

BID DOCUMENTS

for

DESTIN-FORT WALTON BEACH AIRPORT VPS CHILLER REPLACEMENT

ITB AP 27-18

Prepared for:



**Okaloosa County Board
of County Commissioners**

Prepared by:



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AVCON Project Number: 2017.050.11

BID DOCUMENTS

May 2018

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FRONT END DOCUMENTS



BID DOCUMENTS
DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT

NOTICE TO BIDDERS

VPS CHILLER REPLACEMENT
for
DESTIN-FORT WALTON BEACH AIRPORT
OKALOOSA COUNTY, FLORIDA

ITB AP 27-18

Notice is hereby given that the Board of County Commissioners of Okaloosa County will receive sealed bids until Wednesday, July 11, 2018 at 2:00 pm (local time) for the Destin-Fort Walton Beach Airport VPS CHILLER REPLACEMENT project at which time and place all bids will be publicly opened and read aloud. Bids must be submitted in a sealed envelope clearly marked "BID ENCLOSED – DESTIN-FORT WALTON BEACH VPS CHILLER REPLACEMENT".

On Wednesday, July 11, 2018 at 2:00 pm (local time), all bids will be opened and read aloud. All bids must be in sealed envelopes reflecting on the outside thereof the Respondent's name and "Destin-Fort Walton Beach Airport VPS CHILLER REPLACEMENT Project". The Board of County Commissioners will consider all bids properly submitted at its scheduled bid opening in the Conference & Training Room #305 (old First National Bank Bldg) located at 302 N. Wilson St, Crestview, FL 32536. Bids may be submitted prior to bid opening by being delivered in person or by mail to the Clerk of Circuit Court, 302 N. Wilson St., #203, Crestview, FL 32536. NOTE: Crestview, FL is not a next day guaranteed delivery location by most delivery services. Respondents using mail or delivery services assume all risks of late or non-delivery.

The project consists of all labor, materials, machinery, tools, equipment and other means of construction necessary and incidental to the completion of the work shown on the plans including replacement of two new 300-ton air-cooled chillers, chilled water pumps, piping, controls, and electrical improvements.

Beginning on Monday, June 4, 2018, digital copies of the above documents may be downloaded from the Okaloosa County Purchasing website (<http://www.co.okaloosa.fl.us/purchasing/home>).

A non-mandatory Pre-Bid Conference will be conducted at the Destin-Fort Walton Beach Airport, Conference Room No. 1, 1701 State Road 85 N., Eglin AFB, Florida 32542, at 10:00 am on June 13, 2018. Engineer will transmit to all plan holders of record such Addenda as Engineer considers necessary in response to written questions received no later than seven (7) days prior to the Bid Opening date. Oral statements may not be relied upon and will not be binding or legally effective.

Funding for this project is being provided by the Florida Department of Transportation and Okaloosa County and will be subject to all applicable requirements and grant assurances of these agencies.

All originals must have original signatures in blue pen ink.

OWNER'S CONTACT:

DeRita Mason
Contracts & Lease Coordinator
Okaloosa County Purchasing Department
5479 Old Bethel Rd., Suite A
Crestview, FL 32536
Tel: 850-689-5960
Fax: 850-689-5970
dmason@myokaloosa.com

ENGINEER'S CONTACT:

John Collins, P.E.
Project Manager
AVCON, INC.
320 Bayshore Drive, Suite "A"
Niceville, Florida 32578
Tel: 850-678-0050
Fax: 850-678-0040
jcollins@avconinc.com

All bids should be addressed as follows:

BID ENCLOSED – DESTIN-FORT WALTON BEACH AIRPORT VPS CHILLER REPLACEMENT

Clerk of the Court
302 N. Wilson St, #203
Crestview, Florida 32536

Note: Crestview Florida is not a next-day-guaranteed delivery location by delivery services.

//Signed//

Jeff Hyde
Purchasing Manager

Date

BOARD OF COUNTY COMMISSIONERS
OKALOOSA COUNTY, FL

Graham W. Fountain
Chair

INSTRUCTIONS TO CONTRACTORS

PROJECT IDENTIFICATION:

a) Project Title:

**DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT PROJECT**

b) Owner:

OKALOOSA COUNTY BOARD OF COUNTY COMMISSIONERS

c) Engineer:

AVCON, INC.

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1. Defined Terms.

Terms used in the Instructions to Contractors that are defined in the Standard General Conditions of the Project Manual have the meanings assigned to them in the General Conditions.

Certain additional terms used in the Instruction to Contractors have the meanings indicated below which are applicable to both the singular and plural thereof.

- 1.1 Contractor – one who submits a Bid directly to Owner as distinct from sub-contractor, who submits a bid to a Contractor.
- 1.2 Issuing Office – the office from which the Project Documents are to be issued and where the bid procedures are to be administered.
- 1.3 Successful Contractor – the lowest, responsible and responsive Contractor to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes and award.

2. Copies of Project Documents.

- 2.1 Complete sets of the Project Documents in the number and for the sum, if any, stated in the Advertisement or Notice to Contractors may be obtained from the Issuing Office.
- 2.2 Complete sets of Project Documents must be used in preparing Bids; neither Owner nor Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Project Documents.
- 2.3 Owner and Engineer in making copies of Project Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

3. Qualifications of Contractors.

To demonstrate qualifications to perform the Work, each Contractor must submit within two (2) business days after Bid opening upon Owner's request detailed written evidence such as financial data, previous experience, present commitments and other such data as may be called for below. Each Bid must contain evidence of Contractors qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the contract.

Contractor shall have prior experience during the last five (5) years with chiller and chilled water systems installation. This experience shall be required as a minimum qualification for this award. Failure to provide projects meeting this criteria with references in the Contractor's Qualification Questionnaire, Page CQQ 1 of 3, of the Bid Documents shall deem the contractor's proposal incomplete.

4. Examination of Documents and Site.

- 4.1 It is the responsibility of each contractor before submitting a Bid:
 - 4.1.1 To examine thoroughly these documents and other related data identified (including "technical data" referred to below);

- 4.1.2 To visit the site to become familiar with and satisfy Contractor as to the general, local and site conditions that may affect cost, progress, performance, or furnishing of the Work;
- 4.1.3 To consider federal, state, and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work;
- 4.1.4 To study and carefully correlate Contractors knowledge and observations with these Project Documents and such other related data; and
- 4.1.5 To promptly notify Engineer of all conflicts, errors, ambiguities or discrepancies which Contractor has discovered in or between these Project Documents and such other related documents.
- 4.2 Reference is made to the Supplementary Conditions for identification of:
- 4.2.1 Those reports of explorations and tests of subsurface conditions at or contiguous to the site which have been utilized by Engineer in preparation of these Project Documents. Contractor may rely upon the general accuracy of the "technical data" contained in such reports but not upon other data, interpretations, opinions or information contained in such reports or otherwise relating to the subsurface conditions at the site, nor upon the completeness thereof for the purposes of the bid or construction.
- 4.2.2 Those drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the site that have been utilized by Engineer in preparation of these Project Documents. Contractor may rely upon the general accuracy of the "technical data" contained in such drawings but not upon other data, interpretations, opinions, or information shown or indicated in such drawings or otherwise relating to such structures, nor upon the completeness thereof for the purposes of the bid or construction.
- Copies of such reports and drawings will be made available by Owner to any Contractor on request. Those reports and drawings are not part of the Project Documents, but the "technical data" contained therein upon which Contractor is entitled to rely as provided in Paragraph 4.2 of the General Conditions and has been identified and established in Article 4 of the Supplementary Conditions. Contractor is responsible for any interpretation or conclusion drawn from any "technical data" or any such data, interpretations, opinions, or information.
- 4.3 Information and data shown or indicated in these Project Documents with respect to existing Underground Facilities at or contiguous to the site is based upon information and data furnished to Owner and Engineer by Owners of such Underground Facilities or others, and the Owner and Engineer do not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary Conditions.
- 4.4 Provisions concerning responsibilities for the adequacy of data furnished to prospective Contractors with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in these Project Documents due to differing or unanticipated conditions appear in Paragraphs 4.2 and 4.3 of the General Conditions.
- 4.5 Before submitting a Bid each Contractor will be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site or otherwise, which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by the Contractor and safety precautions and programs incident thereto or performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents.

- 4.6 On request, Owner will provide each Contractor access to the site to conduct such examinations, investigations, explorations, tests, and studies as each Contractor deems necessary for submission of a Bid. Contractor must fill all holes and clean up and restore the site to its former conditions upon completion of such explorations, investigations, tests, and studies.
- 4.7 Reference is made to the Supplementary Conditions for the identification of the general nature of work that is to be performed at the site by Owner or others (such as utilities and other prime contractors) that relates to the work for which a Bid is to be submitted. On request, Owner will provide to each Contractor for examination access to or copies of appropriate documents (other than portions thereof related to price) for such work.
- 4.8 The submission of a Bid will constitute and incontrovertible representation by Contractor that Contractor has complied with every requirement of this Article 4, that without exception of the Bid is premised upon performing and furnishing the Work required by these Project Documents and applying the specific means, methods, techniques, sequences, or procedures for construction (if any) that may be shown or indicated or expressly required by these Project Documents, the Contractor has given Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Contractor has discovered in these Project Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.
- 4.9 The provisions of 1-4.1 through 4.8, inclusive, do not apply to Asbestos, Polychlorinated biphenyls (PCBs), Petroleum, Hazardous Waste, or Radioactive Material covered by Paragraph 4.5 of the General Conditions.

5. Availability of Lands for Work, Etc.

The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the successful Contractor in performing the Work are identified in these Project Documents. All additional land and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by the Successful Contractor. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in these Project Documents.

6. Interpretations and Addenda.

- 6.1 All questions about the meaning or intent of these Project Documents are to be directed to Engineer. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed, faxed or delivered to all parties recorded by Engineer as having received the Project Documents. Questions received less than ten (10) days prior to the date for opening of Bids may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 6.2 Addenda may also be issued to modify these Project Documents as deemed advisable by Owner or Engineer.

7. Bid Security.

- 7.1 Each Bid must be accompanied by Bid security made payable to Owner in an amount of five percent (5%) of Contractors maximum Bid Price in the form of a certified or bank check or a Bid

Bond on form attached, issued by a surety meeting the requirements of Paragraph 5.1 of the General Conditions.

- 7.2 The Bid security of Successful Contractor will be retained until such Contractor has executed the Agreement, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Contractor fails to execute and deliver the Agreement and furnishes the required contract security within fifteen days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Contractor will be forfeited. The Contractor security of other Contractors whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of:

the seventh (7th) day after the Effective Date of the Agreement

or

the sixtieth (60th) day after the Bid opening,

whereupon Bid security furnished by such Contractors will be returned. Bid security with Bids which are not competitive will be returned within seven (7) days after the Bid opening.

8. Contract Times.

The number of days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the term "Contract Times" is defined in paragraph 1.12 of the General Conditions) are set forth in the Agreement (or incorporated therein by reference to the attached Bid Form).

9. Substitute and "Or-Equal" Items.

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications. Whenever it is indicated in the Drawings or specified in the specifications that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to the County, acceptance of the substitution "or equal" to material or equipment, will typically be considered by the County after the contract is awarded. must be approved prior to submission of the bid responses. However, any proposed substitution that represents a deviation from the design intent, must be approved prior to submission of the bid responses. A determination as to whether a design deviation or particular item that changes the design intent of the plans or specification is acceptable as a substitute or "equal" will be made by the County and Engineer. Design deviations approved prior to bid submittals will be made known to other bidders through an addendum. Specific product substitute materials or equipment and requested "or equal" items to be used will be reviewed during the submittal process and follow the procedures outlined in Paragraphs 6.7.1, 6.7.2. and 6.7.3. of the General Conditions.

10. Subcontractors, Suppliers, and Others

- 10.1 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers and other persons and organizations (including those who are to furnished the principal items of material and equipment) to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, apparent Successful Contractor, and any other Contractor so requested, shall within 24 hours after Bid opening submit to Owner a list of all such Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the

Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor Supplier, person, or organization if requested by Owner. An Owner or Engineer who after due investigation has reasonable objection to any proposed Subcontractor, Supplier, other person, or organization, may before the Notice of Award is given request apparent Successful Contractor to submit an acceptable substitute without an increase in Bid Price.

If apparent Successful Contractor declines to make any such substitution, Owner may award the contract to the next lowest Contractor that proposes to use acceptable Subcontractors, Suppliers, and other persons and organizations. The declining to make requested substitutions will not constitute grounds for sacrificing the Bid security of any Contractor. Any subcontractor, Supplier, other person or organization listed and to whom Owner or Engineer does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.8.2 of the General Conditions.

11. Bid Form.

- 11.1 All blanks on the Bid Form must be completed by printing in ink or by typewriter.
- 11.2 Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.
- 11.3 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.
- 11.4 All names must be typed or printed in ink below the signature.
- 11.5 The bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).
- 11.6 The address and telephone number for communications regarding the bid must be shown.
- 11.7 Evidence of authority to conduct business as an out-of-state corporation in the state where the Work is to be performed shall be provided. State contractor license number, if any, must also be shown.

12. Submission of Bids.

- 12.1 Contractor shall submit the original plus two (2) copies of their bid to the place indicated in the Advertisement of Notice to Contractor.
- 12.2 Bids shall be submitted at the time and place indicated in the Advertisement of Notice to Contractor and shall be enclosed in an opaque sealed envelope, marked with the Project title and name and address of Contractor and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system the sealed envelope shall

be enclosed in a separate envelope with the notation "**BID ENCLOSED – VPS CHILLER REPLACEMENT PROJECT**" on the face of it.

13. Modification and Withdrawal of Bids.

- 13.1 Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are submitted at any time prior to the opening of Bids.
- 13.2 If, within twenty-four hours after Bids are opened, any Contractor files a duly signed, written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Contractor may withdraw its Bid and bid security will be returned. Thereafter, that Contractor will be disqualified from further bids on the Work to be provided under the Project Documents.

14. Opening of Bids.

Bids will be opened and (unless obviously non-responsive) read aloud publicly at the place where Bids are to be submitted. An abstract of the amounts of the base Bids and major alternates (if any) will be made available to Contractors after the opening of Bids.

15. Bids to Remain Subject to Acceptance.

All Bids will remain subject to acceptance for one hundred twenty (120) days after the day of the Bid opening, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to that date.

16. Disqualification of Contractors.

Any of the following reasons may be considered as sufficient for the disqualification of a contractor and the rejection of his proposal or proposals:

- A. More than one proposal for the same work from an individual, firm or corporation under the same or different name.
- B. Evidence that the contractor has a financial interest in the firm of another contractor for the same work.
- C. Evidence of collusion among contractors. Participants in such conclusion will receive no recognition as contractors for any future work of the County until such participant shall have been reinstated as a qualified contractor.
- D. Uncompleted work that in the judgment of the County might hinder or prevent the prompt completion of additional work if awarded.
- E. Failure to pay or satisfactorily settle all bills due for labor and material on former contracts in force at the time of advertisement for bids.
- F. Default under previous contract.

17. Award of Contract.

- 17.1 Owner reserves the right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, non-responsive, unbalanced, or conditional Bids and to reject the Bid of any Contractor if Owner believes that it would not be in the best interest of the Project to make an award to that Contractor, whether because the Bid is not responsible or the Contractor is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.
- 17.2 In evaluating Bids, Owner will consider the qualifications of Contractors, whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- 17.3 Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the Supplementary Conditions. Owner also may consider the operating costs, maintenance requirements, performance data and guarantees of major item of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.
- 17.4 Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications, and financial ability of Contractors, proposed Subcontractors, Suppliers, and other persons and organizations to perform and furnish the Work in accordance with the Project Documents to Owner's satisfaction within the prescribed time.
- 17.5 The Owner in its absolute discretion may reject any bid of a Contractor that has failed, in the opinion of the Owner, to complete or perform an Owner-contracted project in a timely fashion, and emphasizes this condition to potential Contractors.
- 17.6 If a contract is to be awarded, it will be awarded to lowest responsive, responsible Contractor whose evaluation by Owner indicates to Owner that the award will be in the best interests of the Project.

18. Pre-Bid Conference.

A **non-mandatory** Pre-Bid Conference will be conducted at the Destin-Fort Walton Beach Airport, Conference Room No. 1, 1701 State Road 85 N., Eglin AFB, Florida 32542, at 10:00 am on Wednesday, June 13, 2018. Engineer will transmit to all plan holders of record such Addenda as Engineer considers necessary in response to written questions received no later than seven (7) days prior to the Bid Opening date. Oral statements may not be relied upon and will not be binding or legally effective.

19. Sales and Use Taxes.

Work under this Bid is subject to the provisions of Chapter 212, Florida Statutes, Tax on state, Use and Other Transactions. Other state, local, or federal taxes may be applicable. The contractor is responsible to remit to the appropriate governmental entity all applicable taxes. Any applicable tax shall be included in the total Bid price by the contractor.

