unit sweating in an unconditioned mechanical room, (it is understood that minor misting of the unit surface may occur at unit seams where thermal breaks do not exist. The manufacturer guarantees that they will take whatever steps are necessary to meet the guarantee, at no additional cost to the Owner, regardless of the extent of the revisions required. A Corporate Officer of the manufacturer shall certify the guarantee and the submittal data.
- J. 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 System.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

Extended warranty shall be provided for systems installed during earlier phases of construction through to substantial completion of the final phase. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.

K. 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.

L. Air-handling units shall be Owner-Furnished. Contractor to coordinate receipt of units from the factory with owner.

1.4 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. No equipment shall be fabricated or delivered until the receipt of approved shop drawings from the Owner or Owner's approved representative.

C. AHU manufacturer shall provide the following information with each shop drawing/product data submission:

1. Dimensioned arrangement drawings for each AHU including a plan and elevation view of the assembled unit with overall dimensions, lift points, unit shipping split locations and dimensions, installation and operating weights, and installation, operation and service clearances.
2. All electrical, piping, and ductwork requirements, including sizes, connection locations, and connection method recommendations.
3. Each component of the unit shall be identified and mechanical specifications shall be provided for unit and accessories describing construction, components, and options.
4. All performance data, including capacities and airside and waterside pressure drops, for components.
5. Fan curves shall be provided for fans with the design operating points indicated and at 15% greater RPM along the system curve with fan efficiency and horsepower clearly indicated. Data shall be corrected to actual operating conditions, temperatures, and altitudes.
6. Submit computer coil selection clearly indicating system design conditions, as well as coil hand connections, electric heating coil data, where applicable.
7. A filter schedule must be provided for each air handling unit supplied by the air handling unit manufacturer. Schedule shall detail unit tag, unit size, corresponding filter section location within the AHU, filter arrangement (e.g. angled/flat), filter depth, filter type (e.g. pleated media), MERV rating, and filter quantity and size.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

8. A schedule detailing necessary trap height shall be provided for each air handling unit. Schedule shall detail unit tag, unit size, appropriate trap schematic with recommended trap dimensions, and unit supplied base rail height.
9. A coil valve coordination schedule shall be provided for each air handling unit supplied by the air handling unit manufacturer. Schedule shall detail unit tag, coil type and corresponding section location within the AHU, valve style (e.g. globe, ball), valve type (e.g. electronic 2-way/3-way), valve position (e.g. normally open/closed), size, flow coefficient (CV), and close-off pressure.
10. An electrical MCA – MOP schedule shall be provided for each electrical circuit to which field-power must be supplied. Schedule to detail unit tag, circuit description, voltage/phase/hertz, Minimum Circuit Ampacity (MCA), and calculated Maximum Overcurrent Protection (MOP).
11. Sound data shall be provided using ARI 260 test methods. Unit discharge, inlet, and radiated sound power levels in dB shall be provided for 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz.

D. The AHU manufacturer shall list any exceptions to the specification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Packaged Air Handling Units (NO SUBSTITUTIONS):

1. Trane

2.2 FABRICATION

A. Packaged Air Handling Units:

1. General:

- a. Sizes, types and performance as indicated on unit schedule.
- b. Each unit complete with factory furnished components as shown on the plans. Each air handler unit shall be completely factory assembled, or partially assembled, tested and shipped in one piece or in sections for field assembly depending on size. All casings and access doors shall be of double wall construction. All components shall be assembled on a base rail or mounting legs of sufficient height to provide proper condensate drain trapping, provided with the unit, complete with lifting lugs to accept cable in chain hooks.
- c. All units shall have decals and tags to indicate caution areas and to aid unit service. Nameplates shall be fixed to the unit.

2. Cabinet, Casing and Frame:

- a. Full height, hinged access doors with stainless steel hinge and lever latching mechanism shall provide access to each cabinet section from both sides. Access doors shall provide gasketing for a positive seal. Doors shall open outward for negative pressure and inward for positive pressure applications, or have a double latching mechanism for safety.
- b. Unit shall be insulated with U.L. listed minimum 2" thick waterproof foam insulation. Insulation to have a minimum thermal resistance or "R-Value" of 13.
- c. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8" w.g., whichever is less, and

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- d. shall not exceed 0.0042" per inch of panel span (L/240).
Casing air leakage shall not exceed 1% of design airflow at the specified casing pressure.
 - e. Exterior panels of all sections shall be constructed of 18 gauge or heavier galvanized steel. All sections shall include galvanized steel internal liners. Wall thickness shall be 2".
 - f. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
3. Access Doors:
- a. Access doors shall be 2" double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.
 - b. All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame.
 - c. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
 - d. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
 - e. Handle hardware shall be designed to prevent unintended closure.
 - f. Access doors shall be hinged and removable without the use of specialized tools to allow.
 - g. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.
 - h. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
 - i. All doors shall be a minimum 60" high when sufficient height is available, or the maximum height allowed by the unit height.
 - j. A single door handle shall be provided for each door linking multiple latching points necessary to maintain the specified air leakage integrity of the unit.
 - k. A shatterproof window shall be provided in fan access doors.
4. Coil Sections:
- a. Coil sections shall be blow thru or draw thru as scheduled or detailed on drawings and incorporate single or multiple coils. Coils shall be guaranteed to have no moisture carry-over.
 - b. Coil row depth shall match that shown on the air handling unit schedule, except that the minimum row depth shall be that listed, or 8 rows, whichever is less. Maximum fin density shall be 130 fins per foot, regardless of the value scheduled.
 - c. Water coils shall be of the cartridge type and have threaded connections (direct expansion coil shall have sweat-type connections) located on the same end. Coil headers, distributors and connections shall be completely enclosed in the unit casing. Vent and drain connections shall be provided on all water cooling coils. Coil supports shall be Type 304 stainless steel.
 - d. Coils shall have non-ferrous headers and copper tubes, mechanically bonded to ripple-corrugated aluminum fins. Coils shall have a staggered tube type design. Coils shall have Type 304 stainless steel casing. Coils shall be certified in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard 410-72. Coil performance shall be

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- e. substantiated by computer generated output data.
Chilled water coils shall have 1/2" or 5/8" O.D. copper tubes. Coils shall be circuited for minimum pressure drop. Coils shall be tested at 315 pounds air pressure under warm water and be guaranteed for 150 psig working pressures. Coils shall be guaranteed to produce no carryover.
5. Condensate Pan:
- b. A double wall condensate drain pan consisting of inner 18 gauge 304SS pan, an outer 18 gauge galvanized steel pan and minimum 5/8" thick rigid foam insulation between the two pans.
 - c. Pan shall be non-trapping design sloped to the drain connection and guaranteed not to have standing water after shut-down. It shall extend beyond the leaving airside of the cooling coil and extend underneath the coil connections.
 - d. The drain pan shall be thermally isolated from the unit casing. A threaded drain connection shall extend through the unit base.
 - e. For stacked coils, an intermediate Type 304 stainless steel drain pan extending a minimum of 6" past shall be provided with drop tubes on each end, or a method to transfer condensate to the lower drain pan shall be provided.
6. Direct Drive Plenum Fans (Refer to Drawing Schedule):
- a. Fan shall be direct driven, arrangement 4 plenum fan constructed per AMCA requirements for the duty specified. The fan or fans in total shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure.
 - b. Fan/motor assemblies will be internally isolated with spring isolators and flex collars.
 - c. Fan motors shall be E+3, inverter ready pedestal mounted, ODP selected at the operating voltage and efficiency as specified or as scheduled elsewhere. Each fan motor shall be sized so the fan maximum brake horsepower does not exceed motor's nominal nameplate rating.
 - d. Fans shall be positioned in the air tunnel cross section and with adequate spacing upstream and downstream for servicing and airflow.
 - e. Fan downstream access door width shall be wide enough to permit the fan motor, fan wheel or fan motor/wheel removal.
 - f. Fans shall be supplied with a Piezometer Flow measuring station consisting of multiple recessed measuring ports located at the narrowest throat on the inlet cone and a static reference port in the unit. Flow measuring station shall not obstruct the inlet of the fan and shall have no effect on fan performance (flow or static) or sound power levels. Piezometer Flow measurement system will be supplied and installed by the fan manufacturer.
 - g. Piezometer signal shall be converted thru an accurate pressure transducer into a 0-10 volt output control signal. Provide a fan calibration formula to convert the flow signal into the fan CFM.
 - h. Units will have an ETL or UL 1995 label.
7. Filter Section:
- a. The filter section shall be capable of accepting 4" face loading filters. They shall be supplied complete with galvanized steel filter racks as an integral part of the unit.
 - b. Provide fixed filter block-offs as required to prevent air bypass around

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- filters.
 - c. Filters shall be accessible from both sides of the unit or as shown on the documents.
 - d. The filter section shall be provided with filters and filter differential pressure gauge (refer to controls drawings) as specified in Section 23 41 00.
8. Return Air/Outdoor Air Mixing Section:
- a. A return air plenum shall provide 100% return air capability. A duct collar shall accept return air ductwork return air connection as detailed on drawings.
9. Factory Plenum Section Casing: Reinforced mill galvanized or primed steel with baked finish, minimum 18 ga. panels, gasketed joints between panels, 1" thick, 3 lbs. density glass fiber insulation with vapor barrier, access doors with safety latch handles. Suitable for 6.0" w.g. positive or 4" w.g. negative static. Field Built Plenums are NOT acceptable.
10. Discharge Air Plenum: A discharge air plenum shall be provided for sound attenuation with outlet velocities as scheduled and will have 1" duct collar for a bottom or front supply air duct connection as detailed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install 8" manufacturer base rail to allow for condensate trapping.
- B. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer's instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.
- C. The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Owner and the Owner's selected Mechanical Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or -welded joints, and all other installation and assembly requirements.
- D. The AHU manufacturer shall provide all screws and gaskets for joining of sections in the field.
- E. If equipment is to be stored for a period of time prior to installation, the Mechanical Contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in a well-drained area. Covering units with plastic tarps shall not be acceptable.
- F. Assemble and install in accordance with manufacturers written installation instructions and details on drawings.
- G. Coordinate duct, piping and electrical work so as to provide access to unit for maintenance, filter replacement, coil, fan shaft and motor removal with minimum disturbance of piping.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- H. Mount units at proper elevation and arrange condensate trap for proper drainage at design pressure differential. Pipe condensate to nearest hub drain.
- I. Install air vents and drain valves to permit proper venting and drainage.
- J. Prior to unit start-up all controls shall be installed and tested.
- K. Prior to initial start-up and for system testing install air filters to protect the unit and ductwork from dirt and debris. After the system has been tested and prior to turning the system over to the Owner, replace the pre-filters with new, clean filters as specified.
- L. All joints or assembled seams of the assembled unit shall be caulked or gasketed air tight up to 1.5 times design static pressure, or 8" w.g., whichever is less, and shall not exceed 0.0042" per inch of panel span (L/240).
- M. Prior to turning the system over to the Owner, all damages incurred during shipping, storing and installing shall be repaired. These repairs shall be sufficient to bring the equipment back to the quality standards equal to the original manufacturing standards. These repairs shall include but are not limited to repairing painted surfaces, dent removal, combing coil fins, repairing or replacing wet, sagging or torn insulation, etc.

END OF SECTION 23 73 00



White Paper

Disassembling an Air Handler Effectively

Executive Summary

At some jobsites, circumstances dictate that an air handler will need to be disassembled to allow entry access to a space-restricted entrance or installation area. It's critical to follow the manufacturer's guidelines to minimize risk of incorrect assembly and reduce the amount of labor involved.

Problem

There are often instances that will require the equipment to fit through tight spaces in the building before it gets to the intended installation location. This becomes a great challenge as the amount of retrofit activity grows.

Solutions

There are two potential solutions to this problem.

1. Work with the manufacturer to determine where shipping splits are located and if they will allow entry into the location. If additional splits are needed, or if the split locations need to be changed, the manufacturer can determine what options are available.

Note: *Additional splits may increase the price of the unit.*

2. If the air handler has been built and shipped before it is known that there is an issue fitting into the space, the air handler will have to be broken down to some extent to accommodate the space requirements.

Reduce time, labor and cost by planning ahead.

Solution Details

With Performance Climate Changer™ air handlers, the roof, walls and internal components of the unit can be disassembled to accommodate tight space requirements.

There are some key points to remember before attempting to disassemble a Performance air handler:

- Plan your work prior to disassembling.
- Mark the panels before disassembly begins. A sticker could be applied and a unique number written.
- Make a quick sketch of the layout of the unit with the numbers of the panels listed in relation to airflow.
- Be careful not to strip the sheet metal on the panels when removing and attaching the screws. In the event the metal strips out, change affected fastener to a larger screw.
 - Standard panel screw 10-16 x 0.75 self driller (5/16-inch hex head)
 - Standard base screw 0.25-14 x 0.75 self driller (3/8-inch hex head)

By following these steps prior to breaking down the unit, you will minimize the man hours it will take plus eliminate confusion when reassembling unit.

Note: The base of each sectional build group cannot be disassembled. The baserail is attached to the unit's bottom panel by an adhesive that prohibits it from being taken apart. This means floor panels, drain pans and the baserail itself cannot be broken down smaller than each shipping split. If this will be an issue, it is critical to work with the factory to modify or add splits as required.

Instructions for Disassembly

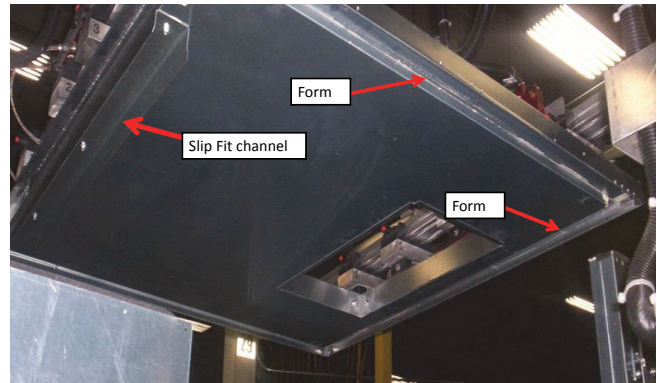
1. Remove 5/15-inch hex head screws that are used to attach the roof panel to the side walls along the perimeter of the panel. See [Figure 1](#).

Figure 1. Roof panel



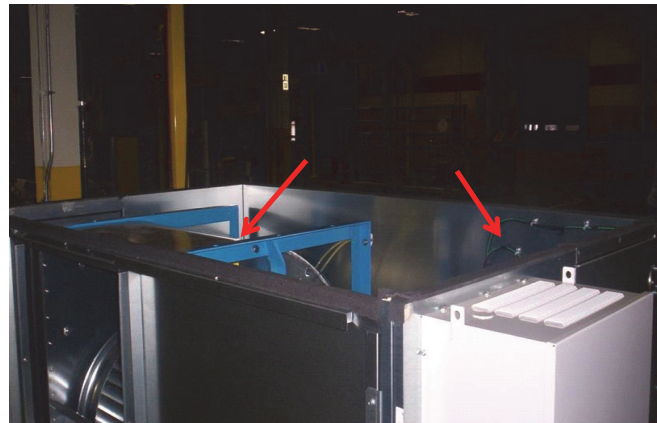
2. Once screws are removed from perimeter of the roof, the panels can be lifted off. Note that the roof panel has a form to allow the panel to slide over the top edge of the side panel. See [Figure 2](#).

Figure 2. Roof panel lifted from the wall



3. There is a gasket along all sides of the unit at the center of unit (COU) panel and wall panels. The gasket should be in good condition in order to be reused, but if not, the gasket will need to be replaced. See [Figure 3](#).

Figure 3. Gasket



- Remove the doors from the unit. Each hinge has a pin that can be removed that will allow the door to break free. Removing the door in this manner will lessen the chance of stripping the screw hole. Place the pin back in the hinge so it is not lost during transport. See [Figure 4](#).

Figure 4. Removal of doors



- The door header connects the door jambs on either side. They are connected during construction with pop rivets. These pop rivets must be drilled out before removal of wall panels. Pop rivets must be installed during panel replacement. Rivet = 0.125-inch diameter (mounting hole 0.136 inch). See [Figure 5](#).