OKALOOSA COUNTY STANDARD CLAUSES

INDEMNIFICATION AND HOLD HARMLESS

To the fullest extent permitted by law, **CONTRACTOR** shall indemnify and hold harmless **COUNTY**, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or intentional wrongful conduct of the **CONTRACTOR** and other persons employed or utilized by the **CONTRACTOR** in the performance of this Agreement.

NOTE: For Contractor's convenience, this certification form is enclosed and is made a part of the bid package.

CONFLICT OF INTEREST

The award hereunder is subject to the provisions of Chapter 112, Florida Statutes. All respondents must disclose with the proposal the name of any officer, director, or agent who is also a public officer or an employee of the Okaloosa Board of County Commissioners, or any of its agencies.

Furthermore, all respondents must disclose the name of any County officer or employee who owns, directly or indirectly, an interest of five percent (5%) or more in the firm or any of its branches.

Furthermore, the official, prior to or at the time of submission of the proposal, must file a statement with the Clerk of Circuit Court of Okaloosa County if he is an officer or employee of the County, disclosing his or spouse's or child's interest and the nature of the intended business.

NOTE: For Contractor's convenience, a certification form is enclosed and is made a part of the bid package

IDENTICAL TIE PROPOSALS

In cases of identical procurement responses, the award shall be determined either by lot or on the basis of factors deemed to serve the best interest of the County. In the case of the latter, there must be adequate documentation to support such a decision.

TRENCH SAFETY ACT

Each contractor must submit with his bid an executed sworn certification that he will comply with the Trench Safety Act, Chapter 90-96, Florida Statutes, on trench safety.

NOTE: For Contractor's convenience, a certification form is enclosed and is made a part of the bid package.

PUBLIC ENTITY CRIME INFORMATION

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.107, for CATEGORY TWO for a period of 36 months from the date of being placed on the convicted vendor list.

BONDING REQUIREMENTS

Bid Bond, Payment Bond and Performance Bond, and others as required.

INSURANCE REQUIREMENTS

CONTRACTORS INSURANCE

1. The Contractor shall not commence any work in connection with this Agreement until he has obtained all required insurance and such insurance has been approved by the Okaloosa County Risk Manager or designee.
2. All insurance policies shall be with insurers authorized to do business in the State of Florida.
3. All insurance shall include the interest of all entities named and their respective officials, employees & volunteers of each and all other interests as may be reasonably required by Okaloosa County. The coverage afforded the Additional Insured under this policy shall be primary insurance. If the Additional Insured have other insurance that is applicable to the loss, such other insurance shall be on an excess or contingent basis. The amount of the company's liability under this policy shall not be reduced by the existence of such other insurance.
4. Where applicable, the County shall be shown as an Additional Insured with a Waiver of Subrogation on the Certificate of Insurance.
5. The County shall retain the right to reject all insurance policies that do not meet the requirement of this Agreement. Further, the County reserves the right to change these insurance requirements with 60-day notice to the Contractor.
6. The County reserves the right at any time to require the Contractor to provide copies of any insurance policies to document the insurance coverage specified in this Agreement.
7. The designation of Contractor shall include any associated or subsidiary company which is involved and is a part of the contract and such, if any associated or subsidiary company involved in the project must be named in the Workers' Compensation coverage.
8. Any exclusions or provisions in the insurance maintained by the Contractor that excludes coverage for work contemplated in this agreement shall be deemed unacceptable and shall be considered breach of contract.

WORKERS' COMPENSATION INSURANCE

1. The Contractor shall secure and maintain during the life of this Agreement Workers' Compensation insurance for all of his employees employed for the project or any site connected with the work, including supervision, administration or management, of this project and in case any work is sublet, with the approval of the County, the Contractor shall require the Subcontractor similarly to provide Workers' Compensation insurance for all employees employed at the site of the project, and such evidence of insurance shall be furnished to the County not less than ten (10) days prior to the commencement of any and all sub-contractual Agreements which have been approved by the County.
2. Contractor must be in compliance with all applicable State and Federal workers' compensation laws, including the U.S. Longshore Harbor Workers' Act or Jones Act, if applicable.
3. No class of employee, including the Contractor himself, shall be excluded from the Workers' Compensation insurance coverage. The Workers' Compensation insurance shall also include Employer's Liability coverage.

BUSINESS AUTOMOBILE LIABILITY

Coverage must be afforded for all Owned, Hired, Scheduled, and Non-Owned vehicles for Bodily Injury and Property Damage in an amount not less than \$1,000,000 combined single limit each accident. If the contractor does not own vehicles, the contractor shall maintain coverage for Hired & Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Policy. Contractor must maintain this insurance coverage throughout the life of this Agreement.

COMMERCIAL GENERAL LIABILITY INSURANCE

1. The Contractor shall carry other Commercial General Liability insurance against all other Bodily Injury, Property Damage and Personal and Advertising Injury exposures.
2. All liability insurance (other than Professional Liability) shall be written on an occurrence basis and shall not be written on a claims-made basis. If the insurance is issued with an aggregate limit of liability, the aggregate limit of liability shall apply only to the locations included in this Agreement. If, as the result of any claims or other reasons, the available limits of insurance reduce to less than those stated in the Limits of Liability, the Contractor shall notify the County representative in writing. The Contractor shall purchase additional liability insurance to maintain the requirements established in this Agreement. Umbrella or Excess Liability insurance can be purchased to meet the Limits of Liability specified in this Agreement.
3. Commercial General Liability coverage shall include the following:
 - 1.) Premises & Operations Liability
 - 2.) Bodily Injury and Property Damage Liability
 - 3.) Independent Contractors Liability
 - 4.) Contractual Liability
 - 5.) Products and Completed Operations Liability
4. Contractor shall agree to keep in continuous force Commercial General Liability coverage for the

length of the contract.

LIMITS OF LIABILITY

The insurance required shall be written for not less than the following, or greater if required by law and shall include Employer's liability with limits as prescribed in this contract:

	<u>LIMIT</u>
1. Worker's Compensation	
1.) State	Statutory
2.) Employer's Liability	\$500,000 each accident
2. Business Automobile	\$1M each occurrence (A combined single limit)
3. Commercial General Liability for Bodily Injury & Property Damage	\$1M each occurrence
\$1M each occurrence Products and completed operations	
4. Personal and Advertising Injury	\$1M each occurrence

NOTICE OF CLAIMS OR LITIGATION

The Contractor agrees to report any incident or claim that results from performance of this Agreement. The County representative shall receive written notice in the form of a detailed written report describing the incident or claim within ten (10) days of the Contractor's knowledge. In the event such incident or claim involves injury and/or property damage to a third party, verbal notification shall be given the same day the Contractor becomes aware of the incident or claim followed by a written detailed report within ten (10) days of verbal notification.

INDEMNIFICATION & HOLD HARMLESS

To the fullest extent permitted by law, Contractor shall indemnify and hold harmless the County, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of this contract.

Note: For Contractor's convenience, this certification form is enclosed and is made a part of the bid package.

CERTIFICATE OF INSURANCE

1. Certificates of insurance indicating the job site and evidencing all required coverage must be submitted not less than 10 days prior to the commencement of any of the work. The certificate holder(s) shall be as follows: Okaloosa County, 5479A Old Bethel Road, Crestview, Florida, 32536.
2. The contractor shall provide a Certificate of Insurance to the County with a thirty (30) day notice of cancellation; ten (10 days' notice if cancellation is for nonpayment of premium).
3. In the event that the insurer is unable to accommodate the cancellation notice requirement, it shall be the responsibility of the contractor to provide the proper notice. Such notification shall be in writing by registered mail, return receipt requested, and

addressed to the Okaloosa County Purchasing Department at 5479-A Old Bethel Road, Crestview, FL 32536.

GENERAL TERMS

Any type of insurance or increase of limits of liability not described above which, the Respondent required for its own protection or on account of statute shall be its own responsibility and at its own expense.

The carrying of the insurance described shall in no way be interpreted as relieving the Respondent of any responsibility under this contract.

Should the Respondent engage a subcontractor or sub-subcontractor, the same conditions will apply under this Agreement to each subcontractor and sub-subcontractor.

The Respondent hereby waives all rights of subrogation against Okaloosa County and its consultants and other indemnities of the Respondent under all the foregoing policies of insurance.

UMBRELLA INSURANCE

The Respondent shall have the right to meet the liability insurance requirements with the purchase of an umbrella insurance policy. In all instances, the combination of primary and umbrella liability coverage must equal or exceed the minimum liability insurance limits stated in this Agreement.

DELIVERY OF BIDS

Bid Opening shall be public, on the date and time specified on the NOTICE TO CONTRACTORS. It is the contractor’s responsibility to assure that his bid is delivered at the proper time and place. Offers by telegram, facsimile, or telephone are NOT acceptable. NOTE: Crestview, Florida is “not a next-day-guaranteed delivery location” by delivery services.

Liquidated Damages:

In case of failure on the part of the Contractor to complete the work within the time(s) specified in the contract, or within such additional time(s) as may be granted by Okaloosa County, the County will suffer damage, the amount of which is difficult, if not impossible, to ascertain. Therefore, the Contractor shall pay to the County, as liquidated damages, the amount established in the schedule below for each calendar day of delay that actual completion extends beyond the time limit specified until such reasonable time as may be required for final completion of the work. In no way shall costs for liquidated damages be construed as penalty on the contractor.

Daily Charge

<u>Original Contract Amount</u>	<u>Per Calendar Day</u>
\$50,000 and under	\$ 311
Over \$50,000 but less than \$250,000	972
\$250,000 but less than \$500,000	1584
\$500,000 but less than \$2,500,000	1924
\$2,500,000 but less than \$5,000,000	2694
\$5,000,000 but less than \$10,000,000	3902
\$10,000,000 but less than \$15,000,000	6102

\$15,000,000 but less than \$20,000,000
\$20,000,000 and over

7022
7022 plus 0.2% for
any amount over
\$20 million

- a. **Determination of Number of Days of Default:** For all contracts, regardless of whether the contract time is stipulated in calendar days or working days, the default days shall be counted in calendar days.
- b. **Conditions under which Liquidated Damages are Imposed:** Should the Contractor or, in case of his default, the Surety, fail to complete the work within the time stipulated in the contract, or within such extra time as may have been granted by the County, the Contractor or, in case of his default, the Surety, shall pay to the County, not as a penalty, but as liquidated damages, the amount so due as determined by the Code requirements, as provided above.
- c. **Right of Collection:** The County shall have the right to apply as payment on such liquidated damages any money which is due to the Contractor by the County.
- d. **Permitting Contractor to Finish Work:** Permitting the Contractor to continue and to finish the work, or any part of it, after the expiration of the contract time allowed, including extensions of time granted to the Contractor, shall in no way act as a waiver on the part of the County the liquidated damages due under the contract.
- e. **Completion of Work by County:** In case of default of the contract and the completion of the work by the County, the Contractor and his Surety shall be liable for the liquidated damages under the contract, but no liquidated damages shall be chargeable for any delay in the final completion of the work by the County due to any unreasonable action or delay on the part of the County.

BID DOCUMENTS



BID DOCUMENTS
DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT

BID FORM

PROJECT IDENTIFICATION:

VPS CHILLER REPLACEMENT

THIS BID IS SUBMITTED TO:

OKALOOSA COUNTY PURCHASING DEPARTMENT

1. The undersigned Contractor proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in these documents to perform and furnish all Work as specified or indicated in these documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of these documents.
2. Contractor accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Contractors, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for one hundred twenty (120) days after the day of Bid opening. Contractor will sign and deliver the required number of counterparts of the Agreement with the Bonds and other documents required by the Project Requirements within fifteen (15) days after the date of Owner's Notice of Award.
3. In submitting this Bid, Contractor represents as more fully set forth in the Agreement, that:
 - (a) Contractor has examined and carefully studied the Project Documents and the following Addenda receipt of all which is hereby acknowledged: (List Addenda by Addendum Number and Date)

Addendum No. _____ Date _____

Addendum No. _____ Date _____

Addendum No. _____ Date _____

Addendum No. _____ Date _____

- (b) Contractor has visited the site and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance, and furnishing of the Work.
- (c) Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.
- (d) Contractor has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except underground facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. Contractor accepts the determination set forth in Article 4 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which Contractor is entitled to rely as provided in paragraph 4.2 of the General Conditions. Contractor acknowledges that such reports and drawings are not Contract Documents and may not be complete

for Contractor's purposes. Contractor acknowledges that Owner and Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Project Documents with respect to underground facilities at or contiguous to the site. Contractor has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and underground facilities) at or contiguous to the site or otherwise which may affect cost progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto. Contractor does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price, and other terms and conditions of these Documents.

- (e) Contractor is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in these documents.
 - (f) Contractor has correlated the information known to Contractor, information and observation obtained from visits to the site, reports and drawings identified in these documents and all additional examinations, investigations, explorations, tests, studies, and data with these documents.
 - (g) Contractor has given Engineer written notice of all conflicts, errors, ambiguities or discrepancies that Contractor has discovered in these documents and the written resolution thereof by Engineer is acceptable to Contractor, and these documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.
 - (h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Contractor has not directly or indirectly induced or solicited any other Contractor to submit a false or sham Bid; Contractor has not solicited or induced any person, firm or corporation to refrain from Project; and Contractor has not sought by collusion to obtain for itself any advantage over any other Contractor or over Owner.
4. Contractor will complete the Work in accordance with these documents for the price found in the Bid Schedule:

Unit Prices have been computed in accordance with paragraph 11.9.2 of the General Conditions.

Contractor acknowledges that quantities are not guaranteed and final payment will be based on actual quantities determined as provided in these documents.

- 5. Contractor agrees that Work will be substantially complete 150 calendar days after the date when the Contract Time commences to run as provided in paragraph 2.3 of the General Conditions, and will be completed and ready for final payment in accordance with paragraph 14.13 of the general conditions within 180 calendar days after the date when the Contract Time commences to run.
- 6. Contractor accepts the provisions of the Agreement as to liquidated damages in the event of failure to achieve substantial complete of the Work within the Substantial Completion time and achieve final completion of the work within the Final Completion time as specified in the Agreement.

7. The following documents are attached to and made a condition of this Bid:
- a) Bid Security as required by the Instructions to Contractors in the form of a certified or bank check made payable to The Board of County Commissioners of Okaloosa County or a Bid Bond on form attached, issued by a surety meeting the requirements of Paragraph 5.1 of the General Conditions. (ITC-1 to ITC-8)
 - b) Bid Schedule (BS-1 to BS-17)
 - c) Bid Affidavit (BA-1)
 - d) Bid Bond (BB-1 to BB-2)
 - e) Required Contractor's Qualification Statement with supporting data. (CQQ-1 to CQQ-3)
 - f) Form of Noncollusion Affidavit (NCA-1)
 - g) Certification of Non-Segregated Facilities (NSF-1)
 - h) Public Entity Crimes (SSPEC-1 to SSPEC-3)
 - i) Certificate as to Corporate Principal (CCP-1)
 - j) Certified Copy of Resolution of Board of Directors (RBD-1)
 - k) Conflict of Interest Disclosure Form (OC-1)
 - l) Drug-Free Workplace Certification (OC-2)
 - m) Certification of Contractor Regarding Trench Safety (OC-3)
 - n) Indemnification and Hold Harmless (OC-4)
 - o) Insurance Compliance (OC-5)
 - p) Affidavit – Worker’s Compensation (OC-6)
 - q) Recycled Content Form (OC-7)
 - r) Disadvantaged Business Enterprise Program (OC-8 to OC-11)
 - s) DBE Certificate of Compliance Form (OC-12)
 - t) A tabulation of Performance of Work by Subcontractors that Contractor prepares to use. (PWSC-1)
 - u) E-Verify Compliance Certification (EVCC-1)
 - v) Cone of Silence (CS-1)

- w) Buy American Certificate (BAC-1)
- x) Lobbying – 31 USC 1352 (LF-1)
- y) Equal Employment Opportunity Report Statement (EEOR-1)

8. Communications concerning this Bid shall be addressed to the address of Contractor indicated below.

9. Terms used in this Bid which are defined in the General Conditions or Instructions to Contractors will have the meanings indicated in the General Conditions or Instructions.

SUBMITTED on _____, 20__

State Contractor License No. _____

If Contractor is:

An Individual

By _____ (SEAL)

(Individual's Name)

doing business as _____

Business address: _____

Phone No.: _____

A Partnership

By _____ (SEAL)

(Firm Name)

(General Partner)

Business address: _____

Phone No.: _____

A Corporation

By _____ (SEAL)

(Corporation Name)

(State of Incorporation)

By _____ (SEAL)

(Name of person authorized to sign)

(Title)

(Corporate Seal)

Attest _____

(Secretary)

Business address: _____

Phone No.: _____

Date of Incorporation is _____

BID SCHEDULE

BIDDER: _____ **DATE:** _____

PROJECT DESCRIPTION: DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT PROJECT

BID SCHEDULE

BASE BID

For all work required to perform the work in accordance with the construction drawings, specifications, and other contract documents, including all costs related to the work, and any required permits, taxes, bonds and insurance, excluding the work specified in Additive Alternate Nos. 1 and 2, the undersigned submits a total lump sum Base Bid amount of:

TOTAL LUMP SUM BASE BID AMOUNT (in words): _____

_____ Dollars and _____ cents

(\$ _____)
(amount in numbers)

ADDITIVE ALTERNATE NO. 1

For all work required to furnish and install chilled water pump CHWP-3 and respective variable speed drive. This work shall include BAS upgrade to current software license, new workstation, additional sensors, devices and programming for chilled water pump CHWP-3, new control valves for chillers and variable primary pumping system, all requirements of sequences of operation as shown on Sheets M-701, M-702, and in Specification Section 23 09 13. For all costs related to this work, and any required permits, taxes, bonds and insurance, the undersigned submits a total lump sum Additive Alternate No. 1 amount of:

TOTAL LUMP SUM ADDITIVE ALTERNATE NO. 1 BID AMOUNT (in words): _____

_____ Dollars and _____ cents

(\$ _____)
(amount in numbers)

ADDITIVE ALTERNATE NO. 2

For all work required to provide commissioning of HVAC system as described in Specification Sections 01 91 13 and 23 08 01 and shall include complete airside test and balance in accordance with specification 23 05 93 (note that water side test and balance shall be included in Base Bid). For all costs related to this work, and any required permits, taxes, bonds and insurance, the undersigned submits a total lump sum Additive Alternate No. 2 amount of:

TOTAL LUMP SUM ADDITIVE ALTERNATE NO. 2 BID AMOUNT (in words): _____

_____ Dollars and _____ cents

(\$ _____)
(amount in numbers)

BID SUMMARY (amount in numbers)

- (A) **TOTAL BASE BID AMOUNT:** \$ _____
- (B) **TOTAL ADDITIVE ALTERNATE NO. 1 AMOUNT:** \$ _____
- (C) **TOTAL ADDITIVE ALTERNATE NO. 2 AMOUNT:** \$ _____
- (D) **TOTAL BID AMOUNT (A + B + C):** \$ _____

Note: The successful bidder shall provide a detailed schedule of values to be used to evaluate percentage of completion during each pay application.

The Bidder represents that it has examined the site of the Work and informed itself fully in regard to all conditions pertaining to the place where the work is to be done; that it has examined the plans and specifications for the work and other Contract Documents relative thereto and has read all of the Addenda furnished prior to the opening of the Bids, as acknowledged below; and that it has otherwise fully informed itself regarding the nature, extent, scope and details of the Work to be performed.

If provided with a Notice of Intent to Award the Contract by the Owner, the Bidder shall execute and deliver to the Owner all of the documents required by the Contract Documents, including but not limited to, the Addendum to the Agreement and the Performance and Payment Bonds in the form contained in the Contract Documents, furnish the required evidence of the specified insurance coverages, furnish all necessary permits, license, materials, equipment, machinery, maintenance, tools, apparatus, means of transportation and labor necessary to complete the Work.

Dated and signed at _____, _____, this _____ day of _____, 2018.

(Name of Bidder)

(Authorized Signature)

(Title)

(Mailing Address)

(City, State, Zip)

(Federal ID No. or SS No.)

BID AFFIDAVIT

The following affidavit must be executed in order that your quotation may be considered.

STATE OF _____

COUNTY OF _____

_____ of lawful age, being first duly sworn, upon his oath deposes and says: That he executed the accompanying Quotation of behalf of the Contractor therein named, and that he had lawful authority so to do, and said Contractor has not directly or indirectly, entered into any agreement, expressed or implied, with any Contractor or Contractors, having to its object the controlling of the price or amount of such quotation or any quotations, the limiting of the Quotation or Contractors, the parceling or farming out to any Contractor or Contractors, to other persons of any part of the contract or any of the subject matter or the Quotations, or of the profits thereof, and that he has not and will not divulge the sealed Quotation to any person whomsoever, except those having a partnership or other financial interest with him in said Quotation or Quotations, until after the sealed Quotation or Quotations are opened.

[signature]

[date]

STATE OF _____ COUNTY OF _____

PERSONALLY APPEARED BEFORE ME, the undersigned authority,

[name of individual signing]

who, after first being sworn by me, affixed his/her signature in the space provided above on this ____ day of _____, 20__.

Subscribed and sworn to before me this _____ day of _____, 20__.

My Commission Expires:

Notary Public

BID BOND

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address):

Okaloosa County
5479A Old Bethel Road
Crestview, FL 32536

BID:

BID DUE DATE: _____
PROJECT (Brief Description Including Location): _____
VPS CHILLER REPLACEMENT PROJECT
Okaloosa County, Florida

BOND:

BOND NUMBER: _____
DATE: (Not later than Bid Due Date): _____
PENAL SUM: _____

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR

SURETY

Contractor's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note:

- (1) Above addresses are to be used for giving required notice.
- (2) Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

EJCDC NO. 1910-28-C (1990 Edition)

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to OWNER upon default of Contractor the penal sum set forth on the face of this Bond.
2. Default of Contractor shall occur upon the failure of Contractor to deliver within the time required by the Project Documents the executed Agreement required by the Project Documents and any performance and payment bonds required by the Project Documents and Contract Documents.
3. This obligation shall be null and void if:
 - 3.1. OWNER accepts Contractor's Bid and Contractor delivers within the time required by the Project Documents (or any extension thereof agreed to in writing by OWNER) the executed Agreement required by the Project Documents and any performance and payment bonds required by the Project Documents and Contract Documents, or
 - 3.2 All Bids are rejected by OWNER, or
 - 3.3 OWNER fails to issue a notice of award to Contractor within the time specified in the Project Documents (or any extension thereof agreed to in writing by Contractor and, if applicable, consented to by Surety when required by paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Contractor and within 30 calendar days after receipt by Contractor and Surety of written notice of default from OWNER, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of and any and all defenses based on or arising out of any time extension to issue notice of award agreed to in writing by OWNER and Contractor, provided that the time for issuing notice of award including extensions shall not in the aggregate exceed 120 days from Bid Due Date without Surety's written consent.
6. No suit or action shall commenced under this Bond prior to 30 calendar days after the notice of default required in paragraph 4 above is received by Contractor and Surety, and in no case later than one year after Bid Due Date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notice required hereunder shall be in writing and sent to Contractor and Surety at their respective addresses shown on the face of this Bond. such notices may be sent by personal deliver, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of any Bond conflicts with any applicable provision of any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

10. Provide a financial statement for your company. This should include a balance and income statement for your most recent fiscal year. A certified audit is preferred but not required. Use an insert sheet, if needed. Only three (3) lowest bidders shall submit this information (if requested by Owner) to the Owner within two (2) business days of the opening of the Bids.

11. State the true, exact, correct and complete name of the partnership, corporation or trade name under which you do business, and the address of the place of business. (If a corporation, state the name of all partners. If a trade name, state the names of the individuals who do business under the trade name.) It is absolutely necessary that information be furnished.

Correct Name of Contractor _____

(a) The business is a _____

(b) The address of principal place of business is:

(c) The names of the corporate officers, or partners, or individuals doing business under a trade name, are as follows:

FORM OF NONCOLLUSION AFFIDAVIT

(This Affidavit is Part of Bid)

STATE OF _____

COUNTY OF _____

_____ Being

first duly sworn, deposes and says that he is

_____ (Sole owner, a partner, president, secretary, etc.) of

_____ the party making the foregoing Proposal or BID that such BID is genuine and not collusive or sham; that said CONTRACTOR has not colluded, conspired, connived, or agreed, directly or indirectly, with any CONTRACTOR or person, to put in a sham BID, or that such other person shall refrain from the project, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the Bid Price of affiant or any other CONTRACTOR, or to fix any overhead, profit or cost element of said Bid Price, or of that of any other CONTRACTOR, or to secure any advantage against OWNER any person interested in the proposed Contract; and that all statements in said Proposal or Bid are true; and further, that such CONTRACTOR has not, directly or indirectly submitted this BID, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

_____ (Contractor)

Sworn to and subscribed before me this _____ day of

_____, 20__.

Notary Public in and for

_____ County,

_____.

My Commission Expires:

_____, 20__.

CERTIFICATION OF NON-SEGREGATED FACILITIES

(Must be completed and submitted with the Bid)

The Contractor certifies that it does not maintain or provide for its employee any segregated facilities at any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor certifies further that it will not maintain or provide for its employees segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this certification is a violation of the equal opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting room, work areas, restrooms and washrooms, restaurants and other eating areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on basis of race, color, religion, or national origin, because of habit, local custom, or any other reason. The Contractor agrees that (except where it has obtained identical certification from proposed subcontractors for the specific time period) it will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the equal opportunity clause, and that it will retain such certification in its files.

(Name of Contractor)

By: _____

Title: _____

Dated: _____

**SWORN STATEMENT UNDER SECTION 287.133 (3) (a),
FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES**

**THIS FORM MUST BE SIGNED AND SWORN IN THE PRESENCE OF A NOTARY PUBLIC OR
OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.**

1. This sworn statement is submitted to _____
[print name of public entity]

by _____
[print individuals name and title]

for _____
[print name of entity submitting sworn statement]

whose business is _____ and (if applicable) its
Federal Employer Identification Number (FEIN) is _____. (If the entity has no FEIN,
include the Social Security Number of the individual signing this sworn statement: _____.)

2. I understand that a "public entity crime" as defined in Section 287.133 (1) (g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or of the United States, including, but not limited to, any bid or contract for goods or services to be provided to any public entity or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.

3. I understand that "convicted" or "conviction" as defined in Section 287.133 (1) (b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, non-jury trial, or entry of a plea of guilty or nolo contendere.

4. I understand that an "affiliate" as defined in Section 287.133 (1) (a), Florida Statutes, means:

A. A predecessor or successor of a person convicted of a public entity crime; or

B. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

5. I understand that a "person" as defined in Section 287.133 (1) (e) Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provision of goods

or services let by a public entity, or which otherwise transacts or applies to transact business with a public entity. The term "person" includes those officers, directors, executives, partners, shareholders, and employees, members, and agents who are active in management of an entity.

6. Based on information and belief, the statement which I have marked below is true and in relation to the entity submitting this sworn statement. **[Indicate which statement applies.]**

Neither the entity submitting this sworn statement, nor any of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, nor any affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearings and the Final Order entered by the Hearing Officer determined that it was not in the public interest to place the submitting this sworn statement on the convicted vendor list. **[attach a copy of the final order]**

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THOROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.107, FLORIDA STATUTES FOR CATEGORY TWO ON ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

[signature]

[date]

STATE OF _____ COUNTY OF _____

PERSONALLY APPEARED BEFORE ME, the undersigned authority,

[name of individual signing]

who, after first being sworn by me, affixed his/her signature in the space provided above on this ____ day of _____, 20__.

Subscribed and sworn to before me this _____ day of _____, 20__.

My Commission Expires:

Notary Public

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that _____ who signed the bond on behalf of the Principal, was then _____ of said Corporation; that I know his/her signature, and his/her signature hereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said Corporation by authority of its governing body.

Secretary (Corporate Seal)

**STATE OF FLORIDA
COUNTY OF**

Before me, a Notary Public, duly commissioned, qualified and acting, personally appeared _____ to me well known, who being my first duly sworn upon oath, says that he/she is the Attorney-in-Fact, for the _____ and that he has been authorized by _____ to execute the foregoing bond on behalf of the Contractor named therein in favor of Okaloosa County.

Subscribed and sworn to before me this ____ day of _____, 20__, A.D.

[Attach Power of Attorney to Original Bid Bond and Financial Statement from Surety Company]

Notary Public
State of Florida-at-Large

My commission Expires:

**CERTIFIED COPY OF RESOLUTION OF
BOARD OF DIRECTORS OF**

(NAME OF CORPORATION)

"RESOLVED that, _____
(Person Authorized to Sign) (Title)

of _____
(Name of Corporation)

is authorized to sign and submit the Bid of this corporation for the following Project:

VPS CHILLER REPLACEMENT PROJECT

and to include in such bid the certificate as to non-collusion, and for any inaccuracies or misstatements in such certificate this corporate Contractor shall be liable under the penalties of perjury.

The foregoing is a true and correct copy of the resolution adopted by

(NAME OF CORPORATION)

at a meeting of its Board of Directors held on the _____ day of _____, 20__.

By _____

Title _____

(SEAL)

The above form must be completed if the Contractor is a Corporation.

CONFLICT OF INTEREST DISCLOSURE FORM

For purposes of determining any possible conflict of interest, all contractors/proposers, must disclose if any Okaloosa Board of County Commissioner, employee(s), elected officials(s), or if any of its agencies is also an owner, corporate officer, agency, employee, etc., of their business.

Indicate either "yes" (a county employee, elected official, or agency is also associated with your business), or "no." If yes, give person(s) name(s) and position(s) with your business.

YES _____ NO _____

NAME(S) _____ POSITION(S) _____

FIRM NAME: _____

BY (PRINTED): _____

BY (SIGNATURE): _____

TITLE: _____

ADDRESS: _____

PHONE NO.: _____

DRUG-FREE WORKPLACE CERTIFICATION

THE BELOW SIGNED CONTRACTOR CERTIFIES that it has implemented a drug-free workplace program. In order to have a drug-free workplace program, a business shall:

1. Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.
2. Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.
3. Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection 1.
4. In the statement specified in subsection 1, notify the employees that, as a condition of working on the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, to any violation of Chapter 893 or of any controlled substance law of the United States or any state, for a violation occurring in the workplace no later than five (5) days after such conviction.
5. Impose a sanction on, or require the satisfactory participation in drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is convicted.
6. Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

As the person authorized to sign this statement, I certify that this firm complies fully with the above requirements.

DATE: _____

COMPANY: _____

SIGNATURE: _____

ADDRESS: _____

NAME: _____

(Typed or Printed)

TITLE: _____

PHONE #: _____

CERTIFICATION OF CONTRACTOR REGARDING TRENCH SAFETY

This certification is required pursuant to the Trench Safety Act, Chapter 90-98, Florida Statutes regarding Trench Safety. The Act specifically incorporates the Occupational Safety and Health Administration's excavation safety standards, 29 CFR S. 1928.650 Subpart P as the state standard. Any revision to OSHA's safety standards that are consistent with the Florida Statutes shall also be complied with upon its effective date. The act requires that any bidder or prospective contractor, or any of their proposed subcontractors, shall provide written assurance that the contractor will comply with the applicable trench safety standards

NAME AND ADDRESS OF CONTRACTOR (Include Zip Code)

1. Contractor agrees that he is aware of the Trench Safety Act and the requirements of the Act.

Yes _____ No _____

2. Contractors agrees to comply with all applicable trench safety standards as set forth in the Act and as referenced in the Act.

Yes _____ No _____

NAME AND TITLE OF SIGNER (Please Print or Type)

SIGNATURE _____ DATE _____

INDEMNIFICATION AND HOLD HARMLESS

To the fullest extent permitted by law, CONTRACTOR shall indemnify and hold harmless COUNTY, its officers and employees from liabilities, damages, losses, and costs including but not limited to reasonable attorney fees, to the extent caused by the negligence, recklessness, or intentional wrongful conduct of the CONTRACTOR and other persons employed or utilized by the CONTRACTOR in the performance of this Agreement.

Contractor's Company Name

Authorized Signature - Manual

Physical Address

Authorized Signature - Typed

Mailing Address

Title

Phone Number

FAX Number

Cellular Number

After-Hours Number(s)

Date

INSURANCE COMPLIANCE

This form is to be completed and signed the Contractor and by your insurance agent/carrier certifying that your policy either meets the insurance requirements (as specified in page BOC-2 to BOC-6) or that the insurance company has reviewed the bid requirements and certifies that you were bidd any price increase due to required coverage.

CONTRACTOR

I certify that the insurance requirements have been reviewed.

Company Name _____

Address _____

Representative

Name _____

Title _____

Phone Number _____

INSURANCE COMPANY

I certify that the insurance requirements have been reviewed with the above contractor.

Company Name _____

Address _____

Representative

Name _____

Title _____

Phone Number _____

AFFIDAVIT - WORKER'S COMPENSATION

State of _____

County of _____

SS: _____

of _____

being duly sworn, deposes and says that he now carries or that he has applied for a Worker's Compensation Policy to cover the operations, as set forth in the preceding contract, and to comply with the provisions thereof.