Figure 5. Door header and jambs



- Remove screws from the wall panels along the perimeter of the panel. There are 5/16-inch hex head screws along the top and sides of panel; 3/8-inch hex head screws along the base side of the panel. See [Figure 6](#).

Figure 6. Wall panel



- Wall panels have slip fit channels to support internal components and COU panels as seen in this coil service panel. See [Figure 7](#).

Figure 7. Slip fit channels



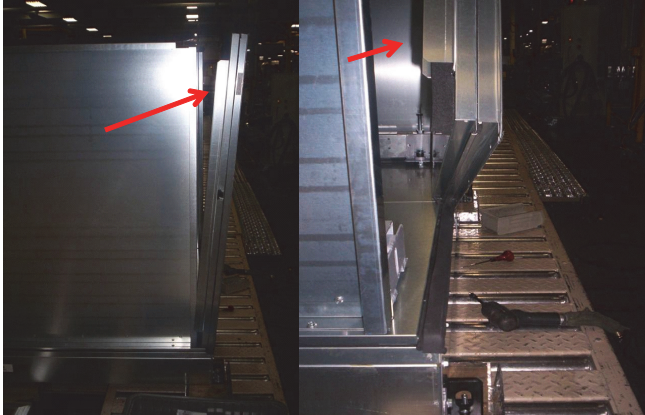
- Occasionally there will be screws internal to the wall that are attached on the slip fit. They may be attached to filter frames, coil blockoffs, etc. The wall panel will not break free without first removing this screw. It is not necessary to reinstall this screw during reassembly. This screw is installed during assembly to keep the walls from falling before the roof is installed. It serves no structural function. See [Figure 8](#).

Figure 8. Screws internal to the wall



9. The slip fit channel will fit over the COU panel. This gives the wall and components alignment and added strength/rigidity. At this point, remove the panels and doors from one side of the unit only. See [Figure 9](#).

Figure 9. Slip fit channels



10. Along the base panel perimeter on the drain pan, there will be Butyl tape that serves as a water guard against condensation leaks. This must be removed and replaced before panels are reinstalled. See [Figure 10](#).

Figure 10. Butyl® tape



11. All COU panels or filter racks are screwed to the base panel and caulked down. This can be a challenge to remove from the base panel. Take care not to damage the panel during this process. A lift bar can be used to lightly lift the bottom. See [Figure 11](#).

Figure 11. COU panel and filter racks



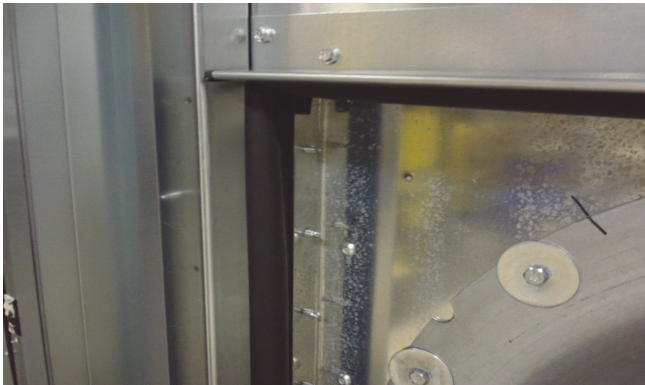
12. Additional steps will need to be taken to remove fan COU panels before the fan can be removed. The COU panels and ductwork is attached to the fan intake or housing. See [Figure 12](#).

Figure 12. Fan COU panel



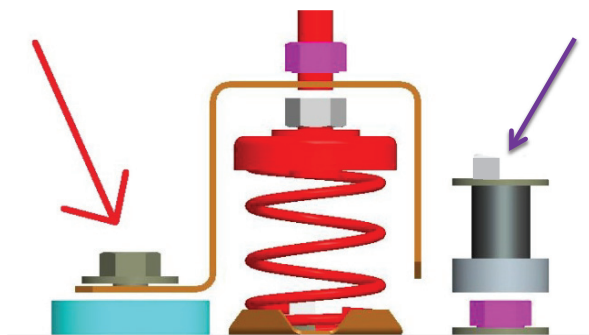
13. A U-shaped duct strip cover is held on by a self-drilling screw. Once the screw is removed, the duct strip cover can be removed and the COU panel and fan will be independent of each other. There may be more than one fan attached to a single COU panel so be sure to release all associated ducts prior to fan removal. A good method to keep the duct covers in the same location is to screw them back in place without the duct and take back off to reattach during the reassembly. See [Figure 13](#).

Figure 13. Duct strip cover



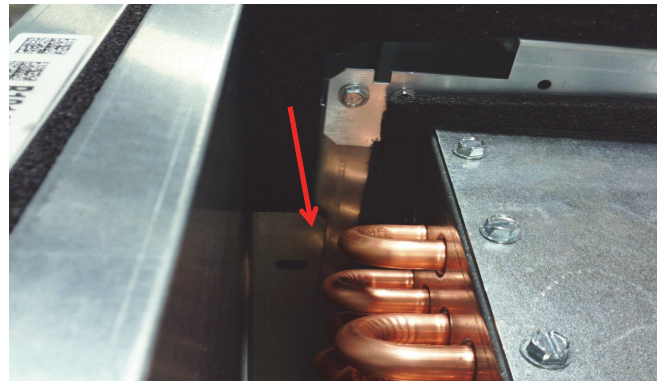
14. Fan isolation snubber nut (purple arrow on right) and tie down bolt (red arrow on left) is shown above. The tie down bolt can be removed. Keep this tie down bolt only if you have a spring isolated unit setup. If not, the tie down bolts can be discarded. The snubber nut can be removed and retained for fan installation after transport. All four corners of the fan isolation base should have this setup or similar for sizes 3-30. Once nut and bolt is removed, the fan is free to be lifted off the base panel assembly. See [Figure 14](#).

Figure 14. Fan isolation



15. Standard coil installation with slip fit is shown over a coil blockoff. There are three blockoffs - header, opposite header, and top blockoff. All three will have corresponding slip fit channels from the wall and roof panels respectively. See [Figure 15](#).

Figure 15. Coil installation



16. Coil blockoff shown in relation to the slip fit channel on the wall panel. This is an opposite header side blockoff. Do not remove blockoffs from the coil during disassembly. See [Figure 16](#).

Figure 16. Coil blockoffs



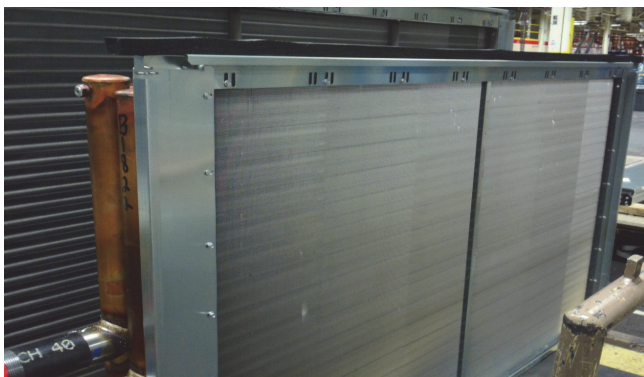
17. You will notice in the photo that a support bracket was added during assembly because the walls are not installed on either side. This is the reason for leaving panels installed on one side of the unit while removing the internal components. Removing both walls could allow a coil to tip and be damaged by the fall. See [Figure 17](#).

Figure 17. Support bracket



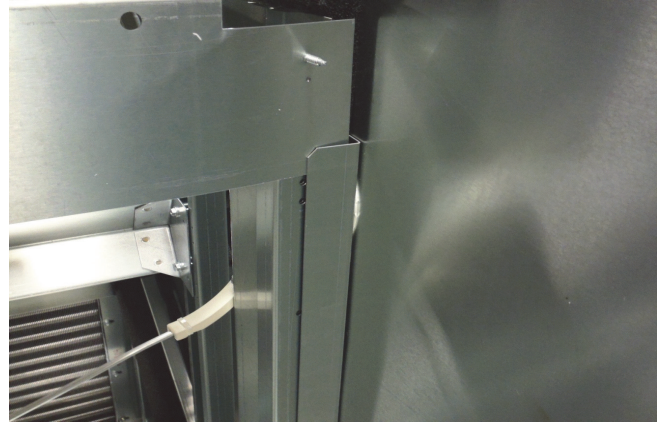
18. Coils are removable by design and should be lifted out by chains attached directly to the coil frame at each end. Some coils have screws that are added to the air leaving side at the base because there is not enough room to add a support bracket. This screw can be removed to allow the coil to be lifted. Check this first before attempting a coil lift. See [Figure 18](#).

Figure 18. Removing coils



19. Standard filter frame with slip fit shown. See [Figure 19](#).

Figure 19. Filter frame



20. Filter frames are attached to the base panel with the same method as COU panels. They are caulked and screwed down. Use a pry bar to gently help lift the filter rack from the base if it does not release cleanly. Be careful not to damage the panel. It is likely the bottom filter frame will be racked a bit during this process. You can use pliers or a hammer to get this part back in shape. During reinstallation, additional screws can be used to close the gap on any rough spots. Add a bead of caulk during the installation on the bottom of the rack. See [Figure 20](#).

Figure 20. Filter frame removal



Electrical Components

⚠ WARNING

Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

There are many different electrical components that may have to be removed during disassembly. Electrical components should only be worked on by qualified electrical personnel.

Low voltage harnesses are labeled, but distinguishable markings should be added where multiple harnesses exist using electrical tape. This will eliminate the chance for cross wiring.

Final Steps

21. Remove all the remaining wall panels and door jambs from the baserail.
22. Move all base assemblies for each shipping split into the final destination.
23. Replace bad gasket.
24. The shipping splits can be reassembled in reverse order from the instructions above. Remember to start with panels on one side to use as a guide and structural support for the internal components that are added next.

Part Numbers

- Foam gasketing 0.375-in. T x 0.750-in. W (size 3-30) - GKT04373
- Foam gasketing 1.0-in. T x 1.0-in. W (size 35-120) - GKT04374
- Butyl tape 0.375-in. T x 0.375-in. W (size 3-30) - SEL00827

Fan Removal

There may be times when the fan housing (scroll) needs to be removed in order to fit into the space. See [HVAC Knowledge Center wave49549](#) for these dimensions. You may contact technical support for further assistance if you need help with fan disassembly.

Action

If space constraints are an issue, it's important to be proactive early in the ordering process to determine how best to get the air handler to fit into the space.

Determine the size of the space that the air handler will have to fit through in the building, including hallways, elevators, stairs, doorways, etc.

Work with the factory to closely review the submittal to determine whether the shipping groups will fit or not. If the air handler can be modified to add shipping splits before shipping, that will potentially be the preferred approach.

If the unit must be broken down at the job site, it is important to follow the method described in this White Paper to minimize risk and reduce the amount of labor involved.



Trane optimizes the performance of homes and buildings around the world. A business of Ingersoll Rand, the leader in creating and sustaining safe, comfortable and energy efficient environments, Trane offers a broad portfolio of advanced controls and HVAC systems, comprehensive building services, and parts. For more information, visit www.Trane.com.

Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

SECTION 23 82 16
COILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Electric heating coils.

1.3 QUALITY ASSURANCE

- A. Certify coil capacities, in accordance with ARI Standard 410.
- B. All electric heating coils shall be listed and labeled by U.L., ETL or a Nationally Recognized Testing Laboratory (NRTL) and comply with NFPA 90A and 90B. When connected to a 277/480 VAC system, the heating coil shall be listed and labeled at 277 VAC or 480 VAC for single phase or three phase units respectively, regardless of the voltage scheduled on the drawings.

1.4 SUBMITTALS

- A. Submit dimension drawings, performance and product data for approval.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Refer to Division 01 for submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Electric Heating Coils:
 - 1. Bell Thermal Unit
 - 2. Brasch
 - 3. Chromolox
 - 4. Dell
 - 5. Environmental Technologies, Inc.
 - 6. Indeeco

2.2 DESIGN AND CONSTRUCTION

- A. Electric Heating Coils:
 - 1. Electric heating coils shall be of the slip-in or flange type, using wire construction of 80% nickel and 20% chromium supported in ceramic bushings. The heating wire for each step shall be strung along the entire coil face to prevent stratification when operating at less than full capacity.
 - 2. Terminals and nuts shall be constructed of stainless steel and terminal insulators and bracket bushings shall be constructed of ceramic securely stacked in position.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

- Coil terminals shall be machine crimped to coil wires.
3. Casings shall be constructed of not lighter than 22 gauge galvanized steel with galvanized steel supports on 4 inch centers, gusseted and spot welded. A solid cover shall be provided on the terminal box conforming to Paragraph 5.6 of U.L Standard 1096. Three-eighths inch thick rigid fiberglass without metal-to-metal contact shall be installed between the coil and terminal box.
 4. Coils shall be tested at twice the rated voltage plus 1,000 volts or at 2,000 volts, whichever is greater. The coils shall be tested and certified for the following: ohm readings to verify capacity, voltage, phase and control voltage.
 5. Safety features shall include an automatic reset thermal cutout wired in series with the control and the heat limiters wired in series with the power legs. All safety devices shall be serviceable through the terminal box without removal of the heater from the duct.
 6. Built-in components shall include an interlocking disconnect switch, contactors, primary fused transformer, single terminal block, pressure type airflow switch and branch circuit fuses per NEC. All components shall be factory wired and mounted either on the heating coil or in a remote cabinet when shown on the drawings. When the interlocking disconnect switch is built in or externally powered, control circuits are indicated, door interlock micro switches shall be installed at the factory. The frame of the heater shall be provided with a ground stud wired to the terminal block for connection to an external grounding conductor.
 7. Solid State Control Relay (SCR) to be provided for infinitely variable power output from 0 to 100% in direct proportion to temperature requirements. Heaters in excess of 20 KW shall have a "vernier" control with an SCR relay and electronic step controller with a minimum of three steps of control. The SCR circuit shall have a KW rating larger than each of the other circuits. The SCR circuit shall be arranged to be first on and last off. When the temperature sensor calls for heat, the SCR circuit will begin to modulate from 0 to 100% capacity. When it reaches 100%, it will stay for one to two minutes. A signal is then sent to the electric step controller to bring in a fixed KW step. The SCR shall then fine tune the KW output. The reverse action shall take place on a fall in temperature. The SCR shall stay at zero output for one or two minutes and then a fixed step shall go off.
 8. Contactors shall be of the magnetic disconnecting type.
 9. Recessed terminals shall be provided where heating coils are installed in internally lined factory fabricated air handling units. Watts density as measured in watts per square inch of wire surface shall not exceed 35 when installed in draw-through units and 25 when installed in blow-through or VAV units.
 10. The heating coil shall be internally wired in such a manner that assures that a balanced electrical load will be provided across all three phases of the load at all times.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Protect coils so fins and flanges are not damaged. Replace loose and damaged fins. Comb out bent fins.
- B. Install coils in accordance with manufacturer's recommendations.

3.2 INSTALLATION

- A. Electric Heating Coils:
 1. Install heaters so that the access door can swing fully open, without restriction.
 2. Provide uniform duct transition into and out of coil for uniform heating.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D - CHILLER & AHU REPLACEMENT

3. In cases where coil is inserted in internally lined duct, provide the necessary cold ends and flanges to prevent hot spots.
4. Install in proper direction of air flow to ensure that thermal cut-outs are downstream for proper over temperature protection.
5. Coordinate the control stages, etc. with the temperature control contractor.