Signed: _____

Subscribed and sworn to before me this _____ day of _____, 20 ____

Notary Public

RECYCLED CONTENT FORM

RECYCLED CONTENT INFORMATION:

1. Is the material in the above: VIRGIN _____ or RECYCLED _____
(Check the applicable blank)
If RECYCLED, what percentage _____%.

Product Description: _____

2. Is your product packaged and/or shipped in material containing recycled content?

Yes _____ No _____

Specify: _____

3. Is your product recyclable after it has reached its intended end use?

Yes _____ No _____

Specify: _____

The above is not applicable if there is only a personal service involved with no product involvement.

Name of Contractor:

DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

The following bid condition applies to this Department of Transportation (DOT) assisted contract. Submission of a bid/proposal by a prospective contractor shall constitute full acceptance of these bid conditions.

1. **DEFINITION** - Disadvantaged Business Enterprise (DBE) as used in this contract shall have the same meaning as defined in 49 CFR Part 26.
2. **POLICY** - It is the policy of DOT that DBE's as defined in 49 CFR Part 26 shall have the maximum opportunity to participate in the performance of contracts and subcontracts financed in whole or in part with Federal funds. Consequently, the DBE requirements of 49 CFR Part 26 apply to this contract.
3. **OBLIGATION** - The contractor agrees to ensure that DBE's as defined in 49 CFR Part 26 have the maximum opportunity to participate in the performance of contracts and subcontracts financed in whole or in part with Federal funds. In this regard, all contractors shall take all necessary and reasonable steps in accordance with 49 CFR Part 26 to ensure that DBE's have the maximum opportunity to compete for and perform contracts. Contractors shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of DOT assisted contracts.
4. **COMPLIANCE** - All bidders, potential contractors, or subcontractors for this DOT assisted contract are hereby notified that failure to carry out the DOT policy and the DBE obligation, as set forth above, shall constitute a breach of contract which may result in termination of the contract or such other remedy as deemed appropriate by the owner.
5. **CONTRACT CLAUSE** - All bidders and potential contractors hereby assure that they will include the above clauses in all subcontracts, which offer further subcontracting opportunities.
6. **CONTRACT AWARD** - Bidders are hereby advised that meeting the DBE subcontract goal or making an acceptable good faith effort to meet said goal are conditions of being awarded this DOT assigned contract.

The owner proposes to award the contract to the lowest responsive and responsible bidder submitting a reasonable bid provided he has met the goal for DBE participation or, if failing to meet the goal, he has made an acceptable good faith effort to meet the established goal for DBE participation. Bidder is advised that the owner reserves the right to reject any or all bids submitted.
7. **DBE PARTICIPATION GOAL** - The attainment of the goal established for this contract is to be measured as a percentage of the total dollar value of the contract. The DBE goal established for this contract is **11.065%**.
8. **AVAILABLE DBE'S** - The FDOT maintains an online searchable database of DBE firms at <https://www3.dot.state.fl.us/equalopportunityoffice/biznet>. This program contains listing of DBE's (certified and noncertified). Bidders are encouraged to inspect this list to assist in locating DBEs for the work. Other DBEs may be added to the list in accordance with the owner's approved DBE program. Credit toward the DBE goal will not be counted unless the DBE to be used can be certified by the owner.
9. **CONTRACTOR'S REQUIRED SUBMISSION** - The owner requires the submission of the following information with the bid:

DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

MBE's

MBE Subcontractors Names/Addresses/ Identity	Subcontract Work Item	Dollar Value of Subcontract Work
_____	_____	_____
_____	_____	_____
_____	_____	_____

WBE's

Women Subcontractors Names/Addresses/ Identity	Subcontract Work Item	Dollar Value of Subcontract Work
_____	_____	_____
_____	_____	_____
_____	_____	_____

OSE's

Other Socially and Economically Disadvantaged Subcontractors within the DBE Group Names/Addresses/ Identity	Subcontract Work Item	Dollar Value of Subcontract Work
_____	_____	_____
_____	_____	_____
_____	_____	_____

<u>Total Dollar Value of Subcontract Work</u>	_____
<u>Total Dollar Value of Basic Bid</u>	_____
<u>Total DBE Percent</u>	_____ %

*(Black, Hispanic, Asian American, American Indian, and other economically disadvantaged.)

If the Contractor fails to meet the contract goal established in Section 7 above, the following information must be submitted prior to contract award to assist the owner in determining whether or not the contractor made acceptable good faith efforts to meet the contract goal. This information (when applicable), as well as the DBE information, should be submitted as specified in Section 9 above.

Suggested guidance for use in determining if good faith efforts were made by a contractor are included in 49 CFR Part 26.

A list of the efforts that a contractor may make and the owner may use in making a determination as to the acceptability of a contractor's efforts to meet the goal as included in 49 CFR Part 26 are as follows:

- a. Whether the contractor attended any pre-solicitation or pre-bid meetings that were scheduled by the recipient to inform DBE's of contracting and subcontracting opportunities;
- b. Whether the contractor advertised in general circulation, trade association, and minority-focus media concerning the subcontracting opportunities;
- c. Whether the contractor provided written notice to a reasonable number of specific DBE's that their interest in the contract was being solicited in sufficient time to allow the DBE's to participate effectively;
- d. Whether the contractor followed up initial solicitations of interest by contacting DBE's to determine with certainty whether the DBE's were interested;
- e. Whether the contractor selected portions of work to be performed by DBE's in order to increase the likelihood of meeting the DBE goal (including, where appropriate, breaking down contracts into economically feasible units to facilitate DBE participation);
- f. Whether the contractor provided interested DBE's with adequate information about the plans, specifications, and requirements of the contract;
- g. Whether the contractor negotiated in good faith with interested DBE's, not rejecting DBE's as unqualified without sound reasons based on a thorough investigation of their capabilities.
- h. Whether the contractor made efforts to assist interested DBE's in obtaining bonding, lines of credit, or insurance required by the recipient or contractor;
and
- i. Whether the contractor effectively used the services of available minority community organizations; minority contractors' groups; local and state Federal Minority Business Assistance Offices; and other organizations that provide assistance in the recruitment and placement of DBE's.

NOTE: The nine items set forth above are merely suggested criteria and the owner may specify that you submit information on certain other actions a contractor took to secure DBE participation in an effort to meet the goals. A contractor may also submit to the owner other information on efforts to meet the goals.

10. CONTRACTOR ASSURANCE - The bidder hereby assures that he will meet one of the following as appropriate:

- a. The DBE participation goal as established in the General Conditions.
- b. The DBE participation percentage as shown in Section 9, which was submitted as a condition of contract award.

Agreements between bidder/proposer and a DBE in which the DBE promises not to provide subcontracting quotations to other bidders/proposers are prohibited. The bidder shall make a good faith effort to replace a DBE subcontract that is unable to perform successfully with another DBE subcontractor. Substitution must be coordinated and approved by the owner.

The bidder shall establish and maintain records and submit regular reports, as required, which will identify and assess progress in achieving DBE subcontract goals and other DBE affirmative action efforts.

11. PROMPT PAYMENT - The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than **10** days from the receipt of each payment the prime contractor receives from the owner. The prime contractor agrees further to return retainage payments to each subcontractor within **10** days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the owner. This clause applies to both DBE and non-DBE subcontractors.

DBE CERTIFICATE OF COMPLIANCE FORM

The Florida Department of Transportation maintains an online searchable database of DBE firms at (<https://www3.dot.state.fl.us/equalopportunityoffice/biznet>).

Okaloosa County intends to utilize and implement this program in the awarding of this contract.

This is to certify that I have reviewed the plan, bid evaluation procedure, and DBE directory and will make all reasonable efforts to include DBE Contractors as outlined in pages OC-8 through OC-11.

Contractor's Signature

Date

Title

Notary Public

PERFORMANCE OF WORK BY SUBCONTRACTORS

The CONTRACTOR hereby states that he proposes, if awarded the Contract, to use the following subcontractors on this project: List below all proposed subcontractors and trade specialties. (List only one subcontractor for each item.)

	<u>Items of Work (Describe)</u>	<u>Subcontractors</u>
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____
10	_____	_____
11	_____	_____
12	_____	_____
13	_____	_____
14	_____	_____
15	_____	_____

Estimated Total Cost of Items that CONTRACTOR states will be performed by Subcontractor:

(\$ _____)

E-VERIFY COMPLIANCE CERTIFICATION

In accordance with Okaloosa County Policy and Executive Order Number 11-116 from the office of the Governor of the State of Florida, Bidder hereby certifies that the U.S. Department of Homeland Security's E-Verify system will be used to verify the employment eligibility of all new employees hired by the contractor during the contract term, and shall expressly require any subcontractors performing work or providing services pursuant to the contract to likewise utilize the U.S. Department of Homeland Security's E-Verify system to verify the employment eligibility of all new employees hired by the subcontractor during the contract term; and shall provide documentation of such verification to the OWNER upon request.

As the person authorized to sign this statement, I certify that this company complies/will comply fully with the above requirements.

DATE: _____

SIGNATURE: _____

COMPANY: _____

NAME: _____

(Typed or Printed)

ADDRESS: _____

TITLE: _____

E-MAIL: _____

PHONE NO.: _____

CONE OF SILENCE

The Board of County Commissioners have established a solicitation silence policy (**Cone of Silence**) that prohibits oral and written communication regarding all formal solicitations for goods and services (ITB, RFP, ITQ, ITN, and RFQ) or other competitive solicitation between the bidder (or its agents or representatives) or other entity with the potential for a financial interest in the award (or their respective agents or representatives) regarding such competitive solicitation, and any County Commissioner or County employee, selection committee member or other persons authorized to act on behalf of the Board including the County's Architect, Engineer or their subconsultants, or anyone designated to provide a recommendation to award a particular contract, other than the Purchasing Department Staff..

The period commences from the time of advertisement until contract award.

Any information thought to affect the committee or staff recommendation submitted after bids are due, should be directed to the Purchasing Manager or an appointed representative. It shall be the Purchasing Manager's decision whether to consider this information in the decision process.

Any violation of this policy shall be grounds to disqualify the respondent from consideration during the selection process.

All respondents must agree to comply with this policy by signing the following statement and including it with their submittal.

I _____ (Signature) representing _____ (Company Name) on this _____ day of _____, 2018 hereby agree to abide by the County's "Cone of Silence Clause" and understand violation of this policy shall result in disqualification of my proposal/submittal.

BUY AMERICAN CERTIFICATE

Except for those items listed by the Bidder below or on a separate and clearly identified attachment to this Bid, the Bidder hereby certifies that steel and each manufactured product, is produced in the United States and that components of unknown origin are considered to have been produced or manufactured outside the United States.

PRODUCT

COUNTRY OF ORIGIN

(Name of Bidder)

By: _____

Title: _____

Dated: _____

LOBBYING- 31 U.S.C. 1352, 49 CFR PART 19, 49 CFR PART 20

APPENDIX A, 49 CFR PART 20—CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned (Contractor) certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for making the lobbying contacts to an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form—LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions [as amended by ”Government wide Guidance for New Restrictions on Lobbying,” 61 Fed. Reg. 1413 (1/19/96). Note: Language in paragraph (2) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995 (P.L. 104-65, to be codified at 2 U.S.C. 1601, et seq.)]

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

[Note: Pursuant to 31 U.S.C. 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such expenditure or failure.]

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. A 3801, *et seq.* apply to this certification and disclosure, if any.

Signature of Contractor’s Authorized Official

Name and Title of Contractor’s Authorized Official

Date

EQUAL EMPLOYMENT OPPORTUNITY REPORT STATEMENT

Section 60-1.7(b) of the Regulations of the Secretary of Labor requires each bidder or prospective prime Contractor and proposed Subcontractor, where appropriate, to state in the bid or at the outset of negotiations for the Contract whether it has participated in any previous Contract or Subcontract subject to the equal opportunity clause; and if so, whether it has filed with the Joint Reporting Committee, the Director, an agency, or the former President's Committee on Equal Employment Opportunity all reports due under the applicable filing requirements. In any case in which a bidder or prospective prime Contractor or proposed Subcontractor which participated in a previous Contract subject to Executive Order 10925, 11114 or 111246 has not filed a report due under the applicable filing documents, no Contract or Subcontract shall be awarded unless such Contractor submits a report covering the delinquent period or such other period specified by the FAA or the Director, OFCCP.

The Bidder (Proposer) shall complete the following statement by checking the appropriate boxes. Failure to complete these blanks may be grounds for rejection of bid.

1. The Bidder (Proposer) has () has not () developed and has on file at each establishment Affirmative Action Programs pursuant to 41 CFR 60-1.4 and 41 CFR 60-2.
2. The Bidder (Proposer) has () has not () participated in any previous Contract or Subcontract subject to the Equal Opportunity Clause prescribed by Executive Order 10925, or Executive Order 11114, or Executive Order 11246.
3. The Bidder (Proposer) has () has not () filed with the Joint Reporting Committee the annual compliance report on Standard Form 100 (EEO-1 Report).
4. The Bidder (Proposer) has () has not () submitted all compliance reports in connection with any such Contract due under the application filing requirements; and that representations indicating submission of required compliance reports signed by proposed Subcontractors will be obtained prior to award of Subcontractors.
5. The Bidder (Proposer) does () does not () employ fifty (50) or more employees.

If the Bidder (Proposer) has participated in a previous Contract subject to the equal opportunity clause and has not submitted compliance reports due under applicable filing requirements, the Bidder (Proposer) shall submit a compliance report on Standard Form 100. "Employee Information EEO-1" prior to the award of Contract.

Standard Form 100 is normally furnished to Contractors annually, based on a mailing list currently maintained by the Joint Reporting Committee. In the event a Contractor has not received the form, he may obtain it by writing to the following address: Joint Reporting Committee, 1800 G Street, Washington, D.C. 20506.

(Name of Bidder)

By: _____

Signature

Title: _____

Title

Date: _____

*Must be the same signature on Bid Proposal

CONTRACT FORMS



BID DOCUMENTS
DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT

STANDARD FORM OF AGREEMENT

THIS AGREEMENT is dated as of the _____ day of _____ in the year 2018 by and between The Board of County Commissioners of Okaloosa County, Florida (hereinafter called Owner) and _____ (hereinafter called Contractor).

Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

Article 1. WORK.

Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

VPS CHILLER REPLACEMENT

Article 2. ENGINEER.

The Project has been designed by

AVCON, INC.

who is hereinafter called Engineer and who is to act as Owner's representative, assume all duties and responsibilities and have the rights and authority assigned to Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

Article 3. CONTRACT TIMES.

3.1 The Work will be substantially completed within 150 calendar days after the date when the Contract Times commence to run as provided in paragraph 2.3 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.13 of the General Conditions within 180 calendar days after the date when the Contract Times commence to run.

3.2 *Liquidated Damages.* Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring of such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner the amount specified in Paragraph 3.3 for each day that expires after the time specified in paragraph 3.1 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the time specified in paragraph 3.1 for completion and readiness for final payment or any proper extension thereof granted by Owner, Contractor shall pay Owner the amount specified in Paragraph 3.3 for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment. The Contractor hereby expressly waives and relinquishes any right which it may have to seek to characterize the liquidated damages as a penalty, which the parties agree represents a fair and reasonable estimate of the Owner's actual damages at the time of contracting if the Contractor fails to substantially complete the Work in a timely manner.

3.3.1 Liquidated Damages are based upon the original contract amount, as established by Okaloosa County. Liquidated damages, based upon the original contract amount of \$_____, will be _____ dollars (\$_____) per calendar day.

Article 4. CONTRACT PRICE.

Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in the Bid Schedule submitted in the Bid Form. The cost of this project is \$_____ as per the attached Contractor bid.

As provided in paragraph 11.9 of the General Conditions estimated quantities are not guaranteed, and determinations of actual quantities and classification are to be made by Engineer as provided in paragraph 9.10 of the General Conditions. Unit prices have been computed as provided in paragraph 11.9.2 of the General Conditions.

Article 5. PAYMENT PROCEDURES

Contractor shall submit Application for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

5.1 *Progress Payments; Retainage.* Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment as recommended by Engineer, on or about the fifteenth (15th) day of each month during construction as provided in paragraphs 5.1.1 and 5.1.2 below. All such payments will be measured based on the number of units completed. Payments to the Contractor shall in no way imply approval or acceptance of Contractor's work.

5.1.1 Prior to Substantial completion, payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as Engineer shall determine, or Owner may withhold, in accordance with paragraph 14.7 of the General Conditions.

90 % of Work completed (with the balance being retainage). Once the Contractor completes at least 50% of the Work based on approved pay applications, the retainage will be reduced from 10% to 5% for the remainder of the project. Therefore, following completion of at least 50% of the Work, the Contractor may be paid 95 % of Work completed (with the balance being retainage).

90 % (with the balance being retainage) of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to Owner as provided in paragraph 14.2 of the General Conditions). Once the Contractor completes at least 50% of the Work based on approved pay applications, the retainage will be reduced from 10% to 5% for the remainder of the project. Therefore, following completion of at least 50% of the Work, the Contractor may be paid 95 % of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to Owner as provided in paragraph 14.2 of the General Conditions).

5.1.2 Upon Substantial Completion, in an amount sufficient to increase total payments to Contractor to 95 % of the Contract Price (with the balance being retainage), less such amounts as Engineer shall determine, or Owner may withhold, in accordance with paragraph 14.7 of the General Conditions.

5.1.3 Retainage requirements may be changed to reflect a proposed change to state regulatory statutes.

5.2 *Final Payment.* Upon final completion and acceptance of the Work in accordance with paragraph 14.13 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said paragraph 14.13.

5.2.1 Contractor's acceptance of final payment shall constitute a full waiver of any and all claims by Contractor against the County arising out of this Agreement or otherwise relating to the Project, except those previously made in writing and identified by Contractor as unsettled at the time of the final Application for Payment. Neither the acceptance of the Work nor payment by the County shall be deemed to be a waiver of the County's right to enforce any obligations of the Contractor hereunder or to the recovery of damages for defective Work not discovered by the Engineer or the County at the time of final inspection.

5.3 Payments Withheld

5.3.1 The Engineer or the County may decline to approve any Applications for Payment, or portions thereof, because of subsequently discovered evidence or subsequent inspections. The Engineer or the County may nullify the whole or any part of any inspections. The Engineer or the County may nullify the whole or any part of any approval for payment previously issued and the County may withhold any payments otherwise due Contractor under this Agreement or any other agreement between the County and the Contractor, to such extent as may be necessary in the County's opinion to protect it from loss because of:

5.3.1.1 Defective Work not remedied;

5.3.1.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

5.3.1.3 Failure of Contractor to make payment properly to subcontractors or for labor, materials or equipment;

5.3.1.4 Reasonable doubt that the Work can be completed for the unpaid balance of the Contract Amount;

5.3.1.5 Reasonable indication that the Work will not be completed within the Contract Time;

5.3.1.6 Unsatisfactory prosecution of the Work by the Contractor;

5.3.1.7 Failure to provide accurate and current "As-Builts"; or

5.3.1.8 Any other material breach of the Contract Documents.

5.3.2 If these conditions in Subsection 5.3.1 are not remedied or removed, the County may after three (3) days written notice, rectify the same at Contractor's expense. The County also may offset against any sums due Contractor the amount of any liquidated or unliquidated obligations of Contractor to the County, whether relating to or arising out of his Agreement or any other agreement between Contractor and the County.

Article 6. CONTRACTOR'S REPRESENTATIONS.

In order to induce Owner to enter into this Agreement Contractor makes the following representations:

6.1 Contractor has examined and carefully studied the Contract Documents (including the Addenda listed in Article 7) and the other related data identified in the Project Documents including "technical data."

6.2 Contractor has visited the site and become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance or furnishing of the Work.

6.3 Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.

6.4 Contractor has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. Contractor accepts the determination of the extent of the "technical data" contained in such reports and drawings upon which Contractor is entitled to rely as provided in paragraph 4.2 of the General Conditions. Contractor acknowledges that such reports and drawings are not Contract Documents and may not be complete for Contractor's purposes. Contractor acknowledges that Owner and Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. Contractor has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor and safety precautions, and programs incident thereto. Contractor does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

6.5 Contractor is aware of the general nature of work to be performed by Owner and others at the site that relates to the Work as indicated in the Contract Documents.

6.6 Contractor has correlated the information known to Contractor, information and observation obtained from visits to the site, reports, and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

6.7 Contractor has given Engineer written notice of all conflicts, errors, ambiguities or discrepancies that Contractor has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Contractor, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

Article 7. CONTRACT DOCUMENTS

The Contract Documents that comprise the entire agreement between Owner and Contractor concerning the Work consist of the following:

- 7.1 This Agreement (pages A-1 to A-5, inclusive)
- 7.2 Performance, Payment, and other Bonds
- 7.3 Notice to Proceed
- 7.4 Okaloosa County Standard Clauses (pages OC-1 to OC-13, inclusive)
- 7.5 General Conditions (pages GC-1 to GC-54, inclusive)
- 7.6 Specifications package as listed in the table of contents thereof
- 7.7 Drawings consisting of a cover sheet and sheets numbered ___ with each sheet bearing the following

general title:

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- 7.8 Addenda numbers _____ to _____, inclusive
- 7.9 Contractor's Bid (pages BF-1 to BF-6 and BS-1 to BS-2, inclusive)
- 7.10 Documentation submitted by Contractor prior to Notice of Award
- 7.11 The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto:

All Written Amendments and other documents amending, modifying or supplementing the Contract Documents pursuant to paragraphs 3.5 and 3.6 of the General Conditions

The documents listed in paragraph 7.2 et seq. above are attached to this Agreement (except as expressly noted otherwise above).

There are not Contract Documents other than those listed above in this Article 7. The Contract Documents may only be amended, modified or supplemented as provided in paragraphs 3.5 and 3.6 of the General Conditions.

Article 8. PUBLIC RECORDS

Any record created by either party in accordance with this Contract shall be retained and maintained in accordance with the public records law, Florida Statutes, Chapter 119.

IF THE CONSULTANT HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT OKALOOSA COUNTY RISK MANAGEMENT DEPARTMENT 5479 OLD BETHEL ROAD CRESTVIEW, FL 32536 PHONE: (850) 689-5977 riskinfo@co.okaloosa.fl.us.

Consultant must comply with the public records laws, Florida Statute chapter 119, specifically Consultant must:

- 8.1 Keep and maintain public records required by the County to perform the service.
- 8.2 Upon request from the County's custodian of public records, provide the County with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in chapter 119 Florida Statutes or as otherwise provided by law.
- 8.3 Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the consultant does not transfer the records to the County.

8.4 Upon completion of the contract, transfer, at no cost, to the County all public records in possession of the contractor or keep and maintain public records required by the County to perform the service. If the consultant transfers all public records to the public agency upon completion of the contract, the consultant shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the consultant keeps and maintains public records upon completion of the contract, the consultant shall meet all applicable requirements for retaining the public records. All records stored electronically must be provided to the public agency, upon the request from the public agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

Article 9. AUDIT

The County and/or its designee shall have the right from time to time at its sole expense to audit the compliance by the Contractor with the terms, conditions, obligations, limitations, restrictions, and requirements of this Contract and such right shall extend for a period of three (3) years after termination of this Contract.

Article 10. TERMINATION FOR CONVENIENCE

Owner may at any time and for any reason terminate Contractor's services and work at Owner's convenience. Upon receipt of such notice, Contractor shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.

Upon such termination, Contractor shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by Contractor as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to Contractor prior to the date of the termination of this Agreement. Contractor shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment. Further, Owner may terminate this contract immediately for failure of contractor to comply with Chapter 119, Florida Statutes.

Article 11. VIOLATIONS OF CHAPTER 119 FLORIDA STATUTES

The County reserves the right to terminate this agreement immediately for failure of Contractor to adhere to the requirements of Florida Statutes Chapter 119.

Article 12. MISCELLANEOUS.

10.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

10.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.3 Owner and Contractor each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants,

agreements, and obligations contained in the Contract Documents.

10.4 Any provisions or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

IN WITNESS WHEREOF, Owner, and Contractor have signed this Agreement in triplicate. One counterpart each has been delivered to Owner, Contractor, and Engineer. All portions of the Contract Documents have been signed, initialed or identified by Owner, and Contractor, or identified by Engineer on their behalf. This Agreement will be effective on _____, 2018 (which is the Effective Date of the Agreement).

OWNER

CONTRACTOR

Okaloosa County, Florida

Graham W. Fountain
Chairman, Board of County Commissioners

Attest

Attest

J.D. Peacock II
Clerk of Circuit Court

Address for giving notices

Address for giving notices

(If Owner is a public body, attached evidence of authority to sign and resolution or other documents authorizing execution of Agreement).

License No. _____

Agent for services of process: _____

If Contractor is a corporation, attach evidence of authority to sign).

PERFORMANCE BOND

KNOW ALL MEN by these presents; That we (1) _____

_____ a (2) _____

hereinafter called "Principal" and (3) _____

of _____, State of _____, hereinafter called the

"Surety", are held and firmly bound unto (4) _____

of _____, hereinafter called "OWNER", in the penal sum

of _____ dollars (\$ _____)

in lawful money of the United States for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the Owner, dated the ____ day of _____, 2018, a copy of which is hereto attached and make a part hereof for the construction of:

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NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligations on this bond, and it does not hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the Specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 2018.

ATTEST:

Principal

(Principal) Secretary

By: _____

Witness as to Surety

Address

Address

SEAL:

ATTEST:

Surety

(Surety) Secretary

Attorney-in-Fact

Witness as to Surety

Address

Address

SEAL:

Date of bond must not be prior to date of Contract

1. Correct name of Contractor.
2. A Corporation, A Partnership or an Individual as case may be.
3. Correct name of Surety.
4. Correct name of Owner.
5. If Contractor is Partnership, all partners should execute bond.

PAYMENT BOND

KNOW ALL MEN by these presents; That we (1) _____
_____ a (2) _____
hereinafter called "Principal" and (3) _____
of _____, State of _____, hereinafter call the
"Surety", are held and firmly bound unto (4) _____
of _____ State of Florida _____, hereinafter called "OWNER", in the penal sum of _____
_____ dollars (\$) in lawful
money of the United States for the payment of which sum well and truly to be made, we bind ourselves,
our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain
contract with the Owner, dated the _____ day of _____, 2018, a copy of which is
hereto attached and make a part hereof for the construction of:

VPS CHILLER REPLACEMENT

NOW, THEREFORE, if the Principal shall promptly make payments to all persons, firms, subcontractors,
and corporations furnishing materials for or performing labor in the prosecution of the work provided for
in such contract, and any authorized extension or modification thereof, including all amounts due for
materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed
or used in connection with the construction of such work, and all insurance premiums on said work, and
for all labor, performed in such work, whether by subcontractor or otherwise, then this obligation shall be
void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be in any wise affect its obligation on this bond, and it does hereby waive notice of any such changes, extension of time, alteration or addition to the terms of the contractor or to the work or to the Specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 2018.

ATTEST:

Principal

(Principal) Secretary

By:

Witness as to Surety

Address

Address

SEAL:

ATTEST:

Surety

(Surety) Secretary

Attorney-in-Fact

Witness as to Surety

Address

Address

SEAL:

CONTRACTOR'S RELEASE OF LIENS

STATE OF: _____

COUNTY OF: _____

Before me, the undersigned Notary Public in and for the said County and State personally appeared _____, representing the Contractor _____, who being duly sworn according to law deposes and says that all labor, materials, and outstanding claims and indebtedness of whatever nature arising out of the performance of the Contract with _____, the Owner, for _____, Contract No. _____, have been paid in full and that for the final payment in the amount of \$ _____, the Contractor releases and discharges the Owner and his authorized representatives from any liens or claims or any nature because of or arising from this Contract and/or its performance, which it has had, has or may have in the future.

By: _____

Sworn to and subscribed before me this

_____ day of _____

(Notary Public)

My Commission Expires: _____

ADVERTISEMENT OF COMPLETION

_____ (Contractor)

_____ (Address)

gives notice of completion of _____ (Project)

and sets _____ as the date of final settlement.

All persons and firms should file all claims for payment to the below address prior to the settlement date:

Okaloosa County
5479A Old Bethel Road
Crestview, FL 32536

By: _____ (Name)

_____ (Title)

Leg: _____ (Publication Dates)

Title VI Clauses for Compliance with Nondiscrimination Requirements

Compliance with Nondiscrimination Requirements

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts And Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.
3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor’s obligations under this contract and the Nondiscrimination Acts And Authorities on the grounds of race, color, or national origin.
4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts And Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. **Sanctions for Noncompliance:** In the event of a contractor’s noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:

- a. Withholding payments to the contractor under the contract until the contractor complies; and/or
 - b. Cancelling, terminating, or suspending a contract, in whole or in part.
6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

Title VI List of Pertinent Nondiscrimination Acts and Authorities

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.*, 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination In Federally-Assisted Programs of The Department of Transportation—Effectuation of Title VI of The Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 *et seq.*), as amended, (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 *et seq.*), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of

the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);

- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration’s Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part time workers.

The [*contractor / consultant*] has full responsibility to monitor compliance to the referenced statute or regulation. The [*contractor / consultant*] must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division

OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text.

Contractor must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The Contractor retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 CFR Part 1910).

Contractor must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

E-VERIFY

Enrollment and verification requirements.

- (1) If the Contractor is not enrolled as a Federal Contractor in E-Verify at time of contract award, the Contractor shall-
 - a. Enroll. Enroll as a Federal Contractor in the E-Verify Program within thirty (30) calendar days of contract award;
 - b. Verify all new employees. Within ninety (90) calendar days of enrollment in the E-Verify program, begin to use E-Verify to initiate verification of employment eligibility of all new hires of the Contractor, who are working in the United States, whether or not assigned to the contract, within three (3) business days after the date of hire (but see paragraph (b)(3) of this section); and,
 - c. Verify employees assigned to the contract. For each employee assigned to the contract, initiate verification within ninety (90) calendar days after date of enrollment or within thirty (30) calendar days of the employee's assignment to the contract, whichever date is later (but see paragraph (b)(4) of this section.)
- (2) If the Contractor is enrolled as a Federal Contractor in E-Verify at time of contract award, the Contractor shall use E-Verify to initiate verification of employment eligibility of
 - a. All new employees.
 - i. Enrolled ninety (90) calendar days or more. The Contractor shall initiate verification of all new hires of the Contractor, who are working in the United States, whether or not assigned to the contract, within three (3) business days after the date of hire (but see paragraph (b)(3) of this section); or

- b. Enrolled less than ninety (90) calendar days. Within ninety (90) calendar days after enrollment as a Federal Contractor in E-Verify, the Contractor shall initiate verification of all new hires of the contractor, who are working in the United States, whether or not assigned to the contract, within three (3) business days after the date of hire (but see paragraph (b)(3) of this section; or
 - ii. Employees assigned to the contract. For each employee assigned to the contract, the Contractor shall initiate verification within ninety (90) calendar days after date of contract award or within thirty (30) days after assignment to the contract, whichever date is later (but see paragraph (b)(4) of this section.)
- (3) If the Contractor is an institution of higher education (as defined at 20 U.S.C. 1001(a)); a State of local government or the government of a Federally recognized Indian tribe, or a surety performing under a takeover agreement entered into with a Federal agency pursuant to a performance bond, the Contractor may choose to verify only employees assigned to the contract, whether existing employees or new hires. The Contractor shall follow the applicable verification requirements of (b)(1) or (b)(2), respectively, except that any requirement for verification of new employees applies only to new employees assigned to the contract.
- (4) Option to verify employment eligibility of all employees. The Contractor may elect to verify all existing employees hired after November 6, 1986 (after November 27, 2009, in the Commonwealth of the Northern Mariana Islands), rather than just those employees assigned to the contract. The Contractor shall initiate verification for each existing employee working in the United States who was hired after November 6, 1986 (after November 27, 2009, in the Commonwealth of the Northern Mariana Islands), within one hundred eighty (180) calendar days of-
- i. Enrollment in the E-Verify program; or
 - ii. Notification to E-Verify Operations of the Contractor's decision to exercise this option, using the contract information provided in the E-Verify program Memorandum of Understanding (MOU)
- (5) The Contractor shall comply, for the period of performance of this contract, with the requirements of the E-Verify program MOU.
- i. The Department of Homeland Security (DHS) or the Social Security Administration (SSA) may terminate the Contractor's MOU and deny access to the E-Verify system in accordance with the terms of the MOU. In such case, the Contractor, will be referred to a suspension or debarment official.

ii. During the period between termination of the MOU and a decision by the suspension or debarment official whether to suspend or debar, the contractor is excused from its obligations under paragraph (b) of this clause. If the suspension or debarment official determines not to suspend or debar the Contractor, then the Contractor must reenroll in E-Verify.

iii. Web site. Information on registration for and use of the E-Verify program can be obtained via the Internet at the Department of Homeland Security Web site: <http://www.dhs.gov/E-Verify>.

Individuals previously verified. The Contractor is not required by this clause to perform additional employment verification using E-Verify for any employee-

- (a) Whose employment eligibility was previously verified by the Contractor through the E-Verify program;
- (b) Who has been granted and holds an active U.S. Government security clearance for access to confidential, secret, or top secret information in accordance with the National Industrial Security Program Operating Manual; or
- (c) Who has undergone a completed background investigation and been issued credentials pursuant to Homeland Security Presidential Directive (HSPD)-12. Policy for a Common Identification Standard for Federal Employees and Contractors.