END OF SECTION 23 82 16

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 01 00 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 OPERATION AND MAINTENANCE MANUALS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- j) Progress and Record Drawing Certification
 - k) Spare Parts Certification Memo
2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 3. Product Data: Product data and/or Catalog sheets shall be a copy of the final and accepted submittal submitted as required in Section Submittals. These shall be inserted in binder in proper order.
 4. Warranties/Guarantees: Provide copy of warranties/guarantees. Original warranties/guarantees are to be incorporated into separate project warranty book with warranties/guarantees provided for other sections and divisions of the specifications and submitted for Architectural/Owner acceptance.
 5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section.
 6. Wiring diagrams, schematic, etc. inserted in proper order, for:
 - a) Each and every part of Division 28 sections of these Specifications.
 7. For Section 26
 - a) Product data and/or catalog sheets on all equipment applicable to this project.
 - b) Equipment supplier list for each section's equipment.
 - c) Product data and/or catalog sheets on equipment applicable to this project.
 - d) Equipment supplier list for each sections equipment.
 - e) Motor Control; in addition to above provide the following:
 1. Internal wiring diagrams.
 2. Wiring diagrams.
 3. Bus diagrams.
 4. Operation and maintenance requirements, instructions, and recommended testing.
 5. Parts list.
 6. Copy of directory.
 7. Testing data, motor test information sheets.
 8. Check-Out Memo Form
 - f) Lightning Protection System: In addition to the above provide:
 1. Shop drawing.
 2. Product data on all components.
 3. Parts list.
 4. Operation and maintenance procedures.
 5. Copy of lightning protection system master label.
 6. Installer's name, address, etc.
 - g) Surge Suppression:
 1. Product data and/or catalog sheets on equipment applicable to this project.
 2. Parts list.
 3. Recommended testing and replacement procedures.
 8. Section 28
 - a) Installer's name, address, phone, etc. for each system.
 - b) Authorized representatives name, address, phone, etc. for each system.
 - c) Equipment supplier's name, address, phone, etc. for each system.
 - d) Surge Suppression.
 1. Product data and/or catalog sheets on equipment applicable to this project.
 2. Parts list.
 3. Recommended testing and replacement procedures.
 - e) Fire Alarm.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

1. Product data and/or catalog sheets on equipment applicable to this project.
2. Parts list.
3. Installation/removal instructions.
4. Wiring diagrams of panels.
5. Point-to-point wiring diagrams of system.
6. Operation and maintenance requirements.
7. Shop drawing as submitted and accepted in submittal process.
8. Check-Out Memo Form

1.4 SUBMITTALS

- A. Refer to Division 01 requirements.
- 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

CHECK OUT MEMO

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

Project Name _____

Type of Equipment Checked _____

Equipment Number _____

Manufacturer of Equipment _____

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

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

MANUFACTURER'S REPRESENTATIVE – PRINT NAME

ADDRESS

TELEPHONE, FAX, E-MAIL

MANUFACTURER'S REPRESENTATIVE – SIGNATURE AND TITLE

DATE CHECKED

WITNESSED BY:

CONTRACTOR'S REPRESENTATIVE – SIGNATURE AND TITLE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

CONDUCTOR INSULATION RESISTANCE TEST

PROJECT NAME _____

CONDUCTOR FROM _____ TO _____

SIZE _____

INSULATION TYPE _____

INSULATION VOLTAGE RATING _____

DATE _____ TIME _____

WEATHER CONDITIONS _____

TEST VOLTAGE (DC) _____

RANGE _____

MEGGER INSTRUMENT/SERIAL NUMBER _____

TESTING METHODOLOGY _____

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

PHASE A TO GROUND _____

PHASE B TO GROUND _____

PHASE C TO GROUND _____

NEUTRAL TO GROUND _____

ISOLATED GROUND TO GROUND _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

OWNER'S REPRESENTATIVE _____

DATE: _____

ENGINEER'S REPRESENTATIVE: _____

DATE: _____

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

DC HIGH VOLTAGE CABLE TEST

Project Name _____

Location _____

Description _____

Rated Voltage _____

TEST DATA

Set Leakage @ Test Voltage _____ ma Variac _____

Pri. Voltage _____

Sphere Gap _____ Inches

Duct Temp. _____ Ambient Temp. _____ Weather _____

Cable Status _____ 1 hour prior to test

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

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

Final Test Voltage _____

Time Finish: _____

KV DC after 1 min.

Test Procedure _____ Number of Terminals _____

Joints _____

Witnessed By: _____ Performed By: _____

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

GROUND TEST INFORMATION

PROJECT NAME: _____

GROUND TYPE: _____

TEST BY: _____

DATE OF TEST: _____

GROUND LOCATION: _____

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

PRIOR TO CONNECTION TO SYSTEM

GROUND _____ (OHMS)

AFTER CONNECTION TO SYSTEM

GROUND _____ (OHMS)

WEATHER CONDITIONS (Wet/Dry) _____

SOIL CONDITIONS (Wet/Dry) _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

ENGINEER'S REPRESENTATIVE _____

DATE: _____

OWNER'S REPRESENTATIVE _____

DATE _____

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

MOTOR TEST INFORMATION

PROJECT NAME: _____

DESCRIPTION OF MOTOR: _____

NAME OF CHECKER: _____

DATE CHECKED: _____

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

Manufacturer _____

Model Number _____

Serial Number _____

RPM _____

Frame Size _____

Code Letter _____

Horsepower _____

Nameplate Voltage and Phase _____

Nameplate Amps _____

Actual Voltage _____

Actual Amps _____

Starter Manufacturer _____

Starter Size _____

Heater Size, Catalog No. and Amp Rating _____

Manufacturer of Dual-Element Fuse _____

Amp Rating of Fuse _____

Power Factor _____

CONTRACTOR'S REPRESENTATIVE: _____

DATE: _____

SIGNATURE OF CHECKER: _____

DATE: _____

OWNER'S AUTHORIZED REPRESENTATIVE: _____

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME _____

SWITCHGEAR/PANELBOARD _____

FULL LOAD AMPERAGE READINGS:

DATE _____

TIME _____

PHASE A _____
 B _____
 C _____
 N _____
 GROUND _____

FULL LOAD VOLTAGE READINGS:

DATE _____

TIME _____

PHASE A TO N _____ A TO B

 B TO N _____ A TO C

 C TO N _____ B TO C

VOLTAGE AT THE END OF THE LONGEST BRANCH _____

TYPE OF LOAD _____

NO LOAD VOLTAGE READINGS:

DATE _____

TIME _____

PHASE A TO N _____ A TO B

 B TO N _____ A TO C

 C TO N _____ B TO C

ENGINEER'S REPRESENTATIVE _____

DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE _____

DATE _____

CONTRACTOR'S REPRESENTATIVE _____

DATE _____

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT: _____

DIVISION NUMBER AND NAME: _____

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

General Contractor

: _____
By: Authorized Signature And Title

Date

Subcontractor

By: Authorized Signature And Title

Date

SPARE PARTS / MAINTENANCE STOCK CERTIFICATION

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

Project Name: _____

Type/Name of Spare Parts/Attic Stock: _____

Specification Reference: _____

Quantity of Spare Parts/Attic Stock: _____

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

Contractor/CM

Authorized Signature, Title

Date: _____

Subcontractor

Authorized Signature, Title

Date: _____

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

Department

Authorized Signature, Title

Date: _____

ORANGE COUNTY CONVENTION CENTER
 WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

MANUAL COVER (face)

OCCC WEST CONCOURSE D CHILLER & AHU REPLACEMENT MPE NO. 2014-077A ELECTRICAL OPERATION AND MAINTENANCE MANUAL DATE (substantial completion date)
--

OCCC WEST CONCOURSE D CHILLER & AHU REPLACEMENT MPE NO. 2014-077A SYSTEMS OPERATION AND MAINTENANCE MANUAL DATE (substantial completion date)

MANUAL COVER (Spine)

OCCC W. CONCOURSE D CHILLER & AHU REPLACEMENT MPE NO 2014-077A E L E C T R I C A L OPERATION AND MAINTENANCE MANUAL DATE

OCCC W. CONCOURSE D CHILLER & AHU REPLACEMENT MPE NO. 2014-077A S Y S T E M S OPERATION AND MAINTENANCE MANUAL DATE

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 01 03 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate any electrical service interruptions/outages with OCCC Project manager prior to scheduling of any such shutdown.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove, relocate, and extend existing installations to accommodate new construction.
- B. Remove abandoned wiring to source of supply.
- C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- E. Disconnect and remove abandoned panelboards and distribution equipment.
- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- been removed.
- G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
 - H. Repair adjacent construction and finishes damaged during demolition and extension work.
 - I. Seal openings in walls, floors, etc. and fire stop in accordance with the accepted UL detail to maintain integrity of assembly.
 - J. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate and as required to comply with the requirements of the NEC.
 - K. Extend existing installations using materials and methods compatible with existing electrical installations. Extension must meet or exceed the materials/methods specified in the contract documents.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused, including but not limited to:
 - 1. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 01 05 - INVESTIGATION OF EXISTING ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes testing and documentation of existing electrical systems.
- B. Test the essential features of the following existing electrical systems:
 - 1. Fire detection devices, smoke detection devices associated with Systems being replaced.
- C. Each system shall be tested once only, and after completion of testing, results given to the Owner, Engineer and/or Owner's Representative. Point out any non-operational function noticed during testing.
- D. Document the existing conditions and operation of the existing electrical systems prior to any work.
- E. Contractor is responsible for all non-working systems and their components unless non-working status is verified prior to work on system.

1.3 REFERENCES

- A. IEEE Recommended Practices

1.4 DESCRIPTION

1.5 TIME

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

1.6 ATTENDING PARTIES

- A. The testing shall be held in the presence of the Owner, or his Representative and Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PERFORMANCE VERIFICATION

- A. Test the operation of each of the following existing devices and associated systems:
 - 1. Fire Alarm System:
 - a) Test each duct mounted smoke detector with canned smoke and verify alarm activation, remote pilot light activation and damper operation. Record location of each tested device; note either operational or non-operational.
- B. The Electrical Contractor shall investigate all existing systems as called out in this performance verification prior to the beginning of any work which could affect these systems.
- C. Each system shall be retested after completion of remodel and/or renovation to ensure proper operation is maintained. Demonstrate operation per Section 26 08 03 Demonstration of Completed Electrical Systems.

3.2 INVESTIGATION/TESTING FORMS

- A. Submit Existing Facilities Investigation Form (included at the end of this Section) and advise

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

Owner/Engineer of all deficiencies in system(s) prior to work. All systems will be assumed to be fully operational if Form is not received by Engineer prior to work on system.

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

Attachments:
Existing Facilities Investigation
Ground Test Information

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

EXISTING FACILITIES INVESTIGATION

PROJECT: _____

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

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

PRIME CONTRACTOR

AUTHORIZED SIGNATURE AND TITLE

DATE _____

OWNER'S AUTHORIZED REPRESENTATIVE

AUTHORIZED SIGNATURE AND TITLE

DATE _____

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 00 - COMMON WORK RESULTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DESCRIPTION OF WORK

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

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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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. 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.
- G. 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.
- H. Work is in connection with existing buildings which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. Notify Owner [72 hours] [24 hours] in advance of any shut-down of existing systems. Perform work during [non-general office] [non-school] operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.
- I. Bid shall include all removal and relocation of all piping, fixtures or other items required for

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

completion of alterations and new construction.

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

1.8 CONTRACT DOCUMENTS

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

1.9 MATERIALS AND EQUIPMENT

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

complies with the referenced standard and supporting test data to substantiate compliance.

- D. Where multiple items of the same equipment or materials are required, they shall be the product of a single Manufacturer.
- E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 26 methods and materials unless specifically noted otherwise.
- F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.
- G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.
- H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.
- I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.
- J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.
- K. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

1.10 MISCELLANEOUS CIRCUITS REQUIRED

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building ahs emergency generator system.

- C. Provide 120 volt, 20 amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical

1.11 SUPERVISION OF THE WORK

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

1.12 COORDINATION

- A. Provide all required coordination and supervision where work connects to or is affected by work of other trades, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
 - 1. Fire Shutters
 - 2. Mechanical Division of the Specifications
- B. Contractor shall obtain set of Contract Documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Division 26 Sections or not.
- C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.
- D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.
- E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

- F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
- G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Structural, Mechanical, and Electrical .
- 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.

1.13 PROVISION FOR OPENINGS

- A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.
- B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.
- C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

1.14 SURFACE MOUNTED EQUIPMENT

- A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

1.15 CUTTING AND PATCHING

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

1.16 INSTALLATION

- A. Erect equipment to minimize interferences and delays in execution of the work.
- B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.
- C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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.

1.17 PROGRESS AND RECORD DRAWINGS

- A. Keep two sets of blueline prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.
- B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:
 - 1. All raceways 1-1/2" and above, exactly as installed.
 - 2. All site raceways exactly as installed.
 - 3. Any combining of circuits (which is only allowed by specific written permission) or change in homerun outlet box shall be made on as-builts.
 - 4. Any circuit number changes on plan shall be indicated on as-builts.
 - 5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..
- C. Marked up prints as noted above are to be submitted to A/E for review.. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.
- D. The changes and alterations shall be transferred to CAD (AutoCAD Release 2006 or higher). Obtain CAD disk of the construction documents by the A/E, from the A/E. Generate/update the CAD disks to include all changes, additions, etc. on the accepted marked up prints. Label each drawing "As-Built" and date. Submit as-built CAD disk and reproducible of the as-builts.
- E. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit set prior to request for final payment and/or request for final observation.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- 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.

1.18 "OBSERVATION OF WORK" REPORT

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

1.19 SYSTEMS WARRANTY

- A. Reference the General Conditions.
- B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of each System. Warranty shall not include lamps in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.
- C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.
- D. Where extended warranty or guarantee are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.
- E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

1.20 WASTE MATERIALS DISPOSAL

- A. Contractor shall include in his bid the transport and disposal or recycling of all waste materials generated by this project in accordance with all rules, regulations and guidelines applicable. Contractor shall comply fully with Florida statute 403.7186 regarding mercury containing devices and lamps. Lamps, ballasts and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal. Contractor shall provide owner with written certification of accepted disposal.

1.21 SUBSTANTIAL COMPLETION

- A. The Contractor shall be fully responsible for contacting all applicable parties. Contact Engineer or OCCC 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

1.22 PROHIBITION OF ASBESTOS AND PCB

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 03 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
 - 1. Electrical connections to equipment specified under other sections.

1.2 RELATED SECTIONS

- A. Summary of Work
- B. Conduit.
- C. Building Wire and Cable.
- D. Boxes.

1.3 REFERENCES

- A. NEMA WD 1 - General Requirements for Wiring Devices
- B. NEMA WD 6 - Wiring Devices-Dimensional Requirements
- C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

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

1.5 REGULATORY REQUIREMENTS

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

1.6 COORDINATION

- A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- D. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: ANSI/NFPA 70, Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

3.1 EXAMINATION

- A. Verify conditions under provisions of Section Investigation of Existing Electrical Systems.
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations (including inside of coolers/freezers).
- C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment and in cooler/freezers.
- D. Provide receptacle outlet where connection with attachment plug is required. Provide cord and cap where field-supplied attachment plug is required.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Install disconnect switches, controllers, control stations, and control devices as required.
- G. Modify equipment control wiring with terminal block jumpers as required.
- H. Provide interconnecting conduit and wiring between devices and equipment where required.
- I. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 EQUIPMENT CONNECTION SCHEDULE

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

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 07 - SUBMITTALS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 26, 29 sections.
- B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

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

1.4 SUBMITTALS

- A. Submittals may be submitted in PDF electronic format.
- B. Submittals shall consist of a PDF Format sheets sized at 8-1/2" x 11" sheets and organized in an "ELECTRICAL SUBMITTALS" (Power and Lighting) zip file.
 - 1. Each Specification section shall be in individual PDF "binder".
- C. Submittals Binders to include:
 - 1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
 - 2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.
 - 3. Provide individual binder sheets tabbed with the appropriate specification reference

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

number and typed index for each section in the Systems Schedule.

4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).
5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
 - a) Fabrication and erection dimensions.
 - b) Arrangements and sectional views.
 - c) Necessary details, including complete information for making connections with other work.
 - d) Kinds of materials and finishes.
 - e) Descriptive names of equipment.
 - f) Modifications and options to standard equipment required by the work.
 - g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).
 - h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
 - i) Conduit/raceway rough-in drawings.
 - j) Items requiring shop drawings include (but not limited to):
 1. Lightning protection system
 2. U.L. listed fire and smoke stopping assemblies for each applicable penetration
 - k) See specific sections of Specifications for further requirements.
6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
 - a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
 - b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
 - c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract and this section of the

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

Specifications, whichever is the most strict.