Subcontracts. The Contractor shall include the requirements of this clause, including this paragraph € (appropriately modified for identification of the parties in each subcontract that-

- (1) Is for-(i) Commercial and noncommercial services (except for commercial services that are part of the purchase of a COTS item (or an item that would be a COTS item, but for minor modifications), performed by the COTS provider, and are normally provided for that COTS item); or
 - (ii) Construction;
- (2) Has a value of more than \$3,500; and
- (3) Includes work performed in the United States.

GENERAL CONDITIONS



BID DOCUMENTS
DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT

GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

- 1.0.1 *AASHTO – The American Association of State Highway and Transportation Officials, the successor association AASHO.*
- 1.0.2 *ACCESS ROAD – The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.*
- 1.1. **Addenda** – Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Project Requirements or the Contract Documents.
 - 1.1.1 *ADVERTISEMENT – A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.*
- 1.2. **Agreement** – The written contract between Owner and Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.
 - 1.2.1 *AIP – The Airport Improvement Program, a grant-in-aid program, administered by the Federal Aviation Administration.*
 - 1.2.2 *AIR OPERATIONS AREA – For the purpose of these specifications, the term air operations area shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.*
 - 1.2.3 *AIRPORT – Airport means the area of land or water which is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any.*
- 1.3. **Application for Payment** – The form accepted by Engineer which is to be used by Contractor in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
- 1.4. **Asbestos** – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 - 1.4.1 *ASTM – The American Society for Testing and Materials.*
 - 1.4.2 *AWARD – The acceptance, by the Owner, of the successful contractor's proposal.*
- 1.5. **Bid** – The offer or proposal of the contractor submitted on the prescribed form setting forth the prices for the Work to be performed.

- 1.5.1 **CONTRACTOR** – Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
- 1.6. **Project Documents** – The advertisement or invitation to Bid, instructions to contractors, the Bid Form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).
- 1.7. **Project Requirements** – The advertisement or invitation to Bid, instructions to contractors, and the Bid Form.
- 1.7.1 **BUILDING AREA** – An area on the airport to be used, considered, or intended to be used for airport buildings, or other facilities or rights-of-way together with all airport buildings and facilities located thereon.
- 1.8. **Bonds** – Performance and Payment bonds and other instruments of security.
- 1.8.1 **CALENDAR DAY** – Every day shown on the calendar.
- 1.8.2 **CERTIFICATES OF COMPLIANCES** – Written statements by the manufacturer stating the material furnished is in conformance with the Specifications.
- 1.9. **Change Order** – A document recommended by Engineer, which is signed by Contractor and Owner and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement. *The work covered by a change order shall be within the scope of the contract.*
- 1.10. **Contract Documents** – The Agreement, Addenda (which pertain to the Contract Documents), Contractor's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders and Engineer's written interpretations and clarifications issued pursuant to paragraphs 3.5, 3.6.1, and 3.6.3 on or after the Effective Date of the Agreement. Shop Drawing submittals approved pursuant to paragraphs 6.26 and 6.27 and the reports and drawings referred to in paragraphs 4.2.1.1 and 4.2.2.2 are not Contract Documents.
- 1.11. **Contract Price** – The money payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.9.1 in the case of Unit Price Work).
- 1.12. **Contract Times** – The numbers of days or the dates stated in the Agreement: (i) to achieve Substantial Completion, and (ii) to complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment in accordance with paragraph 14.13.
- 1.12.1 **CONTRACT ITEM (PAY ITEM)** – A specific unit of work for which a price is provided in the Contract.

- 1.13. **Contractor** – The person, firm or corporation with whom Owner has entered into the Agreement.
- 1.14. **Defective** – An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with paragraph 14.8 or 14.10).
- 1.14.1 *DRAINAGE SYSTEM* – *The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.*
- 1.15. **Drawings** – The drawings which show the scope, extent, and character of the Work to be furnished and performed by Contractor and which have been prepared or approved by Engineer and are referred to in the Contract Documents. Shop drawings are not Drawings as so defined.
- 1.16. **Effective Date of the Agreement** – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
- 1.17. **Engineer** – The person, firm, or corporation named as such in the Agreement.
- 1.18. **Engineer's Consultant** – A person, firm, or corporation having a contract with Engineer to furnish services as Engineer's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions. *The following list of independent professional associates and consultants are considered the Engineer's consultant for this Construction Contract: AVCON, Inc.*
- 1.18.1 *EQUIPMENT* – *All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.*
- 1.18.2 *EXTRA WORK* – *An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which if found by the Engineer to be necessary to complete the work within the intended scope of the contract as previously modified.*
- 1.18.3 *FAA* – *The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his duly authorized representative.*
- 1.18.4 *FEDERAL SPECIFICATIONS* – *The Federal Specifications and Standards, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government. They may be obtained from the Specifications Activity, Printed Materials Supply Division, Building 197, Naval Weapons Plant, Washington, D.C. 20407.*
- 1.19. **Field Order** – A written order issued by Engineer which orders minor changes in the Work in accordance with paragraph 9.5 but which does not involve a change in the Contract Price or the Contract Times.

- 1.20. **General Requirements** – Sections of Division 1 of the Specifications.
- 1.21. **Hazardous Waste** – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
- 1.22. *1.21.1 INSPECTOR – An authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.*
- 1.21.2 *INTENTION OF TERMS – Whenever, in these specifications or on the plans, the words, "directed," "required," "permitted," "ordered," "designated," "prescribed," or words of the like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended; and similarly, the words "approved," "acceptable," "Satisfactory," or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Owner.*
- 1.21.3 *LABORATORY – The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer.*
- 1.22. **Laws and Regulations; Laws or Regulations** – Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.
- 1.23. **Liens** – Liens, charges, security interests, or encumbrances upon real property or personal property.
- 1.23.1 *LIGHTING – A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.*
- 1.23.2 *MAJOR AND MINOR CONTRACT ITEMS – A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 25 percent of the total amount of the award contract. All other items shall be considered minor contract items.*
- 1.23.3 *MATERIALS – Any substance specified for use in the construction of the Contract work.*
- 1.23.4 *MIL SPECIFICATIONS – The Military Specifications and Standard, and indices thereto, that are prepared and issued by the Department of Defense.*
- 1.24. **Milestone** – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
- 1.25. **Notice of Award** – The written notice by Owner to the apparent successful contractor stating that upon compliance by the apparent successful contractor with the conditions precedent enumerated therein, within the time specified, Owner will sign and deliver the Agreement.
- 1.26. **Notice to Proceed** – A written notice given by Owner to Contractor (with a copy to Engineer) fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform Contractor's obligations under the Contract Documents.

- 1.26.1 *FDOT – The Florida State Department of Transportation. When used to designate a person, FDOT shall mean the commissioner or his duly authorized representative.*
- 1.27. **Owner** – The public body or authority, corporation, association, firm, or person with whom Contractor has entered into the Agreement and for whom the Work is to be provided.
- 1.28. **Partial Utilization** – Use by Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.
- 1.28.1 *PAVEMENT – The combined surface course, base course, and subbase course, if any, considered as a single unit.*
- 1.28.2 *PAYMENT BOND – The approved form of security furnished by the Contractor and his/her surety as a guaranty that he will pay in full all bills and accounts for materials and labor used in the construction of the work.*
- 1.29. **PCBs** – Polychlorinated biphenyls.
- 1.29.1 *PERFORMANCE BOND – The approved form of security furnished by the Contractor and his/her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.*
- 1.30. **Petroleum** – Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.
- 1.30.1 *PLANS – The official drawings or exact reproductions which show the location, character, dimensions, and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.*
- 1.31. **Project** – The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.
- 1.31.1 *PROPOSAL – (See Bid).*
- 1.32. **Radioactive Material** – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
- 1.33. **Resident Project Representative** - The authorized representative of Engineer who may be assigned to the site or any part thereof.
- 1.33.1 *RUNWAY – The area on the airport prepared for the landing and takeoff of aircraft.*
- 1.34. **Samples** – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

- 1.35. **Shop Drawings** – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
- 1.35.1 SPECIAL PROVISIONS – The specific clauses setting forth conditions or requirements peculiar to the project under consideration, covering work or materials involved in the proposal and estimate, which are not thoroughly or satisfactorily stipulated in these specifications.
- 1.36. **Specifications** – Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.
- 1.36.1 *SPONSOR* – For AIP Contracts, the term Sponsor shall have the meaning as the term Owner.
- 1.36.2 *STRUCTURES* – Airport facilities such as bridges; culverts; catch basins; inlets; retaining walls; cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
- 1.37. **Subcontractor** – An individual, firm, or corporation having a direct contract with Contractor or with any other Subcontractor for performance of a part of the Work at the site.
- 1.37.1 *SUBGRADE* – The soil which forms the pavement foundation.
- 1.37.2 *SUPERINTENDENT* – The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instruction from the Engineer, and who shall supervise and direct the construction.
- 1.38. **Substantial Completion** – The Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer as evidenced by Engineer's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by Engineer's written recommendation of final payment in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
- 1.38.1 *SUPPLEMENTAL AGREEMENT* – A written agreement between the Contractor and the Owner covering: (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25 percent, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.
- 1.39. **Supplementary Conditions** – The part of the Contract Documents which amends or supplements these General Conditions.
- 1.40. **Supplier** – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.

- 1.40.1 *SURETY* – *The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds which are furnished to the Owner by the Contractor.*
- 1.40.2 *TAXIWAY* – *For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways or aircraft parking areas.*
- 1.41. **Underground Facilities** – All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone, or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.
- 1.42. **Unit Price Work** – Work to be paid for on the basis of unit prices.
- 1.43. **Work** – The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and furnishings and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.
- 1.44 **Work Change Directive** - A written directive to Contractor, issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraph 4.2 or 4.3 or to emergencies under paragraph 6.23. A Work Change Directive will not change the Contract Price or the Contract Times, but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times as provided in paragraph 10.2.
- 1.44.1 *WORKING DAY* – *A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least 6 hours toward completion of the Contract. Unless work is suspended for causes beyond the Contractor's control, Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work, requiring the presence of an inspector, will be considered as working days.*
- 1.44.2 *WORK PERIOD* – *A work period shall consist of any designated block of time on which the normal working forces of the Contractor may proceed with regular work for at least 5 hours toward completion of the contract. Unless work is suspended for causes beyond the Contractor's control, work occurring on any day, regardless of it being a weekend or holiday, which requires an Inspector, will be considered a work period. Work periods are limited to between 7:00 a.m. and 5:00 p.m. local time Monday through Friday. Weekend work will not be permitted unless contractor obtains written permission from Owner.*
- 1.45. **Written Amendment** – A written amendment of the Contract Documents, signed by Owner and Contractor on or after the Effective Date of the Agreement and normally dealing with the nonengineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

ARTICLE 2 – PRELIMINARY MATTERS

Delivery of Bonds:

- 2.1. When Contractor delivers the executed Agreements to Owner, Contractor shall also deliver to Owner such Bonds as Contractor may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

- 2.2. Owner shall furnish to Contractor up to five copies (unless otherwise specified in the Supplementary Conditions) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Commencement of Contract Times; Notice to Proceed:

- 2.3. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within thirty days after the Effective Date of the Agreement. In no event will the Contract Time commence to run later than the *one hundred twentieth (120th)* day after the day of Bid opening or the *ninetieth (90th)* day after the Effective Date of the Agreement, whichever date is earlier.

Starting the Work:

- 2.4. Contractor shall start to perform the Work on the date when the Contract Times commence to run, but no Work shall be done at the site prior to the date on which the Contract Times commence to run.

Before Starting Construction:

- 2.5. Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby; however, Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents, unless Contractor knew or reasonably should have known thereof.
- 2.6. Within ten days after the Construction Notice to Proceed contractor shall submit to Engineer for review:
 - 2.6.1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
 - 2.6.2. a preliminary schedule of Shop Drawings and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal;
 - 2.6.3. a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include and appropriate amount of overhead and profit applicable to each item of Work.

2.7. Before any Work at the site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with paragraphs 5.4, 5.6, and 5.7.

Preconstruction Conference:

2.8. Within twenty (20) days *prior to Construction Notice to Proceed*, but before any Work at the site is started, a conference attended by Contractor, Engineer and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.6, procedures for handling Shop Drawings, and other submittals, processing Applications for Payment and maintaining required records.

Initially Acceptable Schedules:

2.9. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with paragraph 2.6. Contractor shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until the schedules are submitted to and acceptable to Engineer as provided below. The progress schedule will be acceptable to Engineer as providing an orderly progression of the Work to completion within any specified Milestones and the Contract Times, but such acceptance will neither impose on Engineer responsibility for the sequencing, scheduling, or progress of Work nor interfere with or relieve Contractor from Contractor's full responsibility therefore, Contractor's schedule of Shop Drawing and Sample submissions will be acceptable to Engineer as providing a workable arrangement for reviewing and processing the required submittals. Contractor's schedule of values will be acceptable to Engineer as to form and substance.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

Intent:

3.1. The Contract Documents comprise the entire agreement between Owner and Contractor concerning the Work. The Contract Documents are complementary: what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.

3.2. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases, which have a well-known technical or construction industry or trade meaning are used to describe Work, materials, or equipment, such words or phrases shall be interpreted in accordance with the meaning. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in paragraph 9.4.

3.3. Reference to Standards and Specifications of Technical Societies: Reporting and Resolving Discrepancies:

3.3.1. Reference to standards, specifications, manuals or codes of any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether

such reference be specific or by implication, shall mean the latest standard, specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

3.3.2. If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual, or code or of any instruction of any Supplier referred to in paragraph 6.5., Contractor shall report it to Engineer in writing at once, and, Contractor shall not proceed with the Work affected thereby (except in an emergency as authorized by paragraph 6.23) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.5 or 3.6; provide, however, that Contractor shall not be liable to Owner or Engineer for failure to report any such conflict, error, ambiguity or discrepancy unless Contractor knew or reasonably should have known thereof.

3.3.3. Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement thereto issued by one of the methods indicated in paragraph 3.5 or 3.6, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

3.3.3.1. the provisions of any such standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents): or

3.3.3.2. the provisions of any such Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

No provision of any such standard, specification, manual, code, or instruction shall be effective to change the duties and responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to Owner, Engineer, or any of Engineer's Consultants, agents, or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of paragraph 9.13 or any other provision of the Contract Documents.

3.3.4. Whenever the plans or specifications are in conflict, resolution of such conflict shall be in the following order of precedence subject to agreement by Engineer:

- Contract Agreement
- Addenda, with those of later date having precedence over those of earlier dates
- Bid Documents
- Supplementary Conditions
- General Conditions
- Construction Drawings
- Technical Specifications
- FAA General Provisions
- Florida DOT Standard Specifications

In case of our inconsistency within the Contract Drawings, the order of procedure is as follows:

- Schedules
- Specific Details
- Typical Details
- Construction Drawings

3.4. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as approved" or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of Engineer as to the Work, it is intended that such requirement, direction, review, or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to Engineer any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.13 or any other provision of the Contract Documents.

Amending and Supplementing Contract Documents:

3.5. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

- 3.5.1. a formal Written Amendment.
- 3.5.2. a Change Order (pursuant to paragraph 10.4) or
- 3.5.3. a Work Change Directive (pursuant to paragraph 10.1).

3.6. In addition, the requirements of the Contract Documents may be supplemented and minor variations, and deviations of the Work may be authorized, in one or more of the following ways:

- 3.6.1. a Field Order (pursuant to paragraph 9.5).
- 3.6.2. Engineer's approval of a Shop Drawing or Sample (pursuant to paragraphs 6.26 and 6.27), or
- 3.6.3. Engineer's written interpretation or clarification (pursuant to paragraph 9.4).

Reuse of Documents:

3.7. Contractor and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with Owner (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's Consultant, and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaption by Engineer.

ARTICLE 4 – AVAILABILITY OF LANDS: SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

Availability of Lands:

4.1. Owner shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of Contractor. Upon reasonable written request, Owner shall furnish Contractor with a correct statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's lien against such lands in accordance with applicable Laws and Regulations. Owner shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which Contractor will have to comply in performing the Work. Easements for permanent structures or permanent in existing facilities will be obtained and paid for by Owner, unless otherwise provided in the Contract Documents. If Contractor and Owner are unable to agree on entitlement to or the amount or extent of any adjustments in the Contract Price or the Contract Times as a result of any delay in Owner's furnishing these lands, rights-of-way or easements. Contractor may make a claim therefore as provided in Articles 11 and 12. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.2. SubSurface and Physical Conditions:

4.2.1. **Reports and Drawings:** Reference is made to the *Information Available to Contractors* for identification of:

4.2.1.1. **Subsurface Conditions:** Those reports of explorations and tests of subsurface conditions at or contiguous to the site that have been utilized by Engineer in preparing the Contract Documents; and

4.2.1.2. **Physical Conditions:** Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) that have been utilized by Engineer in preparing the Contract Documents.

4.2.2. **Limited Reliance by Contractor Authorized; Technical Data:** Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the *Information Available to Contractors*. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner, Engineer, or any of Engineer's Consultants with respect to:

4.2.2.1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto, or

4.2.2.2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings, or

4.2.2.3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such data, interpretations, opinions, or information.

4.2.3. Notice of Differing Subsurface or Physical Conditions: If Contractor believes that any subsurface or physical condition at or contiguous to the site that is uncovered or revealed either:

4.2.3.1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is materially inaccurate, or

4.2.3.2. is of such a nature as to require a change in the Contract Documents, or

4.2.3.3. differs materially from that shown or indicated in the Contract Documents, or

4.2.3.4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then Contractor shall, promptly, but in no event later than fifteen (15) days, after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as permitted by paragraph 6.23), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such conditions or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

4.2.4. Engineer's Review: Engineer will promptly review the pertinent conditions, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

4.2.5. Possible Contract Documents Change: If Engineer concludes that a change in the Contract Documents is required as a result of a condition that meets one or more of the categories in paragraph 4.2.3., a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.

4.2.6. Possible Price and Times Adjustments: An equitable adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of such uncovered or revealed condition causes an increase or decrease in Contractor's cost of, or time required for performance of the Work; subject, however, to the following:

4.2.6.1. such condition must meet any one or more of the categories described in paragraphs 4.2.3.1 through 4.2.3.4. inclusive;

4.2.6.2. a change in the Contract Documents pursuant to paragraph 4.2.5 will not be an automatic authorization of nor a condition precedent to entitlement to any such adjustment:

4.2.6.3. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract price will be subject to the provisions of paragraphs 9.10 and 11.9; and

4.2.6.4. Contractor shall not be entitled to any adjustment in the Contract Price or Times if;

4.2.6.4.1. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner in respect of Contract Price and Contract Times by the submission of a bid or becoming bound under a contract: or

4.2.6.4.2. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the site and contiguous

areas required by the Project Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

4.2.6.4.3. Contractor failed to give the written notice within the time and as required by paragraph 4.2.3.

If Owner and Contractor are unable to agree on entitlement to or as to the amount or length of any such equitable adjustment in the Contract Price or Contract Times, a claim may be made therefore as provided in Articles 11 and 12. However, Owner, Engineer, and Engineer's Consultants shall not be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

4.3. Physical Conditions – Underground Facilities:

4.3.1. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the *Information Available to Contractors*:

4.3.1.1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and

4.3.1.2. The cost of all of the following will be included in the Contract Price and Contractor shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities as provided in paragraph 6.20 and repairing any damage thereto resulting from the Work.

4.3.2. Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents. Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.23), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence of the Underground Facility. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document such consequences. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 6.20. Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or the amount or length of any such adjustment in Contract Price or Contract Times, Contractor may make a claim, therefore, as provided in Articles 11 and 12. However, Owner, Engineer, and Engineer's Consultants shall not be liable to Contractor for any claims, costs, losses or damages incurred or sustained by Contractor on or in connection with any other project or anticipated project.

Reference Points:

4.4. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of Owner, Contractor shall report to Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

4.5. Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material:

4.5.1. Owner shall be responsible for any Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material uncovered or revealed at the site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. Owner shall not be responsible for any such materials brought to the site by Contractor, Subcontractor, Suppliers, or anyone else for whom Contractor is responsible.

4.5.2. Contractor shall immediately: (i) stop all Work in connection with such hazardous condition and in any area affected thereby (except in an emergency as required by paragraph 6.23), and (ii) notify Owner and Engineer (and thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such hazardous condition to take corrective action, if any. Contractor shall not be required to resume Work in connection with such hazardous condition or in any such affected area until after Owner has obtained any required permits related thereto and delivered to Contractor special written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of such Work stoppage or such special conditions under which Work is agreed by Contractor to be resumed, either party may make a claim therefore as provided in Articles 11 and 12.

4.5.3. If after receipt of such special written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order such portion of the Work that is in connection with such hazardous condition or in such affected area to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a claim therefore as provided in Articles 11 and 12. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

4.5.4. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, Engineer, Engineer's Consultants and the officers, directors, employees, agents, other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages arising out of or resulting from such hazardous condition, provided that: (i) any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and (ii) nothing in this subparagraph 4.5.4. shall obligate Owner to indemnify any person or entity from and against the consequences of that person's or entity's own negligence.

4.5.5. The provisions of paragraphs 4.2 and 4.3 are not intended to apply to Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Material uncovered or revealed at the site.

ARTICLE 5 – BONDS AND INSURANCE

Performance, Payment, and Other Bonds:

5.1. Contractor shall furnish Performance and Payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

5.2. If the surety on any Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.1. Contractor shall within ten days thereafter substitute another bond and surety, both of which must be acceptable to Owner.

5.3. Licensed Sureties and Insurers; Certificates of Insurance:

5.3.1. All Bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.3.2. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain in accordance with paragraph 5.4.

Contractor's Liability Insurance:

5.4. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance and furnishing of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed or furnished by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

5.4.1. claims under workers' compensation, disability benefits and other similar employee benefit acts;

5.4.2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

5.4.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

5.4.4. claims for damages insured by customary personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or by any other person for any other reason;

5.4.5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

5.4.6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

The policies of insurance so required by this paragraph 5.4 to be purchased and maintained shall:

5.4.7. with respect to insurance required by paragraphs 5.4.3 through 5.4.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) Owner, Engineer, Engineer's Consultants and any other persons or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers and employees of all such additional insureds;

5.4.8. include the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

5.4.8.1 Contractor's Liability Insurance and the Owner's Protective Liability Insurance specified above shall be provided in not less than the following amount:

a. Injury or death to more than one person or single occurrence	\$1,000,000
b. On and Off Premises Operations Liability	\$1,000,000
c. Explosion and Collapse Hazard	\$1,000,000
d. Underground Hazard	\$1,000,000
e. Completed Operations and Products Liability	\$1,000,000
f. Property damage in account of all occurrences	\$1,000,000
g. Independent Contractors Liability	\$1,000,000
h. Personal Injury Liability Insurance	\$1,000,000

Contractor's Vehicle Insurance as follows:

1. Injury or death to one person	\$1,000,000
2. Injury or death to more than one person or a single occurrence	\$1,000,000
3. Property Damage	\$1,000,000
4. Business Auto Liability, Including all owned, non owned and hired vehicles	\$1,000,000

An Umbrella Policy may be used to meet the above limits.

All policies shall be drawn to cover a period of not less than one (1) year from the date of issue.

5.4.10. include contractual liability insurance covering Contractor's indemnity obligations under paragraphs 6.12, 6.16, and 6.31 through 6.33;

5.4.11. contain a provision or endorsement that the coverage afforded will not be cancelled, materially changed or renewal refused until at least thirty days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to paragraph 5.3.2 will so provide);

5.4.12. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing or replacing **defective** Work in accordance with paragraph 13.12; and

5.4.13. with respect to completed operations insurance, and any insurance coverage written on an occurrence basis, remain in effect for at least two years after final payment (and Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter).

Owner's Liability Insurance:

5.5. In addition to the insurance required to be provided by Contractor under paragraph 5.4, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents. Any liability insurance carried by Owner is excess and non-contributory to any and all other coverage whether collectable or not.

Property Insurance:

5.6 *Contractor shall purchase and maintain property insurance upon the Work at the site in amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in these Supplementary Conditions or required by Laws and Regulations). This insurance shall:*

5.6.1 include the interests of Owner, Contractor, Subcontractors, Engineer, Engineer's Consultants and any other persons or entities identified in the Supplementary Conditions each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;

5.6.2 include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

5.6.3 cover materials and equipment in transit for incorporation in the Work or stored at the site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer; and

5.6.4 be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with thirty days written notice to each other additional insured to whom a certificate of insurance has been issued.

5.7. NOT USED

5.8. NOT USED

5.9. Owner shall not be responsible for purchasing and maintaining any property insurance to protect the interests of Contractor, Subcontractors or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount, will be borne by Contractor, Subcontractor, or others suffering any such loss and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.10. NOT USED

5.11. NOT USED

Receipt and Application of Insurance Proceeds:

5.12. Any insureds loss under the policies of insurance required by paragraphs 5.6 and 5.7 will be adjusted with Owner and made payable to Owner as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.13. Owner shall deposit in a separate account any money so received, and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

5.13. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

Acceptance of Bonds and Insurance; Option to Replace:

5.14. If either party (Owner or Contractor) has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within ten days after receipt of the certificates (or other evidence requested) required by paragraph 2.7. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

Partial Utilization – Property Insurance:

5.15. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with paragraph 14.10; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or

policies, but the property insurance shall not be cancelled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

6.1. Contractor shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but Contractor shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. Contractor shall be responsible to see that the completed Work complies accurately with the Contract Documents.

6.2. Contractor shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications to the superintendent shall be as binding as if given to CONTRACTOR.

Labor, Materials and Equipment:

6.3. Contractor shall provide competent, suitably qualified personnel to survey, lay out and construct the Work as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours and Contractor will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without Owner's written consent given after prior written notice to Engineer.

6.4. Unless otherwise specified in the General Requirements, Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, S, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

6.5. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

Progress Schedule:

6.6. Contractor shall adhere to the progress schedule established in accordance with paragraph 2.9 as it may be adjusted from time to time as provided below:

6.6.1. Contractor shall submit to Engineer for acceptance (to the extent indicated in paragraph 2.9) proposed adjustments in the progress schedule that will not change the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

6.6.2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of paragraph 12.1. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.7. Substitutes and "Or-Equal" Items:

6.7.1. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by Engineer under the following circumstances:

6.7.1.1. "Or-Equal": If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items.

6.7.1.2. Substitute Items: If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under subparagraph 6.7.1.1, it will be considered a proposed substitute item. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. The procedure for review by the Engineer will include the following as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor. If Contractor wishes to furnish or use a substitute item of material or equipment, Contractor shall first make written application to Engineer for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice Contractor's achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by

Engineer in evaluating the proposed substitute. Engineer may require Contractor to furnish additional data about the proposed substitute.

6.7.1.3. Contractor's Expense: All data to be provided by Contractor in support of any proposed "or-equal" or substitute item will be at Contractor's expense.

6.7.2. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in an expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by Engineer will be similar to that provided in subparagraph 6.7.1.2.

6.7.3. Engineer's Evaluation: Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.7.1.2 and 6.7.2. Engineer will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized without Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any "or-equal" or substitute. Engineer will record time required by Engineer and Engineer's Consultants in evaluating substitutes proposed or submitted by Contractor pursuant to paragraphs 6.7.1.2 and 6.7.2 and in making changes in the Contract Documents (or in the provisions of any other direct contract with Owner for work on the Project) occasioned thereby. Whether or not Engineer accepts a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the changes of Engineer and Engineer's Consultants for evaluating each such proposed substitute item.

6.8. Concerning Subcontractors, Suppliers and Others:

The Contractor shall submit a list of Subcontractors and major Material Suppliers for the Owner's approval within (24) hours after Bid Opening. Such list shall be accompanied by an experience statement with pertinent information as to similar projects and other evidence of qualifications from each such Subcontractor, person and organization requested by Owner. If Owner, after due investigation has reasonable objections to any proposed Subcontractor, other person or organization, the Owner may before giving the Notice of Award request the apparent successful Contractor to submit an acceptable Subcontractor without an increase in Bid Price. If the apparent successful Contractor declines to make any such substitution, the Contract shall not be awarded to such Contractor, but his declining to make any such substitution will not constitute grounds for sacrificing his Bid Security. Any Subcontractor, other person or organization so listed and to whom Owner does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner.

6.8.1. Contractor shall not employ any Subcontractor, Supplier or other person or organization (including those acceptable to Owner and Engineer as indicated in paragraph 6.8.2), whether initially or as a substitute, against whom Owner or Engineer may have reasonable objection. Contractor shall not be required to employ any subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom Contractor has reasonable objection.

6.8.2. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials or

equipment) to be submitted to Owner in advance of the specified date prior to the Effective Date of the Agreement for acceptance by Owner and Engineer, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's or Engineer's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the project documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case Contractor shall submit an acceptable substitute, the Contract Price will be adjusted by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by Owner or Engineer of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of Owner or Engineer to reject **defective Work**.

6.9.1. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other person or organization any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

6.9.2. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with Contractor. Contractor shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the Engineer through Contractor.

6.10. The divisions and sections of the Specifications and the identifications of any drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

6.11. All Work performed by Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.6. or 5.7. the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, Engineer's Consultants and all other additional insureds for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

Patent Fees and Royalties:

6.12. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work

and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Engineer, Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents.

Permits:

6.13. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Contractor shall pay all charges of utility owners for connections to the Work, and Owner shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

6.14 Laws and Regulations:

6.14.1. Contractor shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

6.14.2. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses and damages caused by, arising out of or resulting therefrom: however, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor or Contractor's obligations under paragraph 3.3.2.

Taxes:

6.15. Contractor shall pay all sales, consumer, use and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

Use of Premises:

6.16. Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, Engineer's Consultant and anyone directly or indirectly employed by any of

them from and against all claims costs, losses and damages arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

6.17. During the progress of the Work, Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall leave the site clean and ready for occupancy by Owner at Substantial Completion of the Work. Contractor shall restore to original condition all property not designated for alteration by the Contract Documents.

6.18. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

Record Documents:

6.19. Contractor shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples and Shop Drawings will be delivered to Engineer for Owner.

Safety and Protection:

6.20. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.20.1. all persons on the Work site or who may be affected by the Work;

6.20.2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

6.20.3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.20.2. or 6.20.3. caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or

Engineer's Consultant or anyone employed by any of them or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with paragraph 14.13. that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

Safety Representative:

6.21. Contractor shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

Hazard Communication Programs:

6.22. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with Laws or Regulations.

Emergencies:

6.23. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, without special instruction or authorization from Owner or Engineer, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

6.24. Shop Drawings and Samples:

6.24.1. Contractor shall submit Shop Drawings to Engineer for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals (see paragraph 2.9.). All submittals will be identified as Engineer may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to shown Engineer the materials and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by paragraph 6.26.

6.24.2. Contractor shall also submit Samples to Engineer for review and approval in accordance with said accepted schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended and otherwise as Engineer may require to enable Engineer to review the submittal for the limited purposes required by paragraph 6.26. The numbers of each Sample to be submitted will be as specified in the Specifications.

6.25. Submittal Procedures:

6.25.1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

6.25.1.1 all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto,

6.25.1.2. all materials with respect to intended use, fabrication, shipping, handling storage, assembly and installation pertaining to the performance of the Work, and

6.25.1.3. all information relative to Contractor's sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

Contractor shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

6.25.2 Each submittal will bear a stamp or specific written indication that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

6.25.3. At the time of each submission, Contractor shall give Engineer specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to Engineer for review and approval of each such variation.

6.26. Engineer will review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals accepted by Engineer as required by paragraph 2.9. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means, method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make corrections required by Engineer, and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.27. Engineer's review and approval of Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at the time of submission as required by paragraph 6.25.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying Shop Drawing or Sample approval; nor will any approval by Engineer relieve Contractor from responsibility for complying with the requirements of paragraph 6.25.1.

6.28. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submissions accepted by Engineer as required by paragraph 2.9, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

Continuing the Work:

6.29. Contractor shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.5 or as Owner and Contractor may otherwise agree in writing.

6.30. Contractor's General Warranty and Guarantee:

6.30.1. Contractor warrants and guarantees to Owner, Engineer and Engineer's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

6.30.1.1. abuse, modification or improper maintenance or operation by persons other than Contractor, Subcontractors or Suppliers; or

6.30.1.2. normal wear and tear under normal usage.

6.30.2. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

6.30.2.1. observations by Engineer;

6.30.2.2. recommendation of any progress or final payment by Engineer;

6.30.2.3. the issuance of a certificate of Substantial Completion or any payment by Owner to Contractor under the Contract Documents;

6.30.2.4. use or occupancy of the Work or any part thereof by Owner;

6.30.2.5. any acceptance by Owner or any failure to do so;

6.30.2.6. any review and approval of Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer pursuant to paragraph 14.13;

6.30.2.7. any inspection, test or approval by others; or

6.30.2.8. any correction of **defective** Work by Owner.

Indemnification:

6.31. To the fullest extent permitted by Laws and Regulations. Contractor shall indemnify and hold harmless Owner, Engineer, Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) caused by, arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage: (i) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and (ii) is caused in whole or in

part by any negligent act or omission of Contractor, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity.