- B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:
1. Project Addresses
 2. Index
 3. Separation Sheets
 4. Basic Materials
 5. Long Lead Items
 6. Systems Product Data
- C. Remainder of submittals are to be submitted no later than 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.
- D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.
- E. Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.
- F. Shop Drawings: For custom fabricated items and systems shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.
- G. Shop Drawing Review Notation.
- | <u>Action</u> | <u>Description</u> |
|---------------------------|--|
| 1. No Exception Noted | No exceptions taken. Resubmittal not required. |
| 2. Rejected | Not in compliance with Contract Documents. Resubmit. |
| 3. Submit Specific Item | Resubmit item as specified. |
| 4. Make Corrections Noted | Make corrections noted, resubmittal not required. |
| 5. Revise and Resubmit | Make corrections noted, resubmittal is required |
| 6. Review not Required | Not required for review. No action taken. Copy retained for reference. |
- H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet, and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.
- I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict, unless a letter requesting such change is

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU
REPLACEMENT

MPE NO. 2014-077A

ELECTRICAL SUBMITTALS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU
REPLACEMENT

MPE NO. 2014-077A

SYSTEMS SUBMITTALS

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

OCCC
W CONCOURSE
D CHILLER & AHU
REPLACEMENT

MPE NO.
2014-077A

ELECTRICAL
SUBMITTALS

(Size To 11")

OCCC W
CONCOURSE D
CHILLER & AHU
REPLACEMENT

MPE NO.
2014-077A

SYSTEMS
SUBMITTALS

(Size To 11")

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 08 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies general, administrative and procedural requirements for substitutions for Divisions 26, 28 above and beyond the requirements of Division 01 General Requirements and any Supplemental requirements/conditions.
- B. Request for substitutions must be submitted no later than 10 days prior to bid due date.
- C. Request for substitution will not be considered after bid due date.

1.3 DEFINITIONS

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

1.4 REQUEST FOR SUBSTITUTION SUBMITTALS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

1.5 REQUEST FOR SUBSTITUTION SUBMITTALS (AFTER BID)

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

1.6 CONSIDERATION AND ACCEPTANCE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 09 - REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	ASME International American Society of Mechanical Engineers International
ASTM	ASTM International American Society for Testing and Materials International
BOR	Board of Regents
BICSI	BICSI, Inc.
CRSI	Concrete Reinforcing Steel Institute
EIA/TIA	Electronics Industries Alliance/Telecommunications Industry Association
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council
FAC	Florida Administrative Code
FBC	Florida Building Code
FCC	Federal Communications Commission
FFPC	Florida Fire Prevention Code
FLA	State of Florida

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

FMC	Florida Building Code (Mechanical)
FMG	FM Global (formerly Factory Mutual System)
FPC	Florida Building Code (Plumbing)
FS	Florida Statutes
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers, Inc
ICPEA	International Power Cable Engineer's Association
LPI	Lightning Protection Institute
NEC	National Electrical Code
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
SBE	State Board of Education
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.

1.4 REGULATORY REQUIREMENTS

- A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc.. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.
1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority Having Jurisdiction):
 - a) Americans with Disabilities Act of 1990, as amended
 - b) ADA Standards for Accessible Design, 2010
 - c) American National Standards Institute
 - d) American Society of Heating, Refrigerating and Air Conditioning Engineers
 - e) American Society of Mechanical Engineers
 - f) American Society for Testing and Materials
 - g) Concrete Reinforcing Steel Institute
 - h) Department of Community Affairs

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- i) Electronics Industries Association/Telecommunications Industry Association
- j) Florida Building Code, 2010
- k) Florida Fire Prevention Code, 5th edition
- l) Institute of Electrical and Electronics Engineers
- m) Illumination Engineering Society
- n) Local Power Company Requirements
- o) Lightning Protection Institute
- p) Local Telephone Company Requirements
- q) National Electrical Code, 2008
- r) National Energy Conservation Policy Act
- s) National Electrical Safety Code
- t) National Electrical Manufacturers Association
- u) NFPA 1 Fire Code
- v) NFPA 101 Life Safety Code
- w) Occupational Safety and Health Act
- x) Safety Code for Elevators and Escalators
A17.1a, 2008 and A17.1b, 2009 Addenda
- y) Safety Code for Existing Elevators and Escalators
A17.3, 1996
- z) Sheet Metal and Air Conditioning Contractors
- aa) Underwriters Laboratories, Inc.
- bb) Applicable Federal, State, Local Codes, Laws and Ordinances, Florida Statutes
and Referenced Codes/Standards

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 10 - ELECTRICAL SYMBOLS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Symbols and abbreviations specifically applicable to all Division 26, 28 sections in addition to those in Division 01 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

- A. In general the symbols used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted.
Corps of Engineers.
Special Symbols as shown in schedules or legends.

1.4 ABBREVIATIONS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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
FVNR	Full Voltage Non-Reversing
GAL.	Gallon
Galv.	Galvanized
GFI	Ground Fault Interrupting
GRS	Galvanized Rigid Steel Conduit
GND.	Ground
HTG	Heaters
HT	Height
HZ	Hertz (Cycles)
HPF	High Power Factor
HPS	High Pressure Sodium
HP	Horsepower
HR	Hour
H.S.	Heat Strip
IMC	Intermediate Metallic Conduit
Incand.	Incandescent
in.	Inches
J.B.	Junction Box
KVA	KiloVolt Ampere
KW	Kilowatts
KWH	Kilowatt Hour
K	Kelvin
L.L.D.	Lamp Lumen Depreciation
LED	Light Emitting Diode
LIU	Light Interface Unit (Fiber Optic Patch Panel)

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 19 - BUILDING WIRE AND CABLE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES:

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

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

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

1.6 QUALIFICATIONS

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

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION

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

PART 2 - PRODUCTS

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

2.1 BUILDING WIRE AND CABLE

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

PART 3 - EXECUTION

3.1 GENERAL

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

3.2 EXAMINATION

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

3.3 PREPARATION

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

3.4 WIRING METHODS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

3.5 INTERFACE WITH OTHER PRODUCTS

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

3.6 FIELD QUALITY CONTROL

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

3.7 VERTICAL RISERS

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

3.8 PULLING

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

3.9 CONTROL AND SIGNAL CIRCUITS

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

3.10 COLOR CODING

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

3.11 TAPS/SPLICES/CONNECTORS/TERMINATIONS

- A. Clean conductor surfaces before installing lugs and connectors.
- B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- C. Power and lighting conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).
- D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum. Pull conductors through to equipment, terminal cabinets, and devices.
- E. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.
- F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.
- G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the Contractor to provide sleeve type vertical cable supports in vertical raceway installations, provided in pullboxes at proper vertical spacings.
- H. A calibrated torque wrench shall be used for all bolt tightening.
- I. Interior Locations:
 - 1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code
- B. NFPA 780 Standard for the Installation of Lightning Protection Systems
- C. UL 467 Grounding and Bonding Equipment

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

- A. Submit catalog cut sheets/product data on:
 - 1. Mechanical connectors.
 - 2. Ground bus bars and associated components.
 - 3. Testing equipment and procedures
- B. Product data shall prove compliance with specifications, National Electrical Code, manufacturers' specifications, and written installation data.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

1.6 PROJECT RECORD DOCUMENTS

- A. Submit record documents to accurately record actual locations of grounding electrodes.
- B. Submit test results of each ground rod. See Section Tests and Performance Verification of Electrical System.

PART 2 - PRODUCTS

2.1 MECHANICAL CONNECTORS

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

2.2 WIRE

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

2.3 GROUNDING BARS/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BARS AND GROUND BUS BARS)

- A. Ground bars shall be copper of the size and description as shown on the Drawings. If not sized on Drawings, bus bar shall be minimum 1/4" x 2" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.
- B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2" on center spacing. Lugs to be manufactured by Burndy or T&B.
- C. Standoff supports to be 2" polyester as manufactured by Glastic #2015-4C.

PART 3 - EXECUTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

3.1 GENERAL

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

3.2 EQUIPMENT GROUNDING CONDUCTOR

- A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.
- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the grounding bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.
- E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
- F. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.
- G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.
- H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

under this Division.

3.3 LIGHTNING PROTECTION SYSTEMS

- A. Repair and recertify existing lightning protection system where roof top equipment is being removed.
- B. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.
- C. See Section 26 41 13 Lightning Protection System.

3.4 EXTERIOR GRADE (OR FREE STANDING ABOVE GROUND) MOUNTED EQUIPMENT

- A. General:
 - 1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc) mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.
 - 2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC 250 based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.
- B. Electrical equipment connection rack mounted equipment.
 - 1. Bond all metal parts as noted above.
- C. Complete installation shall exceed the minimum requirements of NEC 250 and, when applicable, NFPA 780.

3.5 ROOF MOUNTED EQUIPMENT

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

3.6 MISCELLANEOUS GROUNDING CONNECTIONS

- A. Provide bonding to meet regulatory requirements.
- B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded to steel or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/l beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.
- C. Grounding conductors shall: be installed to permit the shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.

- D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.
- E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.
- F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
- I. Grounding provisions shall include double locknuts on all heavywall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.

3.7 COMMUNICATIONS SYSTEMS

- A. Provide and install all grounding as required by NEC Article 800 and where available on project: Articles 810 (Radio and Television Equipment); 820 (Community Antenna Television and Radio Distribution Systems); and 830 (Network-Powered Broadband Communications Systems).
- B. Provide and install grounding electrode at point of entry of communication cables and bond to service entrance grounding electrodes per NEC 800. Install ground bus bar at point of entry of communications cable and connect electrode to ground bus. Connect communications cable metal sheath and surge protection devices to ground bar.

3.8 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 26 08 13 Tests and Performance Verification.

3.9 INTERFACE WITH OTHER PRODUCTS

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

sections.

3.10 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 29 - HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

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

PART 2- PRODUCTS

2.1 PRODUCT REQUIREMENTS

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- K. All items shall be supported from the structural portion of the building, except standard ceiling-mounted lighting fixtures, and small devices may be supported from ceiling system where permitted by Ceiling Contractor, however, no sagging of the ceiling will be permitted. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.
- L. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, wall, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching later at his own expense to the satisfaction of the Architect.
- M. All conduits shall be securely fastened in place per NEC. Hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- N. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.
- O. Hanger assemblies shall be protected after fabrication by galvanizing. Hangers for PVC coated conduit shall be PVC coated galvanized conduit or stainless steel.
- P. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self tapping power driven type are acceptable. Plastic anchors are not acceptable.
- Q. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.
- R. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.
- S. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom of pre-stressed beams are not acceptable.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

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

1.5 DESIGN REQUIREMENTS

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

1.6 SUBMITTALS

- A. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.
- B. Submit catalog cut sheet on all types of conduit bodies and fittings.
- C. Product data shall be submitted for acceptance on:
 - 1. Conduits.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- 2. Conduit straps, hangers and fittings.
 - 3. Fitting entering and leaving the ground or pavement
 - D. Submit UL listed fire and smoke stopping assemblies for each applicable application.
 - E. Product data shall prove compliance with Specifications, National Electrical Code, National Board of Fire Underwriters, manufacturers' specifications and written installation data.
- 1.7 PROJECT RECORD DOCUMENTS
- A. Submit record documents to accurately record actual routing of conduits larger than 1.25".
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, properly store and protect products at the site.
 - B. Accept conduit on site. Inspect for damage.
 - C. Protect conduit from sun, rain, corrosion and entrance of debris by storing above grade. Provide appropriate covering.
 - D. Protect PVC conduit from sunlight.
- 1.9 PROJECT CONDITIONS
- A. Verify that field measurements are as shown on Drawings.
 - B. Verify routing and termination locations of conduit prior to rough-in.
 - C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All conduits shall bear UL label or seal and shall be manufactured in the United States.
- B. Conduit systems and all related fittings, boxes, supports, and hangers must meet all the requirements of national, state, Orange County and other federal codes where applicable.

2.2 MINIMUM TRADE SIZE

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

2.3 RIGID METAL CONDUIT

- A. Comply with:
 - 1. ANSI C80.1.
 - 2. UL 6.
 - 3. NEC 344.
- B. Conduit material:
 - 1. Zinc coated or hot dipped galvanized steel.
- C. Fittings:
 - 1. Threaded.
 - 2. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

bushings must not melt or support flame.

3. Zinc plated or hot dipped galvanized malleable iron or steel.

D. Conduit Bodies:

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

2.4 RIGID METAL CONDUIT PVC COATED

A. Comply with:

1. UL 6.
2. ANSI C80.1.
3. NEC 344.
4. NEMA RN1.

B. Conduit material: Hot-dipped galvanized rigid steel with external PVC coating, 40 mil thick.

C. Fittings:

1. Threaded.
2. Insulated bushings on terminations.
3. Zinc plated or hot-dipped galvanized malleable iron or steel with external PVC coating, 40 mil thick.

D. Conduit Bodies:

1. Comply With:
 - a) ANSI/NEMA FB 1.
 - b) Threaded hubs.
2. Zinc plated or hot-dipped galvanized malleable iron with external PVC coating 40 mil thick.

2.5 FLEXIBLE METAL CONDUIT

A. Comply With:

1. NEC 348.
2. ANSI/UL 1.

B. Conduit Material:

1. Steel, interlocked.

C. Fittings:

1. ANSI/NEMA FB 1.
2. ANSI/UL 514B.
3. Malleable iron, zinc plated.
4. Threaded rigid and IMC conduit to flexible conduit coupling.
5. Direct flexible conduit bearing set screw type not acceptable.

2.6 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Comply with:

1. NEC 350.
2. ANSI/UL 360.

B. Conduit material:

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

C. Fittings:

1. Threaded for IMC/rigid conduit connections.
2. Accepted for hazardous locations where so installed.
3. Provide sealing washer in wet/damp locations.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

4. Compression type.
5. ANSI/NEMA FB 1.
6. ANSI/UL 514B.
7. Zinc plated malleable iron or steel.

2.7 ELECTRICAL METALLIC TUBING

- A. Comply with:
1. UL 797.
 2. ANSI C80.3.
 3. NEC 358.
 4. ANSI/UL 797.
- B. Conduit material: Galvanized steel tubing.
- C. Fittings:
1. ANSI/NEMA FB 1.
 2. Compression Type
 3. Zinc plated malleable iron or steel.
 4. Concrete tight.

2.8 RIGID POLYVINYL CHLORIDE CONDUIT

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

2.9 EXPANSION FITTINGS

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

PART 3 - EXECUTION

3.1 LOCATION REQUIREMENTS

- A. In Slab Above or on Grade:
1. Use coated rigid steel conduit, coated intermediate metal conduit (if accepted) or rigid non-metallic conduit.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

2. Coating of metallic conduit to be black asphaltic or PVC.
- B. Penetration of Slab:
1. Exposed Location:
 - a) Where penetrating a floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 2. Concealed Location:
 - a) Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 48" above finished floor.
 - b) Where penetrating a floor in location other than that above use a black mastic coated or PVC coated galvanized rigid steel conduit.
- C. Outdoor Location:
1. Above Grade:
 - a) Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 - b) In general all exterior conduit runs shall be rigid and threaded connectors as specified elsewhere.
 - c) Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.
 - d) Exterior conduits not on roof and not subject to damage (i.e. 6' above grade/floor or higher) may be rigid non-metallic PVC conduit as specified elsewhere. (Schedule 40 for low voltage Class II wiring, Schedule 80 for power wiring.)
 - e) Exterior conduits from grade level to 6' above grade may be rigid non-metallic Schedule 40 PVC for low voltage Class II wiring provided rigid metal conduit is used at transition from below grade to 12" above grade (due to weed eater damage, etc.).
 2. Metal Canopies:
 - a) Conduit runs except for canopy lighting raceways are not to be run on (top or bottom) of metal canopies roof systems. All new conduit shown on or at these areas shall be run underground.
 3. Roofs:
 - a) Conduit is not to be installed on roofs, without written authorization by A/E for specific conditions.
 - b) When accepted by written authorization conduit shall comply with the following:
 1. Be PVC coated rigid galvanized metal conduit.
 2. All fittings, etc. are to be PVC coated.
 3. Conduit shall be supported above roof at least 6" using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
 4. Supports to be fastened to roof using roofing adhesive or means as accepted by roofing contractor.
- D. Interior Dry Locations:
1. Concealed: Use rigid metal conduit, intermediate metal conduit, electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" AFF except where prohibited by the NEC (Places of Assembly, etc.).
 2. Exposed: Use rigid metal conduit, intermediate metal conduit, electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.
 3. Concealed or Exposed Flexible Conduit:
 - a) Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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.

E. Interior Wet and Damp Locations:

1. Use rigid galvanized steel or intermediate metal conduit.

F. Concrete Columns or Poured in-place Concrete Wall Locations:

1. Use rigid non-metallic conduit. Penetration shall be by accepted metal raceway (i.e. metal conduit as required elsewhere in these specifications).

3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT

A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.

1. Accepted pipe vise.
2. Roller/bade type cutter or band saw.
3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.

B. Hangers shall be installed 8' apart.

C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.

3.3 ADDITIONAL REQUIREMENTS FOR EMT

A. Electrical metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.

B. All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted reamer.

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

A. Shall be properly grounded.

B. Shall be installed with accepted fittings.

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

A. Rigid non-metallic PVC conduit is not allowed anywhere inside building(s) except underground, in slab, in poured in place concrete, and in block wall up to first outlet box (if not over 40" AFF) if allowed by codes. Rigid non-metallic PVC conduit may be used exterior to building as stated elsewhere in these specifications.

B. Join rigid non-metallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

C. Threads will not be permitted on rigid non-metallic PVC conduit and fittings, except for rigid steel to rigid non-metallic PVC couplings.

D. Installation of rigid non-metallic PVC conduit shall be in accordance with manufacturer's recommendations.

E. Rigid non-metallic PVC conduit shall not be used to support fixture or equipment.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- F. Field bends shall be made with accepted hotbox. Heating with flame and hand held dryers are prohibited.

3.6 SUPPORTS

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

3.7 EXPANSION FITTINGS

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

3.8 GROUNDING

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

3.9 FIRE AND SMOKE STOPPING

- A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.

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

3.10 VERTICAL RACEWAYS

- A. Cables in vertical raceways shall be supported per NEC 300.19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless if shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with architect prior to installation. This includes empty raceways for future use.

3.11 GENERAL

- A. Install conduit in accordance with NECA Standard Practice of Good Workmanship in Electrical Contracting. Contractor shall layout all work prior to rough-in.
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange conduit to maintain headroom and present neat appearance.
- D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.
- E. Route conduit in and under slab from point-to-point.
- F. Do not cross conduits in slab.
- G. Maintain adequate clearance between conduit and piping.
- H. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- I. Cut conduit square using saw or pipecutter; de-burr cut ends.
- J. Bring conduit to shoulder of fittings; fasten securely.
- K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- L. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2" size.
- M. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- N. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC 300, whether shown on Drawings or not.
- O. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- P. Ground and bond conduit under provisions of Section 26 05 26 Grounding and Bonding.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- Q. Identify conduit under provisions of Section 26 05 53 Identification for Electrical Systems.
- R. Install all conduits concealed from view unless specifically shown otherwise on drawings
- S. Rigid steel box connections shall be made with double locknuts and bushings.
- T. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- U. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- V. All raceways shall be run from outlet to outlet as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.
- W. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade. Marker shall be 6" round x 6" deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.
- X. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."
- Y. All connections to motors or other vibrating equipment including transformers or at other locations where required shall be made with not less than 12" of flexible liquid-tight steel conduit, with nylon insulated throat connectors and wire mesh grip fittings (manufactured by Thomas & Betts or accepted equal) at both terminations of conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.
- Z. Provide conduit seal-offs wherever conduit crosses obvious temperature changes (i.e. from inside to outside of coolers, freezers, etc.).
- AA. Route conduit through roof openings for piping and ductwork or through suitable roof flashing or boot. Coordinate location with roofing installation specified under other Sections of these specifications.
- BB. All raceways shall be run in neat and workmanlike manner and shall be properly in accordance with latest edition of NEC with accepted conduit clamps, hanger rods and structural fasteners.
- CC. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.
- DD. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 34 - OUTLET BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

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

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 GENERAL

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

and number of conduits connecting thereto.

- E. Handy boxes shall not be used.
- F. Outlet boxes to be one-piece.

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

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

2.3 CAST BOXES NEMA FB 1:

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

PART 3 - EXECUTION

3.1 GENERAL

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
- D. Install boxes to preserve fire resistance rating of partitions and other elements.
- E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- F. Use flush mounting outlet boxes in finished areas.
- G. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation. Provide minimum 24" separation in acoustic rated walls.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

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

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for products furnished under all Sections of these specifications.
- B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.
- C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closure in unused box opening.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 35 - PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

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

1.6 PROJECT RECORD DOCUMENTS

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

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 GENERAL

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

required by NEC, whichever is largest.

- B. Pull and junction boxes shall meet all requirements of UL and NEC.
- C. Small pull boxes (i.e. 4" x 4") shall meet the requirements of these Specifications for outlet boxes as a minimum.
- D. All boxes (above ground) of 100 cubic inches or more shall be constructed of 14 gauge steel with hot dip galvanized coating.

2.2 SHEET METAL BOXES

- A. NEMA OS 1, galvanized steel.
- B. Box to be fully weatherproof and watertight where installed outside.

PART 3- EXECUTION

3.1 GENERAL

- A. Install per NEC.
- B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
- F. Install boxes to preserve fire resistance rating of partitions and other elements.
- G. Align adjacent wall-mounted boxes with each other.
- H. Use flush mounting boxes in finished areas.
- I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation. Provide minimum 24" separation in acoustic rated walls.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Pull and junction boxes larger than 25 square inches shall be supported with two 3/8" all-thread rod hangers minimum.
- M. Pull and junction boxes used for Systems Division 28 larger than 25 square inches shall be hinged cover type.
- N. Do not fasten boxes to ceiling support wires.
- O. Support boxes independently of conduit.
- P. Large Pull Boxes:
 - 1. Boxes larger than 100 cubic inches in volume or 12" in any dimension.:
 - a) Interior dry locations per NEC with screw covers.
- Q. Outdoor Locations: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations and sizes of required access doors with applicable sections in these

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

Specifications.

- B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only.
Coordinate masonry cutting to achieve neat opening.

3.3 ADJUSTING

- A. Install knockout closure in unused box opening.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 REFERENCES

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

1.4 REGULATORY REQUIREMENTS

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

PART 2- PRODUCTS

2.1 NAMEPLATES

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

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

2.2 WIRE MARKERS

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

2.3 CONDUIT/JUNCTION BOX COLOR CODE

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

<u>COLOR CODE FOR JUNCTION BOXES</u>	<u>KRYLON PAINT NUMBER</u>
System Emergency 277/480 volt	Cherry Red K02101
System Emergency 120/208 volt	Zinger Pink S01150
Fire Alarm	Popsicle Orange K02410
Normal Power 277/480 volt	Leather Brown K02501
Normal Power 120/208 volt	Glossy Black K01601
BAS	Cameo White K04129
Grounding	Fluorescent Green K03106

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

public areas in question.

2.4 CONDUIT/JUNCTION BOX MARKER

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

2.5 UNDERGROUND WARNING TAPE

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

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel pop rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Nameplates installed inside on dead front cover shall be self-adhesive tape. Do not drill or install screws in dead front.
- E. Identify new and existing conduit, junction boxes, and outlet boxes using field painting.
- F. Identify new underground conduit using underground warning tape. Install a minimum of one tape per trench at 6" below finished grade. For trenches exceeding 24" in width, provide one tape per 24" of trench width spaced evenly over trench width.
- G. Install wire markers at all new connections and terminations, and at existing connections and terminations modified or altered.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 08 03 - DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1. Communications Systems
 - a) Each system included in Systems sections.
2. Electrical Entrance Equipment
 - a) Circuit breakers
 - b) Fuses and fuseholders
 - c) Meters (where applicable)
3. Miscellaneous Electrical Equipment
 - a) Electrical systems controls and equipment
 - b) Electrical power equipment
 - c) Motor control devices
 - d) Relays
 - e) Starting devices
 - f) Surge suppression equipment
4. Lightning Protection System
5. Distribution Equipment
 - a) Lighting and appliance panelboards
6. Wiring Devices
 - a) Low-voltage controls
 - b) Switches: regular, time

- C. Upon completion of testing, each system is to be demonstrated only once.

1.3 TIME

- A. The demonstration shall be held upon completion of testing of all systems at a date to be agreed upon in writing by the Owner or his representative.

1.4 ATTENDING PARTIES

- A. The demonstration shall be held by this Contractor in the presence of the Owner and the manufacturer's representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

- A. Demonstrate the function and location (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.
- 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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 CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 08 13 - TESTS AND PERFORMANCE VERIFICATION OF ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section pertains to the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.
- B. Operate system for a three day period. Do performance verification work as required to show that the system is operating correctly in accordance with design. Supply instruments required to read data. Adjust system to operate at the required performance levels.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 TESTS

A. System:

1. General: After installation of all conductors and before final acceptance, make required tests to determine proper functioning of all circuits. Furnish all necessary instruments required to make tests and correct any deficiencies found. Prior to energizing, circuits shall be "rung-out" to verify opens, intentional and non-intentional grounds, continuity and detect short circuits by accepted constant megger.
2. Procedure:
 - a) All wires in conduit that are shorted or unintentionally grounded shall be replaced.
 - b) Insulation resistance of all feeder conductors and all conductors AWG #1 and larger shall be tested. This is to include all new conductors and/or all existing conductors that are connected and/or extended. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps, and connections are made, except connection to source and point of final termination at distribution or utilization equipment.
 - c) Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using AVO Biddle (or accepted equal) megger at not less than 1000 volts dc. Resistance shall be measured from conductor to conduit (ground). Testing methodology shall conform to short-time or spot-reading procedural recommendations of AVO Biddle Instruments for specific megger being used. Acceptable insulation resistance of conductors rated at 600 volts shall not be less than 1 megohm.
 - d) Conductors that do not satisfy test requirements of paragraph c) above, shall be removed, replaced, and testing repeated on new cable at no additional cost to the Owner. All tests shall be performed by licensed electrician trained in the use of test instruments. Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed and complete Conductor Insulation Resistance Test form (see Section 26 01 00 Operation and Maintenance Manuals) and submit five copies to Engineer for acceptance. Test shall be witnessed by Owner's Representative and Engineer (if so desired). Final acceptance data is to be submitted in O & M Manual.
 - e) Test reports shall identify each feeder conductor tested, date, time and result of

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

test, weather conditions and range, test voltage, and serial number of the megger instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced, and additional test shall be performed.

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

B. Motors:

1. Test run each motor via motor's control unit in both manual mode and automatic mode. Verify proper operation, voltage and rotation.
2. Test run each motor furnished under this Division of the Specifications and all existing motors specifically noted on the Drawings and/or Specifications to be tested:
 - a) With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate +/- 10% from the nameplate ratings, the condition shall be corrected. Notify the Engineer immediately should deviations occur.
 - b) Record results of existing motors tested and submit values to A/E in writing.
 - c) Test the insulation resistances of all motor windings to ground with a megger before applying line voltage to the motors. If these values are less than 1 megohm, the Contractor furnishing the motor shall be responsible for correcting the error.
 - d) Tabulate readings, complete Motor Test Information form (see Section 26 01 00 Operation and Maintenance Manuals) and submit five copies to the Engineer for acceptance. Final accepted data is to be submitted in O & M Manual.

C. Grounds:

1. Test each raceway for raceway continuity as called for in Section 26 05 26 Grounding and Bonding.
2. Test each grounding system used in the project as called for in Section 26 05 26 Grounding and Bonding.
3. Submit Ground Test Information form (see Section 26 01 00 Operation and Maintenance Manuals) for every grounding system in the project, including but not limited to, each ground rod installation, each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment), and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
4. Grounding resistance shall be as called for in Section 26 05 26 Grounding and Bonding.
5. Testing shall be 3-point method in accordance with IEEE recommended practice.
6. Transformer grounding.

D. Communications:

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

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 27 26 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
 - 1. Wall switches.
 - 2. Receptacles.
 - 3. Device plates and decorative box covers.

1.3 REFERENCES

- A. NEMA WD 1 General Requirements for Wiring Devices
- B. NEMA WD 6 Wiring Devices Dimensional Specifications

1.4 REGULATORY REQUIREMENTS

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

1.5 SUBMITTALS

- A. Submit Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 - 1. Submit product data on all types of wiring devices including plates and engraving.
- B. Submit Manufacturer's Instructions:
 - 1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

1.6 QUALIFICATIONS

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

1.7 EXTRA MATERIALS

- A. Provide a minimum of two screwdrivers of each type of tamper proof screw used on project.
- B. Turn over to Owner and submit Spare Parts/Maintenance Stock Certification. (See Section 26 01 00 Operation and Maintenance Manual).

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices shall be Specification Grade as minimum.
- B. General purpose wiring devices shall meet NEMA standard WD-1, Wiring Devices, General Purpose. Special purpose devices shall conform to the requirements of NEMA standard WD-5,

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

Wiring Devices, Special Purpose.

- C. All wiring devices shall bear UL labels.
- D. All devices of one type (i.e. all snap switches, all duplex receptacles, etc.) shall be by the same manufacturer. Hazardous Location and Special Purpose Devices may not be available from the same manufacturer; this shall constitute the only exception to this requirement of single-source.
- E. Corrosion resistant devices shall be as specified for normal usage, and fabricated of yellow color melamine plastic. Where "Weatherproof" type is indicated for exterior or wet locations, provide matching self-closing cover with gasketed seals at plate/wall junctions and for cover.
- F. Provide factory packaged wiring devices having high impact strength molded plastic bodies.
- G. Except where specifically required in these Specifications, use of interchangeable type or combination switch-receptacle-pilot devices is not acceptable and shall be removed.
- H. Switches and receptacles connected to life safety branch of the emergency power system shall be red. Plates shall be as specified for devices connected to normal circuits, but shall be engraved reading "Emergency", see Drawings for other engraving requirements.

2.2 WALL SWITCHES

A. Manufacturers:

- 1. See Drawings.

B. General:

- 1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in Specifications and/or on Drawings.
- 2. Switches shall be toggle or key-operated types, as indicated on the Drawings. All key-operated switches shall be keyed alike.
- 3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "On". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.
- 4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front relampable.
- 5. Snap switches installed in hazardous locations shall be UL listed for the type of location (class and division).
- 6. Voltage and ampere rating of switches shall be marked on switch, and shall conform to voltage of system to which applied.

C. Description: NEMA WD 1, heavy-duty, ac only general-use snap switch.

D. Voltage Rating: 120-277 volts, ac.

E. Current Rating: 20 amperes minimum.

F. Ratings: Match branch circuit and load characteristics.

2.3 RECEPTACLES

A. General:

- 1. All receptacles shall be of standard NEMA configuration, as indicated on the Drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

Color to match plates unless specifically noted otherwise in specifications and/or on drawings.

2. Duplex receptacles shall have integral UL listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of Industrial Fluorescent light fixtures on the same switching circuit. Receptacle face to be impact resistant nylon.
 3. Weatherproof duplex receptacles shall be provided in all exterior locations, and shall be ground fault circuit interrupting (GFCI) types, with weatherproof cover plates allowing use of receptacle with cover in closed position.
 4. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.
 5. Duplex receptacles shall have back and side wired screw pressure terminals.
- B. Description: NEMA WD 1; heavy-duty general use receptacle.
- C. Configuration: NEMA WD 6; heavy-duty, general use type as specified and indicated.
- D. Convenience Receptacle: Type 5-20.
- E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- F. Manufacturers:
1. See Drawings.

2.4 COVER PLATES

- A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.
- B. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel having a nominal thickness of .04" and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.
- C. Where so directed by the A/E (either by Contract Documents or direction after the bid), substitute nylon plates of quality as specified below without increase in Contract Price. Coordinate prior to securing plates for project. Where nylon cover plates are required in finished interior spaces, these shall be fabricated of either non-combustible mar-proof high impact resistant fiberglass or nylon reinforced thermosetting material or nylon, having a minimum thickness of .10", with smooth finish. Screws securing the plates shall have flush (when installed) heads of color to match plates. Nylon cover plates shall conform to Federal Specification QP-455A and all other NEC, UL, and NEMA requirements. Where required by A/E, nylon plates shall be fitted with nylon screws for totally nonmetallic surface installation.
- D. Cover plates for switches located in corrosive atmospheres (where vaporproof is not indicated) shall be equal to Hubbell #17CM81/#17CM82/#17CM83/#17CM84 one-piece neoprene with matching presswitch.
- E. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed..
- F. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the Drawings. Metallic plates and nylon plates in ivory, beige, gray, and white shall be engraved with black fill. Red, brown, and black nylon plates shall

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

be engraved with white fill.

- G. Unless specifically noted otherwise in Specifications or on Drawings, all outlets for telephone and other communications and data systems shall be provided with standard size one-piece cover plates having a minimum 3/4" diameter bushed hole in the center unless specifically noted otherwise in Specifications and/or on Drawings. Where telephone conductors are installed, plates shall contain telephone type, polarized plug-in receptacles.
- H. All device plates (including systems device plates and trims) located in secure areas such as cells, dayrooms, holding rooms, recreation areas, etc., shall have security wall plates (minimum 10 gauge) with minimum 12 gauge galvanized steel backplate. Plates shall have TORX counter pin reject type tamperproof screws.
- I. All device plates (including systems device plates and trims) and blank plates located in all secure areas shall be mounted with tamper proof screws, unless otherwise noted.

2.5 COLOR

- A. Wiring devices connected to normal power and located in unfinished spaces shall be grey color. Devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the following list of standard colors: ivory, beige, gray, white, brown, black.
- B. Cover plates for devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the above list of standard colors or #302 stainless steel.
- C. All devices and coverplates in paneled walls shall have finish to match paneling.
- D. Devices connected to [the life safety or critical branch of the emergency distribution system] emergency power shall be red color, except where established building standards and/or isolated ground devices require otherwise. Coordinate before purchase.
- E. Contractor shall modify any given catalog numbers as required to procure devices and plates of the proper color.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Verify conditions under provisions of Division 01 General Requirements and any other applicable supplemental requirements/conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify floor boxes are adjusted properly.
- E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on bottom.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- E. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- F. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.
- G. Where two or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang box and combination multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.
- H. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.
- I. In finished areas provide same type of plate for all surface mounted devices as for recessed mounted devices.
- J. In any room where new and existing construction is present, all receptacles, switches, and coverplates which are existing to remain shall be changed as required to match new work.
- K. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.
- L. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.
- M. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.
- N. All devices shall be installed so that only one wire is connected to each terminal.
- O. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.
- P. Receptacles shown to be floor mounted shall be installed in floor boxes (with coverplates) which are approved for this use.
- Q. Connect wiring devices by wrapping conductor around screw terminal.
- R. Install protective rings and split nozzle on active flush cover service fittings.
- S. Install local room area wall switches at door locations on the lock side of the door approximately 4" from the jamb. Where locations shown on the Drawings are in question, provide written request for information to A/E prior to rough-in.

3.4 NEUTRAL CONDUCTOR CONNECTIONS

- A. Each receptacle's "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under other Sections of these Specifications to obtain mounting heights specified and indicated on Drawings.

3.6 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 28 19 - ENCLOSED DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

- A. Provide all labor, materials, and equipment necessary to properly install switches as shown on the Drawings and as required by codes.
- B. Coordinate with Division 23 Contractor and Specifications as to who is to provide disconnect switches for mechanical equipment. Provide all disconnect switches not being provided by Division 23 Contractor.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver switches in factory wrapped packaging to the site. Handle switches carefully to prevent damage. Store in a clean, dry space protected from dirt, water, and physical damage. Do not install damaged switches.

1.4 QUALITY ASSURANCE

- A. The manufacturer of switches shall be the same as that of the panelboards.

1.5 SUBMITTALS

- A. Submit catalog cut sheet on each type of disconnect switch to be used on this project. Submit catalog cut sheet on enclosure locks to be used on this project.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

- A. Switches shall be heavy duty types with visible, quick-make, quick-break blades.
- B. Units for 2-speed motors shall be 6-pole in a single enclosure. Use of two 3-pole units will not be acceptable.
- C. Provide ground bus, and where required a solid neutral bus.
- D. Switches shall be fusible or nonfusible as denoted on the Drawings or as required by the equipment served from the switch. Fusible switches shall have rejection type fuse holders.
- E. Terminal lugs shall be rated for 75 degrees Centigrade.
- F. Enclosures, unless otherwise noted, shall be NEMA 1 for indoor locations and NEMA 3R stainless steel for outdoor locations as a minimum. Krydon or fiberglass material may be used in a NEMA 4X application. All switches mounted outdoors including those noted to be NEMA 3R on drawings shall be heavy duty type 4X, watertight, corrosion resistant
- G. The enclosure shall be interlocked with the switch handle such that the enclosure door or cover cannot be opened with the switch in the "ON" position. The switch handle shall be capable of being padlocked in the "OFF" position but not in the "ON" position.
- H. Finish for NEMA I units shall be standard baked gray enamel finish over a rust inhibiting phosphate primer.
- I. Each disconnect switch shall be provided with a Homac #ELB-2 or similar enclosure lock. Homac #ELB-2 is available from Graybar Electric.
- J. Disconnect switches installed between any variable speed drive type of unit (VFD, AFD, USD,

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

etc.) and its respective motor(s), shall have auxiliary break before break (open) interlock control contact.

- K. Disconnect switches installed to disconnect HVAC equipment are to be fusible type with fuses as recommended by HVAC manufacturer.

2.2 RATING

- A. The size, number of poles, and fusing for each switch shall be as denoted on the Drawings. As a minimum, no less than one pole for each ungrounded conductor shall be provided. Switches shall be rated 250 VAC or 600 VAC as required by the circuit to which it is connected.
- B. Switches serving motors with more than one set of windings shall have the number of poles necessary to disconnect all conductors to all windings in a single switch. Switches serving motor loads shall be horsepower rated of sufficient size to handle the load.

2.3 SERVICE ENTRANCE EQUIPMENT

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

2.4 KITCHEN EQUIPMENT

- A. All switches in kitchen areas, wet areas, etc. to be NEMA 4 stainless steel.

2.5 ENCLOSED CIRCUIT BREAKERS

- A. Molded Case Circuit Breakers: NEMA AB1, plug-on type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Breakers shall be HID rated. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- B. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all switches in accordance with the manufacturer's written instructions, NECA National Electrical Installation Standards, the applicable requirements of the NEC, and recognized industry practice.
- B. All switches shall be firmly anchored to walls and supporting structures (where used) using appropriate installation. Switches shall be installed with the turning axis of their handles approximately 5'-0" above finished floor unless otherwise indicated. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.
- C. Switches shall be mounted in accessible locations chosen where the passageway to the switch is not likely to become obstructed. Where a switch serves as the disconnecting means for a load, the switch shall be located as close as practical to the load with the switch handle within sight of the load.
- D. Provide and install lugs on disconnect switch as required to accept conductors called for on Drawings.
- E. Disconnect switches shall not be mounted on equipment unless specifically noted or required, and meet all applicable codes, etc. If switches are noted or required to be mounted on equipment, they shall have vibrator clips on fuses and be connected to conduit system with liquid tight flexible conduit.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- F. Provide and install enclosure lock on each disconnect switch. Enclosure lock bolt shall be tightened firmly but not tight enough to break bolt.
- G. Coordinate all requirements for controls between variable speed drive unit and its respective motor with drive specification, manufacturer, provider and installer. Provide auxiliary contacts, relays, etc. as required.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 26 41 13 - LIGHTNING PROTECTION SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Air terminals and interconnecting conductors.
 - 2. Grounding and bonding for lightning protection.

1.3 REFERENCES

- A. ANSI/NFPA 780 Standard for the Installation of Lightning Protection Systems
- B. ANSI/UL 96 Lightning Protection Components
- C. UL 96A Installation Requirements for Lightning Protection Systems
- D. LPI - Lightning Protection Institute
- E. OSHA Standard 29 CFR
- F. Section 26 05 26 Grounding and Bonding
- G. Section 26 08 13 Tests and Performance Verification

1.4 REGULATORY REQUIREMENTS

- a) ANSI/NFPA 780 Class II
- b) UL 96A; Letter of Findings.

1.5 DESCRIPTION

- A. A Lightning Protection System shall be provided and installed on the structure(s) even though not shown on Drawings, by experienced installers in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Underwriters Laboratories. All equipment to that result shall be included whether or not specifically called for herein with the additional requirement that the system shall meet all the requirements of LPI.
- B. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.
- C. Materials shall comply in weight, size and composition with the requirements of Underwriters' Laboratories and the National Fire Protection Code relating to this type of installation, and shall be UL labeled.
- D. All materials, where available by any one manufacturer, shall be cast.
 - 1. System shall comply with the following:

1.6 SUBMITTALS

- A. Submit shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details. Drawings shall include full layout of cabling and points, and connections.
- B. Submit product data showing dimensions and materials of each component, and include indication of listing in accordance with ANSI/UL 96.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- C. Submit manufacturer's installation instructions.
- D. Submittal shall include ground wells as called for in Section 26 05 26 Grounding and Bonding.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit project record documents.
- B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in lightning protection equipment with minimum five years documented experience and member of the Lightning Protection Institute.
- B. Installer: Authorized installer of manufacturer with minimum five years documented experience and member of the Lightning Protection Institute.

1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference one week prior to commencing work of this Section.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with roofing and exterior and interior finish installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Thompson Lightning Protection, Inc. - Premium Line
- B. Independent Protection Company, Inc. - Premium Line
- C. Heary Bros. Lightning Protection - Premium Lines
- D. Harger Lightning Protection, Inc. - Premium Line

2.2 MATERIALS

- A. Components: In accordance with ANSI/UL 96 and LPI.
- B. Air Terminals:
 - 1. Air Terminals shall be solid (aluminum or copper) as required to match roof conductors, shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface.
 - 2. Terminals shall be of such length as to comply with NFPA 780.
 - 3. Air Terminal for Chimney: Lead-coated copper.
- C. Conductors:
 - 1. Roof conductors shall consist of (aluminum or copper) complying with the weight and construction requirements of the code. Roof conductor material shall match and/or be compatible with roof flashing material.
 - 2. Down conductors shall be copper and shall be provided where shown installed in PVC conduit and hidden within the structure.
 - 3. If routing of down conductor raceway is in location where PVC is not allowed per code, install in metal conduit to meet code and bond both ends.
- D. Fastener:
 - 1. Conductor fasteners shall be of the same material as the conductor, having ample strength

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

to support conductor.

E. Connectors and Splicers:

1. Above-Grade and Accessible: They shall be bronze or aluminum as required to be compatible with conductor being connected.

F. Ground Plate: Copper.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that field measurements are as shown on shop drawings.
- C. Beginning of installation means installer accepts existing conditions.

3.2 PROTECTION OF SURROUNDING ELEMENTS

- A. Protect elements surrounding work of this Section from damage or disfiguration.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with UL 96A, ANSI/NFPA 780, and LPI.
- C. Install ground rods in accordance with Section 26 05 26 Grounding and Bonding. Where conflict exists between the requirements of Section 26 05 26 Grounding and Bonding and this Section, the most stringent shall govern.
- D. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- E. Conductors concealed in steel reinforced concrete shall be installed, bonded, etc. per NFPA 780 4.15.3. Specific attention is brought to the requirements of NFPA 780 4.9.13 requiring down conductors to be connected to reinforced steel at its upper and lower extremities.
- F. Lightning protection system shall be bonded to metal bodies as required by NFPA 780 4.21.
 1. The Contractor shall provide proper connection of the lightning protection system to all grounded media in and around the protected structure (see NFPA 780 4.20, Potential Equalization).
 2. The Contractor shall provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14, including electric service, telephone and antenna system grounds, underground metallic piping systems, underground metal conduits.
 3. All fences, gates, handrails, metal flagpoles, metal bleacher seats, metal playground equipment shall be grounded and bonded to the grid.
 4. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.
- G. Provide proper connections of lightning protection system to all grounded media in and around the protected structure per NFPA 780 4.20 Potential Equalization.
- H. Provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14 including electric service, telephone and antenna system grounds as well as underground metallic piping systems, underground metal conduits, etc.
- I. All exposed conductors located 6' or less above finished floor or finished grade is to be suitably protected/shielded as well as other exposed locations where conductor is subject to mechanical

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

damage.

- J. Coordinate and receive acceptance of all penetrations of roofing system and mounting to roofing system with Architect and Roofing Contractor prior to submittal of shop drawings.
- K. Coordinate and receive acceptance of all connections to structural steel, rebar, etc. with Structural Engineer prior to submittal of shop drawings.
- L. Submittal of shop drawing by Contractor is evidence that the Contractor has received acceptance of penetrations, connections, etc. by all parties and that Contractor assumes responsibility for such penetrations, connections, etc.

3.4 FIELD QUALITY CONTROL

- A. Test grounds per Section 26 05 26 Grounding and Bonding and 26 08 13 Tests and Performance Verification.
- B. Obtain the service of Underwriters Laboratories to provide inspection and certification of the lightning protection system under provisions of UL 96A.
- C. Obtain UL Letter of Findings and submit to Architect/Engineer.
- D. Submit test results on each ground location including final length of each ground rod and final distance between each installed ground rod at each ground rod location.

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. The requirements in this section of the specification are in addition to all requirements in sections referenced above.

1.2 SUMMARY

- A. This section includes Basic Electrical Requirements specifically applicable to Division 28 Sections, in addition to Division 01 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

- A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.
- B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.
- C. The Division 28 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.
- D. Only trained and qualified personnel shall be used by the Contractor to perform work. The Contractor shall not perform work, which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.
- E. Refer to other Division 26 28 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.

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.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

1.8 CONTRACT DOCUMENTS

- A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.
- B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc which is the most expensive and costly to implement.
- C. The drawings are diagrammatic and are not intended to include every detail of construction,

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.

- D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.
- E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.
- F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.
- G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.
- H. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division those requirements shall govern.

1.9 MATERIALS AND EQUIPMENT

- A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.
- B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with Section Substitutions and requirements.
- C. When a product is specified to be in accordance with a trade association or government 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 28 methods and materials unless specifically noted otherwise.
- F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless specifically noted otherwise.
- G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.
- H. Electrical equipment shall be protected from the weather during shipment, storage, and

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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.

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 including but not limited to electrical work required for:
 - 1. Mechanical Division of the Specifications
- B. Contractor shall obtain set of contract documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Divisions 26 27 28 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

- E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
- G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Mechanical, and Electrical.
- 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 and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

1.14 CUTTING AND PATCHING

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

1.15 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. 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.
- D. 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.
- E. 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.

1.16 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 writtem permission) or change in homerun outlet box shall be made on as-builts.
 - 4. Any circuit number changes on plan shall be indicated on as-builts.
 - 5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..
- C. Marked up prints as noted above are to be submitted to A/E for acceptance.. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.
- D. The changes and alterations shall be transferred to AutoCAD (AutoCAD Release 2006 or higher). Obtain CAD disk of the construction documents by the A/E, from the A/E. Generate/update the CAD disks to include all changes, additions, etc. on the accepted marked up prints. Label each drawing "As-Built" and date. Submit as-built CAD disk and reproducible of the as-builts.
- E. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit set prior to request for final payment and/or request for final

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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.

1.17 "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.

1.18 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.

1.19 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.

1.20 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.]

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- 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.

1.21 PROHIBITION OF ASBESTOS AND PCB

- A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.
- B. Prior to the final review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 16 contain no asbestos or PCB's. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB's. This statement shall be signed and dated by a duly authorized agent of the manufacturer.

PART 2 - PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 28 05 07 - SUBMITTALS FOR ELECTRONIC SAFETY AND SECURITY

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 28 Sections, in addition to Division 01 - General Requirements and any supplemental requirements/conditions.
- B. See Section Substitutions for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

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

1.4 SUBMITTALS

- A. MPE will accept Digital PDF formatted submittals as long as they meet the size and organization listed below.
- B. 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; for "SYSTEMS SUBMITTALS"
 - 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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "SYSTEMS SUBMITTALS."

C. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.
3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).
5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
 - a) Fabrication and erection dimensions.
 - b) Arrangements and sectional views.
 - c) Necessary details, including complete information for making connections with other work.
 - d) Kinds of materials and finishes.
 - e) Descriptive names of equipment.
 - f) Modifications and options to standard equipment required by the work.
 - g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).
 - h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
 - i) Conduit/raceway rough-in drawings.
 - j) Items requiring shop drawings include (but not limited to):
 1. Lightning protection system
 2. Special built light fixtures
 3. Each section of fire alarm, television, etc..
 4. UPS systems
 5. Emergency generator systems
 6. Special and/or modified equipment
 7. Main switchboard(s)
 8. UL listed fire and smoke stopping assemblies for each applicable penetration
 - k) See specific sections of Specifications for further requirements.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
 - a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
 - b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
 - c) See specific sections of Specifications for further requirements.

1.5 PROCESSING SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.
- B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:
 1. Project Addresses
 2. Index
 3. Separation Sheets
 4. Basic Materials
 5. Panelboards
 6. Light Fixtures
 7. Long Lead Items
 8. Systems Product Data
- C. Remainder of submittals are to be submitted no later than 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.
- D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.
- E. Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.
- F. Shop Drawings: For custom fabricated items and systems shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.
- G. Shop Drawing Review Notation.

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- | | | |
|----|------------------------|--|
| 3. | Submit Specific Item | Resubmit item as specified. |
| 4. | Make Corrections Noted | Make corrections noted, resubmittal not required. |
| 5. | Revise and Resubmit | Make corrections noted, resubmittal is required |
| 6. | Review not Required | Not required for review. No action taken. Copy retained for reference. |
- H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet, and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.
- I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict, unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

1.6 DELAYS

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

1.7 RE-SUBMITTALS

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

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

PROJECT ADDRESSES

OWNER:

ARCHITECT:

ENGINEER:

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

GENERAL CONTRACTOR:

SUBCONTRACTOR:

BINDER EXAMPLES FOR SUBMITTALS

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder

OCCC WEST CONCOURSE D CHILLER &
AHU REPLACEMENT

MPE NO. 2014-077A

ELECTRICAL SUBMITTALS

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

OCCC WEST CONCOURSE D CHILLER &
AHU REPLACEMENT

MPE NO. 2014-077A

SYSTEMS SUBMITTALS

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

OCCC WEST
CONCOURSE D
CHILLER & AHU
REPLACEMENT

MPE NO. 2014-
077A

ELECTRICAL
SUBMITTALS

(Size To 11")

OCCC WEST
CONCOURSE D
CHILLER & AHU
REPLACEMENT

MPE NO. 2014-
077A

SYSTEMS
SUBMITTALS

(Size To 11")

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 28 05 08 - SUBSTITUTIONS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies general, administrative and procedural requirements for substitutions for Division 28 Sections above and beyond the requirements of Division 01 General Requirements and any Supplemental requirements/conditions.
- B. Request for substitutions must be submitted no later than 10 days prior to bid due date.
- C. Request for substitution will not be considered after bid due date.

1.3 DEFINITIONS

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

1.4 REQUEST FOR SUBSTITUTION SUBMITTALS

- A. A separate request for substitutions shall be submitted for each product, material, etc. that is defined as a substitution.
- B. Submittal must consist of written request for substitution with data as required below. Request must be very specific as to what specified item, request for substitution is submitted for.
- C. Each request for substitution submittal for each product, etc. shall include:
 - 1. Name of material or equipment for which it is to be substituted.
 - 2. Drawings, product data, performance data and/or other information necessary for the engineer to determine that the equipment meets all specifications and requirements.
 - 3. Compliance Statement. Each request shall include the following compliance statement typed on letterhead of submitting company:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- a) Submittal complies with all aspects/requirements of Contract Documents. (Yes or No). If no, state deviance.
- b) Submittal complies with all applicable codes. (Yes or No). If no, state deviance.
- c) Submittal complies with all other elements of the work and does not require any other changes. (Yes or No). If No, state required change.
- d) Meets or exceeds the performance of specified product. (Yes or No). If no, state required change.

1.5 REQUEST FOR SUBSTITUTION SUBMITTALS (AFTER BID)

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

1.6 CONSIDERATION AND ACCEPTANCE

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

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

SECTION 28 31 00 - ADDRESSABLE FIRE ALARM/DETECTION SYSTEM (EXTENSION OF EXISTING)

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test an extension of the existing automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.
- B. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least seven days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the Authority Having Jurisdiction.
- C. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The Contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.
- D. The Contractor shall provide and install the fire alarm system (including all equipment, wiring, etc.) in accordance with the manufacturer's recommendations.
 - 1. Installation of devices shall be in accordance with the manufacturer's requirements as well as the requirements of the Contract Documents. Recommendations by the manufacturer for the proper installation of the fire alarm system and its equipment shall not preclude the requirement for the Contractor to comply with the requirements of the Contract Documents.
 - 2. Termination of fire alarm circuits shall be in accordance with the manufacturer's recommendations, applicable requirements of the National Electrical Code (NFPA 70), ADA, other applicable codes and the Contract Documents.
 - 3. Voice evacuation audio circuits (25 or 70V) shall be run in separate raceways from fire alarm data loops and other system circuits where the potential exists for interference or adverse effect upon the proper operation of the any fire alarm equipment, circuit or the system as a whole.
 - 4. The fire alarm installer shall be responsible for ensuring that prior to bidding the project, the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the fire alarm system manufacturer's recommendations for proper installation of the

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.

- E. The Owner shall be responsible for any retrofits, installation and design required by the local AHJ to comply with the requirements of the 2010 Florida Fire Prevention Code, NFPA 1, Section 11.10. This code requirement can only be determined after the construction of the building and may or may not be required by the local AHJ in the area of this project.

1.3 DESCRIPTION

- A. The Contractor shall furnish and install an addressable fire alarm system extension to match the existing system. The existing system is a Simplex Grinnel system that is currently in the process of being replaced. All devices shall be addressable. Control shall be microprocessor based and field-programmable. All electronics shall be solid state.
- B. Provide all materials, work, labor, etc. as required to modify (including any programming, battery capacity, etc.) the existing to comply with the operation, etc. noted in these contract documents.
- C. The system extension shall include but not be limited to:
 - 1. Main fire alarm control panel (FACP) including all required power supplies
 - 2. Duct detectors
 - 3. Remote fire alarm control panels (Network Nodes)
 - 4. Remote power supplies (Remote power supplies shall be in a UL listed assembly and be provided by the same manufacturer as the fire alarm control panel (FACP)).
 - 5. AHU Shut down.
 - 6. Programming
 - 7. Grounding
 - 8. Firestopping
 - 9. Wire and cable labeling
 - 10. Electrical power required to comply with all functions and operations called for in this section of the specifications
 - 11. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system
- D. The Contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:
 - 1. HVAC system control and/or shutdown
 - 2. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown
 - 3. Smoke Control system control and/or shutdown
 - 4. Control of fire, smoke, and/or combination fire/smoke dampers
 - 5. Control of fire and/or smoke doors, dampers, shutters, etc.
 - 6.
- E. The system shall operate as in exact sequencing as existing system.
- F. The system shall be wired as a Class A system for all circuits.
- G. All portions of fire alarm system shall be installed in conduit. Conduit and boxes to be installed by

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

electrical contractor.

- H. The fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.
- I. Provide and install wiring, equipment, etc. for connection to devices furnished under other divisions of the work.
- J. Provide and install wiring, equipment, etc. as required to deactivate power to computer power panels and air conditioning equipment by automatic or manual devices as shown on plans.
- K. Although they may not be indicated on the Fire Alarm system diagram and/or drawings, all required control and interlock wiring between the Fire Alarm system and building equipment shall be provided hereunder, Controls are required to/for/from:
 - 1. Fire/smoke air and duct detectors
 - 2. Fire, smoke and/or combination fire/smoke dampers.
 - 3. Supply/Return fans, Exhaust fans, and/or Fan Terminal Boxes (FTB)
 - 4. Automatic fire extinguishing systems
- L. Provide and install all relays (electric-electric, electric-pneumatic, and/or pneumatic-electric) as required for a complete and operational fire alarm system, complying with all applicable codes and all requirements, and coordinated with all divisions of these specifications.
- M. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.

1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

- A. Reference Section Reference Standards and Regulatory Requirements.
- B. The equipment and installation shall comply with the current or applicable provisions of the following standards:
 - 1. ANSI S3.41 American National Standard Audible Emergency Evacuation Signal
 - 2. National Fire Protection Association Standards:
 - a) NFPA 70 National Electrical Code (including but not limited to Article 760, Fire Alarm Systems)
 - b) NFPA 72 National Fire Alarm Code
 - c) NFPA 101 Code For Safety to Life from Fire in Buildings and Structures
 - d) NFPA 90A Installation of Air Conditioning and Ventilating Systems
 - 3. Underwriters Laboratories Inc. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
 - a) UL 864 (Category UOJZ) APOU Control Units and Accessories for Fire Alarm Systems. All Control Equipment shall be listed under UL category UOJZ.
 - b) UL 268 Smoke Detectors for Fire Alarm Systems
 - c) UL 268A Smoke Detectors for Duct Application
 - d) UL 217 Smoke Detectors Single Station and Multiple Station Smoke Alarms
 - e) UL 521 Heat Detectors for Fire Protective Signaling Systems
 - f) UL 228 Door Closers With or Without Integral Smoke Detectors
 - g) UL 464 Audible Signal Appliances

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- h) UL 1638 Visual Signaling Appliances
 - i) UL 1481 Power Supplies for Fire-Protective Signaling Systems
 - j) UL 1480 Speakers
 - k) UL 1424 Cables for Power-Limited Fire-Alarm Circuits
 - l) UL 1971 Signaling Devices for the Hearing Impaired
 - m) UL 1449 3rd Edition Surge Protective Devices
 - n) UL 497, UL 497A, UL 497B.
4. All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed by the Underwriters' Laboratories product directory called Fire Protection Equipment and/or the Electrical Construction Materials List.
5. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
6. The system controls shall be UL listed for Power Limited Applications per NEC. All circuits must be marked in accordance with NEC.
7. All equipment supplied as part of the Fire Alarm System shall be provided by a single manufacturer and shall comprise a complete UL Listed Fire Alarm System.
8. IEEE: The fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in Table 1, Location Category A High Exposure of ANSI/IEEE Standard C62.41-1991.
- C. The equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
- 1. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Standards for Accessible Design, 2010.
 - 2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
 - 3. ASME/ANSI A17.1 – Safety Code for Elevators and Escalators
 - 4. Local and State Building Codes.
 - a) Florida Building Code, 2010.
 - b) Florida Administrative Code. All applicable chapters including but not limited to:
 - 1. Chapter 69A Rules, including but not limited to:
 - (a) Ch 69A-3 Fire Prevention - General Provisions.
 - (b) Ch 69A-46 Fire Protection System Contractors and Systems.
 - (c) Ch 69A-47 Uniform Fire Safety Standards for Elevators.
 - (d) Ch 69A-48 Fire Safety Standards for the Fire Alarm Systems.
 - c) Florida Department of Insurance:
 - 1. Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- d) Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal
- e) Authority Having Jurisdiction:
 - 1. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local Authority Having Jurisdiction.
 - 2. Fire Department:
 - 3. Building Official
 - 4. State of Florida: Division of State Fire Marshal.

D. Surge Suppression

- 1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters Laboratories, shall bear the UL seal and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.
- 2. Comply with all standards and guides as listed under "References" above.

1.5 RELATED SECTIONS

A. Applicable sections of these specifications with regard to, but not limited to:

- 1. Ductwork accessories: smoke dampers
- 2. Building control systems
- 3. Mechanical Equipment

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years experience and with service facilities within 50 miles of Project.

B. Installer:

- 1. Company specializing in installing the products specified in this section with minimum ten (10) years experience.
- 2. The Installer shall be currently licensed as a Florida Certified Alarm System Contractor I (EF).
- 3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
- 4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
- 5. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least ten (10) consecutive years going back from date of bid.

C. Surge Suppression

- 1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
- 2. The surge suppressor manufacturer shall offer technical assistance through support by a

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

factory representative and local stocking distributor.

3. Verify proper clearances, space, etc. is available for surge suppressor.

D. Coordination/Project Conditions

1. Verify proper grounding is in place.
2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide a coupling conductor within the fire alarm underground raceway system to run along side fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.

E. The work specified herein is an extension of the existing system and as such all equipment shall match existing. In the event that the existing equipment is no longer available other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the engineer (See Section Substitutions):

1. Certified letter from the manufacturer specifically stating the following:
 - a) Part numbers and descriptions of each item that is no longer manufactured.
 - b) Manufacturer name (if not the same as the original manufacturer), part numbers and descriptions of items that are certified by the manufacturer to be compatible with the existing system.
 - c) A detailed listing of specific differences, including both advantages and disadvantages, between the original item and the proposed substitution.
2. Contractor qualifications (as listed above).
3. Complete lists, descriptions and drawings of materials to be used.
4. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
5. A complete riser diagram of Fire Alarm System.

1.7 SUBMITTALS

A. Submit in accordance with Section Common Work Results and Section Submittals.

B. In addition to requirements above, the contractor shall submit:

1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
2. Manufacturer's data on all products, including but not limited to:
 - a) Catalog cut sheets.
 - b) Roughing-in diagrams.
 - c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
 - d) Operation and maintenance manuals.
 - e) Typical wiring diagrams and risers.
 - f) The contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

3. Submit floor plans to locate all devices. Wiring diagrams shall include wire and raceway sizes, fire alarm control panels, riser wiring and associated raceway sizes, wiring details, connections and terminal identification. All devices shall be identified by the same applied identification symbol as shown on the contract documents.
4. Submit all load calculations and cable/wire sizing for each branch of the individual fire alarm field circuits. Wire sizing calculations to prove maximum three percent (3%) voltage drop at all AC voltages and maximum eight percent (8%) voltage drop at all DC voltages.
5. Battery sizing calculations.
6. Submit a detailed step by step testing procedure for a component by component system functional checkout and test.
7. Point to point wiring diagrams and block diagrams of system to be installed. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with submittals.
8. Riser diagrams and floor plans showing conduit runs and number of wires. All devices shall be identified by the same applied identification symbol as shown on the drawings.
9. Surge Suppression
 - a) Surge protective data for 120 volt power source, power circuit, outside signaling circuit, and exterior incoming circuits from other buildings (if any), and outgoing circuits to other buildings (if any).
 - b) Submit Product Data for each type of suppressor:
 1. Dimensions.
 2. Means of mounting.
 3. Compliance with UL Standards referenced.
 4. Compliance with IEEE Standards referenced.
 5. Design type (Hybrid, MOV).
 6. Size of wire leads.
 7. warranty.
 8. Performance data showing compliance with performance as specified herein.
 9. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
 10. Manufacturer's certified test data on each suppressor type.
 11. Test data from an independent test laboratory.
10. Name, qualifications, etc. of company providing and installing system.
11. Qualifications of installer. Submit proof installer meets specified requirements.
12. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire to be used in installation of fire alarm and communications system.
13. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details and specification sheets for all fire alarm system components and rough-in boxes.
14. Submit Florida Registered Firm certificate number.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

15. Submit Florida Fire Alarm Contractor's license number.
16. Submit Fire Alarm Technician(s) Manufacturer's certification.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit in accordance with Section Common Work Results and Section Operation and Maintenance Manuals.
- B. In addition to the requirements above, the contractor shall submit:
 1. Updated and revised contract documents to record actual locations (as-installed) of all equipment, devices, initiating devices, signaling appliances, and end-of-line devices.
 2. Record actual type, size, and routing of cables installed.
 3. Record all cable identifications.
 4. Drawings required herein are in addition to those required under Operation and Maintenance Data.
 5. All drawings required herein to be on AutoCAD 2007 or higher.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit in accordance with Section Common Work Results and Section Operation and Maintenance Manuals.
- B. In addition to the requirements above, the contractor's O & M Manuals shall include:
 1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
 2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codings (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.
 3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
 4. Repair parts list for each and every major equipment item furnished.
 5. Service manuals for each and every major equipment item furnished.
 6. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.
 7. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.
 8. Surge Suppression
 - a) O & M data to include:
 1. All accepted shop drawings, product data, and/or cutsheets.
 2. Installation, connection, and maintenance information on each type of surge suppression.
 3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

9. Complete equipment rack layouts showing locations of all rack mounted equipment items.
 10. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing detectors, speaker locations and orientation, rack locations, and all other related device locations.
 11. The Contractor/Installer shall videotape the entire training session(s), and submit the video tape with the Operational Manual.
- C. Drawings required herein are in addition to those required under Project Record Documents.
1. All drawings required herein shall be on AutoCAD 2007 or higher.

1.10 WARRANTY

- A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.
1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
 2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.
- B. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.
- C. Surge Suppression
1. All surge suppression devices shall be warranted free from defects in materials and workmanship for a period of five (5) years.
 2. Any suppressor, which shows evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.
 3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.11 MAINTENANCE SERVICE

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

1.12 EXTRA MATERIALS

- A. Provide six (6) keys of each type.
- B. Provide three (3) of each type of automatic smoke detector without base.
- C. Provide three (3) of each type of surge suppression device.

1.13 OWNER'S INSTRUCTION:

- A. Provide instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel operation and instruction on peripheral device operation, including what are normal indications and alarm indications of each type of new/added device. Videotape all training sessions and deliver (4) copies of tapes to Owner (for use in future training).

1.14 SYSTEM OPERATION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- A. System operation shall meet the operation requirements of all codes and regulatory requirements.
- B. Upon activation of the Fire Alarm System by a manual station, smoke detector, or any other new or existing automatic device (except AHU smoke duct detector), the following shall take place:
 - 1. Energize all alarm signaling devices.
 - 2. Sound all audible alarms and flash visual signals throughout the campus.
 - 3. Alert local fire department or proprietary system.
 - 4. Cause alarm to be displayed on the annunciator section of the control panel.
 - 5. Close all doors or fire shutters, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
 - 6. Shut down all air handlers, exhaust fans supplying or exhausting air, and fan terminal boxes (FTB) in at least the zone where the alarm is initiated.
 - 7. Shut down of air handling unit by a local smoke duct detector shall not activate audible alarms or flash visual signals, but shall provide a supervisory indication at the fire alarm control panel/fire alarm annunciator.
 - 8. Shut all fire and/or smoke dampers in ducts associated with the air handling units and exhaust fans, which are shut down, in at least the zone where the alarm is initiated.
 - 9. Transmit signals to the building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
 - 10. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.
- C. System operation shall meet the operation requirements of all codes and regulatory requirements.
- D. Upon activation of the Fire Alarm System by any smoke detector, any sprinkler flow alarm switch or other automatic detection device, the following shall take place in addition to the above:
 - 1. Shut down all air handlers and exhaust fans supplying or exhausting air in at least the zone where the alarm is initiated.
 - 2. Shut all smoke dampers in ducts associated with the air handling units and exhaust fans, which are shut down, in at least the zone where the alarm is initiated. (Coordinate with mechanical contractor and provide all electrical as required).
 - 3. Transmit signals to building elevator control panel to initiate return to main floor or alternate floor.
 - 4. Transmit signals to building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
 - 5. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.
 - 6. Send a signal to all non-fire alarm sound reinforcement systems. Fire alarm signals shall override all other sound systems. Alarm notification signals shall take precedence over all other signals. Operation of other sound systems shall resume after fire alarm system

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

clears alarm.

- E. System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall place the system in the trouble mode, which causes the following system operations:
 - 1. Visual and audible trouble signal indicated by zone at the fire alarm control panel.
 - 2. Visual and audible trouble signal indicated at remote annunciator panel.
 - 3. Trouble signal transmitted to central station.
 - 4. Manual acknowledgement function at fire alarm control panel shall silence audible trouble signal; visual signal shall be displayed until initiating failure or circuit trouble is cleared.
- F. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.
- G. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.
- H. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.
- I. Where required by codes or Authority Having Jurisdiction:
 - 1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.
- J. The fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.
- K. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

1.15 ZONING

- A. Alarm Zones.
 - 1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
 - a) One per building, per floor for pull stations.
 - b) One per building, per floor for automatic devices.
 - c) One for each duct smoke detector.
- B. Notification Zones.
 - 1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
 - a) One (or more) circuit(s) for administration building
 - b) One (or more) circuit(s) for exterior horns
 - c) One (or more) circuit(s) for remainder of campus.
 - 2. Breakdown circuits as required for load and distances involved.
- C. Alarm Zones.
 - 1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- a) One per 3000 square feet per floor, for pull stations and heat detectors.
 - b) One per 3000 square feet per floor, for smoke detectors.
 - c) One for each duct smoke detector.
- D. Notification Zones.
- 1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
 - a) One per floor. Breakdown circuits as required for load and distances involved.

PART 2- PRODUCTS

2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.
- B. Provide all equipment to match existing equipment required to perform all functions and/or features included in this section of the specifications although not specifically noted or specified herein.
- C. Modify/rework existing system as required for extension to new devices and/or as required for proper operation of system with new devices, adding new zone modules, adding surge suppression, adding power supply and battery capacity to meet regulatory requirements with new devices, etc.

2.2 RACEWAYS

- A. General:
 - 1. All raceways (conduit, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Divisions 26, 28 of these specifications.
 - 2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.
- B. Conduit: Comply with Section Conduit except as noted below:
 - 1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
 - 2. Size: Minimum size shall be 3/4" conduit.
- C. Boxes:
 - 1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
 - 2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

- A. Terminal cabinets are to comply with applicable sections of these specifications.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

- A. Bus to comply with applicable sections of these specifications.

2.5 PHOTOELECTRIC SMOKE DETECTOR

- A. The contractor shall furnish and install Analog addressable photoelectric smoke detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

compatible with a UL-listed fire alarm panel.

- B. The smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Actuating the control panel reset switch may reset the detector.
- C. The sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.
- D. The vandal-resistant, security locking feature shall be used in those areas as indicated on the drawings. The locking feature shall be field removable when not required.
- E. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.
- F. To facilitate installation, the detector shall be nonpolarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.
- G. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

2.6 DUCT MOUNTED SMOKE DETECTOR

- A. The Duct Mounted Smoke Detector for the fire and smoke detection system shall be a high velocity rated Analog addressable series smoke detector intended for use with ventilation and conditioning ducts.
- B. The detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with NFPA 90A. The detector shall be UL-listed specifically for the use in air handling systems.
- C. The detector shall operate at air velocities ranging from 300 feet per minute to 4000 feet per minute without requiring compensation for operation at specific air velocities. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.
- D. Whether shown on drawings or not, a remote alarm indicator/test station shall be provided for each duct mounted smoke detector to annunciate smoke detector operation remotely. Mount unit in ceiling or wall near respective remote smoke detectors (in an occupied space).

2.7 HEAT DETECTORS

- A. The contractor shall furnish and install Analog addressable heat detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
- B. The heat detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Actuating the control panel reset switch may reset the detector.
- C. Fixed temperature automatic heat detectors shall be rated at 135°F. The fixed temperature element shall use dual thermistor technology. Detectors shall have a smooth ceiling rating of 625 square feet and 2 Form 'A' contacts with rating of 3 amps at 6 to 125 volts AC and 1 amp at 6 to 28 volts D.C.
- D. Detectors shall be installed in accordance with appropriate articles of National Fire Protection Association and the spacing rating assigned by the Underwriters' Laboratories and located as shown on the drawings. Automatic heat detectors shall be Underwriter's Laboratories and Factory Mutual approved.
- E. Where indicated on the drawings the contractor shall provide heat detectors rated, by the

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

manufacturer, as explosion proof. If not an integral part of the heat detector assembly, the addressable module shall be located outside the area protected by the explosion proof heat detector (but interior to the building) in an accessible area. If the addressable module is located above a gypsum ceiling the contractor shall provide a fire rated access panel.

2.8 ADDRESSABLE MODULE

- A. Analog addressable device shall be furnished as required to monitor fire alarm or supervisory initiating devices or control auxiliary functions. Each module shall contain address switches to assign a unique input point for programming or control by the system.

2.9 RELAYS

- A. Relays required for control (i.e. Air Handler shutdown, Supply Fan shutdown, Exhaust Fan shutdown, Fan Terminal Box shutdown, Door Lock release, Fire Shutter release, Smoke Damper closure, Fire Damper closure, Smoke/Fire Damper closure, or any other interface required by these specifications or applicable codes) shall be UL listed relays suitable for use in Fire Alarm systems.
- B. Per NFPA, relays used for control of other systems shall be located within three feet (3') of the device to be controlled.
- C. Relays shall be analog addressable devices powered and controlled from the fire alarm system. Each relay shall contain address switches to assign a unique input point for programming or control by the system.
- D. Each relay shall provide at least one set of Form "C" dry relay contacts.

2.10 SURGE SUPPRESSION

- A. Non-Addressable Initiation Devices:
 - 1. Plug-in replacement modular design with associated female wiring connector.
 - 2. UL 497B listed and labeled.
 - 3. Multi-stage hybrid protection circuit.
 - 4. Fail short/fail safe.
 - 5. Surge Capacity: 10KA with 8 x 20 μ s waveform, 500A per line with 10 x 700 μ s waveform.
 - 6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
 - 7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
 - 8. Capacitance: 1500 pf.
 - 9. Manufacturer:
 - a) EDCO #PC642C series with #PCBIB base.
- B. Addressable Initiation Devices and Data Loops:
 - 1. Plug-in replacement modular design with associated female wiring connector.
 - 2. UL 497B listed and labeled.
 - 3. Multi-stage hybrid protection circuit.
 - 4. Fail short/fail safe.
 - 5. Surge Capacity: 10KA with 8 x 20 μ s waveform, 500A per line with 10 x 700 μ s waveform.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
 7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
 8. Capacitance: 50 pf.
 9. Manufacturer:
 - a) EDCO #PC642C-LC series with #PCBIB base.
- C. Power Circuit (120 volt):
1. UL 1449 listed.
 2. 15 amp, 120V rated.
 3. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
 4. Normal mode (L-N), and common mode (L+N-G) protection.
 5. Internal fusing.
 6. Hybrid design.
 7. Indicators for normal operation and failure indication.
 8. Enclosure:
 - a) Fire retardant high impact, phenolic or plastic housing or metal enclosure.
 9. Clamping voltage UL 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20 μ s): 385V @ 120V.
 10. Maximum Surge Capacity: 20,000 amps.
 11. Maximum Continuous Operating Voltage: 115% of line voltage.
 12. Provide hardwire connection or add 15 amp receptacle device to hardwired devices to match equipment being protected and maintain UL listing.
 13. Provide additional 15 amp in-line fusing as required to comply with UL and the NEC when connected to a 20 amp, 120V circuit.
 14. Manufacturers:
 - a) Leviton #51020-WM (hardwired).
 - b) EDCO #HSP-121BL2.
- D. Terminations
1. Provide terminals sized for circuits required on project.
 2. Where surge suppression modules are for mounting on 'M' block assembly, provide M block assembly complete with grounding system that mates with surge suppression equipment.
- E. Terminal Cabinets
1. Provide terminal cabinets for all terminations and surge suppression equipment including 120VAC power surge suppressor as required in Section Surge Suppression. Size terminal cabinets as required to facilitate installation of terminations and surge suppression in a neat and workmanlike manner.
 2. Terminal cabinet to meet specifications in Section Cabinets and Enclosures unless specifically manufactured for use.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

3. Manufacturers:
 - a) Interior.
 1. Square "D"
 2. Hoffman
 3. BUD
 - b) Exterior.
 1. Hoffman
 2. BUD
 3. Carlon

2.11 CABLE

- A. Contractor shall provide and install cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed Fire Alarm system.
- B. Fire alarm system cables installed in exterior and/or underground raceways shall comply with the

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.
- B. Locate, install, and test fire alarm and detection systems in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electrical Code, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.
- C. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.
- D. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.
- E. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.
- F. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.
- G. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

certifying licensee shall be present for the final test prior to certification.

- H. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate-of-registration number of the registered firm.
- I. Installation of detectors:
 - 1. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.
 - 2. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.
 - 3. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

3.2 RACEWAYS AND BOXES

- A. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.
- B. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.
- C. Provide supporting devices per Section Hangers and Supports.
- D. Identify raceways and boxes per Section Electrical Identification.

3.3 WIRE/CABLE

- A. Conductor: 98% conductivity, solid copper or stranded copper. If stranded conductors are used, then a compression lug shall be installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductors without crimp-on lugs may be terminated into terminal strips of box-lug connectors.
- B. Insulation: A type accepted by NEC for the application. Individual conductors shall be Type THHN/THWN. All cable shall be UL listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types.
- C. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:
 - 1. Multiplex Signaling Line Circuit: AWG #14, shielded twisted pair cable.
 - 2. Initiating Circuits, Hard-Wired Devices: AWG #14, THHN/THWN conductors.
 - 3. Notification Circuits: AWG #14, THHN/THWN conductors.
 - 4. Initiating Circuits, Addressable Devices: AWG #14, shielded twisted pair cable.
 - 5. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.
- D. The above wire sizes shall be increased to size as required to comply with Authority Having Jurisdiction or as required for voltage drop, load, etc.
- E. Color Coded:
 - 1. Wiring shall be color coded as required to match existing system.

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.

F. UL:

1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
2. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, Power Limited Fire Protective Signaling Cable. All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
3. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760.179. All such cable shall bear a cable marking that includes a Type designation as given in NEC Table 760.179(I). Provide Type FPL.

G. Connections of Installation Wiring:

1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.
4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

H. Rated Enclosures:

1. All vertical fire alarm wiring traversing more than one level shall be routed in rated enclosures. In addition, all horizontal wiring serving devices location on floors other than where wiring originates shall be routed in 2-inch concrete encasement, suitable rated building construction, or 2-hour wrap application enclosure accepted by local Authority Having Jurisdiction.

3.4 END-OF-LINE DEVICE

- A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.5 AUXILIARY CONTROL RELAYS

- A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.
- B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.
- C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.6 SPRINKLER FLOW SWITCHES

- A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm panel.
- B. Run conduit and wiring to the flow switches, and connect them so as to provide an operable

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

supervised sprinkler alarm system per NFPA standards, and state and local codes.

- C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.7 CABLE IDENTIFICATION

- A. Provide and install permanent cable markers on all cables/wire lines, telephone lines, etc. at terminal strips, terminal cabinets and at main equipment.

3.8 EXISTING CONDITIONS

- A. Contractor shall investigate existing conditions prior to bid.

3.9 CONDUIT/BOX IDENTIFICATION

- A. Contractor shall identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" on center.

3.10 DEMONSTRATION

- A. When system is complete it shall be demonstrated to owner's representative who shall be given complete instructions, spare parts, manuals and maintenance information.

3.11 SYSTEM TESTING

- A. Prior to certification of the fire alarm system the contractor shall accomplish a complete test of the fire alarm system in accordance with NFPA 72, Chapter 10, Paragraph 10.4 Testing.
- B. Perform a complete, functional, component by component test of the entire fire alarm and detection system. Provide a detailed step by step testing procedure, which is unique to this project, reflecting the type of system and the number and location of all components.
- C. Demonstrate the proper operation of each component as follows:
1. Ionization, photoelectric, and duct smoke detectors: activate the detector with a "false smoke" product which has been specifically formulated for testing smoke detection systems.
- D. Demonstrate the supervisory function at each device loop circuit, and at all single component wiring runs such as for the sprinkler valve supervisory switches.

3.12 CERTIFICATION

- A. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing Form. The Inspection and Testing form format shall be as indicated in NFPA 72, Chapter 10, Figure 10.6.2.3 Inspection and Testing Form. When an Inspection and Testing Form has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.
- B. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.13 FINAL DRAWINGS

- A. As-built drawings shall be given to the Owner's representative, at time of instruction, in addition to those to be supplied as general requirements of the job.

3.14 AUTHORITY HAVING JURISDICTION

ORANGE COUNTY CONVENTION CENTER
WEST CONCOURSE D CHILLER & AHU REPLACEMENT

- A. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the Authority Having Jurisdiction.

END OF SECTION