6.32. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.31 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

6.33. The indemnification obligations of Contractor under paragraph 6.31 shall not extend to the liability of Engineer and Engineer's Consultants, officers, directors, employees or agents caused by the professional negligence, errors or omissions of any of them.

Survival of Obligations:

6.34. All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

ARTICLE 7 – OTHER WORK

Related Work at Site:

7.1. Owner may perform other work related to the Project at the site by Owner's own forces, or let other direct contracts therefore which shall contain General Conditions similar to these, or have other work performed by utility owners. If the fact that such other work is to be performed was not noted in the Contract Documents, then; (i) written notice thereof will be given to Contractor prior to starting any such other work, and (ii) Contractor may make a claim therefore as provided in Articles 11 and 12 if Contractor believes that such performance will involve additional expense to Contractor or requires additional time and the parties are unable to agree as to the amount or extent thereof.

7.2. Contractor shall afford each other contractor who is a party to such a direct contract and each utility owner (and Owner if Owner is performing the additional work with Owner's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents. Contractor shall do all cutting, fitting, and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are

comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

7.3. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7. Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure so to report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent or non-apparent defects and deficiencies in such other work.

Coordination:

7.4. If Owner contracts with others for the performance of other work on the Project at the site, the following will be set forth in Supplementary Conditions:

- 7.4.1. the person, firm or corporation who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified;
- 7.4.2. the specific matters to be covered by such authority and responsibility will be itemized: and
- 7.4.3. the extent of such authority and responsibilities will be provided.

Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility in respect of such coordination.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.1. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.2. In case of termination of the employment of Engineer, Owner shall appoint an engineer, whose status under the Contract Documents shall be that of the former Engineer.

8.3. Owner shall furnish the data required of Owner under the Contract Documents promptly and shall make payments to Contractor promptly when they are due as provided in paragraphs 14.4 and 14.13.

8.4. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions at the site and drawings of physical conditions in existing structures at or contiguous to the site that have been utilized by Engineer in preparing the Contract Documents.

8.5. Owner's responsibilities in respect of purchasing and maintaining liability and property insurance are set forth in paragraphs 5.5 through 5.10.

8.6. Owner is obligated to execute Change Orders as indicated in paragraph 10.4.

8.7. Owner's responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4.

8.8. In connection with Owner's right to stop Work or suspend Work, see paragraphs 13.10 and 15.1. Paragraph 15.2 deals with Owner's right to terminate services of Contractor under certain circumstances.

8.9. The Owner shall not supervise, direct or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. Owner will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

8.10. Owner's responsibility in respect of undisclosed Asbestos, PCBs, Petroleum, Hazardous Waste or Radioactive Materials uncovered or revealed at the site is set forth in paragraph 4.5.

8.11. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

Owner's Representative:

9.1. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and shall not be extended without written consent of Owner and Engineer.

Visits to Site:

9.2. Engineer will make visits to the site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer will endeavor for the benefit of Owner to determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and on-site observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work. Engineer's visits and on-site observations are subject to all the limitations on Engineer's authority and responsibility set forth in paragraph 9.13, and particularly, but without limitation, during or as a result of Engineer's on-site visits or observations of Contractor's Work Engineer will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work.

Project Representative:

9.3. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more continuous observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in

paragraph 9.13 and in the Supplementary Conditions. If Owner designates another representative or agent to represent Owner at the site who is not Engineer's Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other person will be as provided in the Supplementary Conditions.

9.3.1 Engineer may furnish a Resident Project Representative, assistants and other field staff as needed, to assist Owner in observing performance of the Work. The Resident Project Representative is to observe and inspect, in the Owner's interest, the materials furnished and the work done as the work progresses in order to insure full and complete compliance with the contract and to verify quantities of work completed.

9.3.2 Owner may also designate one of its employees to represent Owner for these purposes.

9.3.3 Engineer, Resident Project Representative, Owner and all such other persons referred to shall have unrestricted access to all parts of the Work. Contractor shall cooperate by supplying necessary facilities and assistance required by above persons to carry out their work of observation and inspection.

9.3.4 It is not the function of the Engineer, Resident Project Representative or Owner to supervise or direct the manner in which the work to be done under this Contract is carried on or conducted. The Engineer, Resident Project Representative or Owner is not responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the work, and they will not be responsible for the Contractor's failure to carry out the work in accordance with the Contract Documents. Nevertheless, Contractor agrees that any method or procedure, which in the opinion of the Engineer or Owner does not achieve the required results or quality of the work specified, shall be discontinued immediately upon the order of the Engineer.

9.3.5 All communications between Contractor and Engineer or Contractor and Owner are to be through the Resident Project Representative.

9.3.6 Duties and Responsibilities of Resident Project Representative (RPR):

- 1) RPR will act as directed by and under the supervision of Engineer and/or Owner, and will confer with Engineer and Owner regarding RPR's actions. RPR's dealings in matters pertaining to the on-site work shall in general be with Engineer and Contractor keeping Owner advised as necessary. RPR's dealings with subcontractors shall only be through or with the full knowledge and approval of Contractor.*
- 2) Review progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by Contractor and consult with Engineer and Owner concerning acceptability.*
- 3) Attend meetings with Contractor, such as pre-construction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.*
- 4) Serve as Engineer's and Owner's liaison with Contractor, working principally through Contractor's superintendent and assist in understanding the intent of the Contract Documents.*
- 5) Advise Engineer, Owner and Contractor of the commencement of any Work requiring a Shop Drawing or sample if the submittal has not been approved by Engineer.*

- 6) *Conduct on-site observations of the Work in progress to assist Engineer and Owner in determining if the Work is in general proceeding in accordance with the Contract Documents. Report to Engineer and Owner whenever RPR believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer and Owner of Work that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.*
- 7) *Report to Engineer and Owner when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.*
- 8) *Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to Engineer and Owner. Transmit to Contractor decisions as issued by Engineer and/or Owner.*
- 9) *Maintain orderly files for correspondence, reports of job conferences, Shop Drawings and samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.*
- 10) *Keep a diary or log book, recording Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or Changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer and Owner.*
- 11) *Record names, addresses and telephone numbers of all Contractors, subcontractors and major suppliers of materials and equipment.*
- 12) *Furnish Engineer and Owner periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and sample submittals.*
- 13) *Draft proposed Change Orders and Work Directive Changes, obtaining backup material from Contractor and recommend to Engineer and Owner Change Orders, Work Directive Changes, and Field Orders.*
- 14) *Report immediately to Engineer and Owner upon the occurrence of any accident.*
- 15) *Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed and materials and equipment delivered at the site but not incorporated in the Work.*
- 16) *During the course of the Work, verify that certificates, maintenance and operation manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Engineer for review and forwarding to Owner prior to final payment for the work.*

17) *Before Engineer issues a Certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.*

18) *Conduct final inspection in the company of Engineer, Owner and Contractor and prepare a final list of items to be completed or corrected.*

19) *Observe that all items on final list have been completed or corrected and make recommendations to Engineer and Owner concerning acceptance.*

9.3.7 *Limitations of Authority of Resident Project Representative (RPR):*

1) *Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by Engineer or Owner.*

2) *Shall not exceed limitations of Engineer's authority as set forth in the Contract Documents.*

3) *Shall not undertake any of the responsibilities of Contractor, subcontractors or Contractor's superintendent.*

4) *Shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advice or directions are specifically required by the Contract Documents.*

5) *Shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.*

6) *Shall not accept Shop Drawing or sample submittals from anyone other than Contractor.*

9.3.8 *The Engineer and or Owner shall have the authority to reject any work, or materials, or any part thereof, which does not in his opinion conform to the plans, drawings, specifications and contract, and it shall be permissible for him to do so at any time during the progress of the work and until its acceptance.*

No material of any kind shall be used upon the work until it has been inspected and accepted by the Engineer. All materials rejected shall be removed immediately from the work and not again offered for inspection. Any materials or workmanship found at any time to be defective or not of the quality or character required by the plans and specifications shall be remedied at once regardless of previous inspection.

Such inspection shall not relieve the Contractor from any obligation to perform said work strictly in accordance with the plans and specifications and work not so constructed shall be removed and made good by the Contractor at his own expense, and free from all expense to the Owner whenever so ordered by the Owner without reference to any previous oversight or error in inspection.

Clarifications and Interpretations:

9.4. Engineer will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as Engineer may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. Such written clarifications and interpretations will be binding on Owner and Contractor. If Owner or Contractor believes that a written clarification or interpretation justifies an adjustment in the

Contract Price or the Contract Times and the parties are unable to agree to the amount or extent thereof, if any, Owner or Contractor may make a written claim therefore as provided in Article 11 or Article 12.

Authorized Variations in Work:

9.5. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree as to the amount or extent thereof, Owner or Contractor may make a written claim therefore as provided in Article 11 or 12.

Rejecting Defective Work:

9.6. Engineer will have authority to disapprove or reject Work which Engineer believes to be defective, or that Engineer believes will not produce a complete Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in paragraph 13.9, whether or not the Work is fabricated, installed or completed.

Shop Drawings, Change Orders and Payments:

9.7. In connection with Engineer's authority as to Shop Drawings and Samples, see paragraphs 6.24 through 6.28 inclusive.

9.8. In connection with Engineer's authority as to Change Orders, see Articles 10,11, and 12.

9.9. In connection with Engineer's authority as to Applications for Payment, see Article 14.

Determinations for Unit Prices:

9.10. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding upon Owner and Contractor, unless, within ten days after the date of any such decision, either Owner or Contractor delivers to the other and to Engineer written notice of intention to appeal from Engineer's decision and, a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to Engineer's decision, unless otherwise agreed in writing by Owner and Contractor. Such appeal will not be subject to procedures of paragraph 9.11.

Decisions on Disputes:

9.11. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work there under. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and Claims under Articles 11 and 12 in respect of changes in the Contract Price or Contract Times will be referred initially to Engineer in writing with a request for

a formal decision in accordance with this paragraph. Written notice of each such claim, dispute or other matter will be delivered by the claimant to Engineer and the other party to the Agreement promptly, but in no event later than fifteen (15) days, after the start of the occurrence or event giving rise thereto, and written supporting data will be submitted to Engineer and the other party within forty-five (45) days after the start of such occurrence or event unless Engineer allows an additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to Engineer and the claimant within thirty days after receipt of the claimant's last submittal (unless Engineer allows additional time). Engineer will render a formal decision in writing within thirty days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. Engineer's written decision on such claim, dispute or other matter will be final and binding upon Owner and Contractor unless: a written notice of intention to appeal from Engineer's written decision is delivered by Owner or Contractor to the other and to Engineer within thirty days after the date of such decision and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable Laws and Regulations within sixty days of the date of such decision, unless otherwise agreed in writing by Owner and Contractor.

9.12. When functioning as interpreter and judge under paragraphs 9.10 and 9.11, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Engineer pursuant to paragraphs 9.10 or 9.11 with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.15) will be a condition precedent to any exercise by Owner or Contractor of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter.

9.13. Limitations on Engineer's Authority and Responsibilities:

9.13.1. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by Engineer shall create, impose or give rise to any duty owed by Engineer to Contractor, any Subcontractor, and Supplier, any other person or organization, or to any surety for employee or agent of any of them.

9.13.2. Engineer will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. Engineer will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

9.13.3. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

9.13.4. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests, and approvals and Other documentation required to be delivered by paragraph 4.12 will only be to determine generally that their content complies with the requirements of, and in the

case of, certificates of inspections, tests and approvals that the results certified indicate compliance with the Contract Documents.

9.13.5. the limitations upon authority and responsibility set forth in this paragraph 9.13 shall also apply to Engineer's Consultants, Resident Project Representative and assistants.

ARTICLE 10 – CHANGES IN THE WORK

10.1. Without invalidating the Agreement and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions or revisions in the Work. Such additions, deletions or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

10.2. If Owner and Contractor are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Times that should be allowed as a result of a Work Change Directive, a claim may be made therefore as provided in Article 11 or Article 12.

10.3. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraphs 3.5 and 3.6 except in the case of an emergency as provided in paragraph 6.23 or in the case of uncovering Work as provided in paragraph 13.9.

10.4. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

10.4.1. changes in the Work which are (i) ordered by Owner pursuant to paragraph 10.1, (ii) required because of acceptance of defective Work under paragraph 13.13 or correcting defective Work under paragraph 13.14, or (iii) agreed to by the parties;

10.4.2. changes in the Contract Price or Contract Times which are agreed to by the parties; and

10.4.3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to paragraph 9.11;

Provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.29.

10.5. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be Contractor's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11 – CHANGE OF CONTRACT PRICE

11.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Price.

11.2. The Contract Price may only be changed by a Change Order. Any claim for an adjustment in the Contract Price shall be based on written notice delivered by the party making the claim to the other party and to Engineer promptly (but in no event later than ten days) after the start of the occurrence or event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within thirty days after the start of such occurrence or event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of the claim) and shall be accompanied by claimant's written statement that the adjustment claimed covers all known amounts to which the claimant is entitled as a result of said occurrence or event. All claims for adjustment in the Contract Price shall be determined by Engineer in accordance with paragraph 9.11 if Owner and Contractor cannot otherwise agree on the amount involved. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph 11.2.

11.3 The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows:

11.3.1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraphs 11.9.1. through 11.9.3. inclusive);

11.3.2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 11.6.2):

11.3.3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 11.3.2, on the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a Contractor's fee for overhead and profit (determined as provided in paragraph 11.6).

Cost of the Work Covered by a Change Order:

11.4. The term Cost of the Work means the sum of all costs necessarily incurred and paid by Contractor in the proper performance of the Work. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5.

11.4.1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include without limitation superintendents, foremen and other personnel employed full-time at the site. Payroll costs for employees not employed full-time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by Owner.

11.4.2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

11.4.3. Payments made by Contractor to the Subcontractors for Work performed or furnished by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner who will then determine, with the advice of Engineer, which bids, if any, will be accepted. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in paragraphs 11.4, 11.5, 11.6 and 11.7. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

11.4.4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work.

11.4.5. Supplemental costs including the following:

11.4.5.1. The proportion of necessary transportation, travel and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

11.4.5.2. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of Contractor.

11.4.5.3. Rentals of all construction equipment and machinery and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof – all in accordance with the terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4. Sales, consumer, use or similar taxes related to the work, and for which Contractor is liable, imposed by Laws and Regulations.

11.4.5.5. Deposits lost for causes other than negligence of Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.4.5.6. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by Owner in accordance with paragraph 5.9), provided they have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner.

No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee. If, however, any such loss or damage requires reconstruction and Contractor is placed in charge thereof, Contractor shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7. The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9. Cost of premiums for additional Bonds and insurance required because of changes in the Work.

11.5. The term Cost of the Work Covered by a Change Order shall not include any of the following:

11.5.1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by Contractor whether at the site or in Contractor's principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.4.1 or specifically covered by paragraph 11.4.4 – all of which are to be considered administrative costs covered by the Contractor's fee.

11.5.2. Expenses of Contractor's principal and branch offices other than Contractor's office at the site.

11.5.3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

11.5.4. Cost of premiums for all Bonds and for all insurance whether or not Contractor is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by subparagraph 11.4.5.9 above).

11.5.5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of **defective** Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

11.6. The Contractor's fee allowed to Contractor for overhead and profit shall be determined as follows:

11.6.1. a mutually acceptable fixed fee; or

11.6.2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

11.6.2.1. for costs incurred under paragraphs 11.4.1 and 11.4.2, the Contractor's fee shall be ten percent;

11.6.2.2. for costs incurred under paragraph 11.4.3, the Contractor's fee shall be five percent.

11.6.2.3. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraphs 11.4.1, 11.4.2, 11.4.3 and 11.6.2 is that the Subcontractor who actually performs or furnishes the Work, at whatever tier, will be paid a fee of ten percent of the costs incurred by such Subcontractor under paragraphs 11.4.1 and 11.4.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor:

11.6.2.4. no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5 and 11.5;

11.6.2.5. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

11.6.2.6. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with paragraphs 11.6.2.1 through 11.6.2.5, inclusive.

11.7. Whenever the cost of any work is to be determined pursuant to paragraphs 11.4 and 11.5, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in form acceptable to Engineer an itemized cost breakdown together with supporting data.

Cash Allowances:

11.8. NOT USED

11.9. Unit Price Work:

11.9.1. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer in accordance with paragraph 9.10.

11.9.2. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

11.9.3. Owner or Contractor may make a claim for an adjustment in the Contract Price in accordance with Article 11 if:

11.9.3.1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

11.9.3.2. there is no corresponding adjustment with respect to any other item of Work; and

11.9.3.3. if Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT TIMES

12.1. The Contract Times (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Times (or Milestones) shall be based on written notice delivered by the party making the claim to the other party and to Engineer promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless Engineer allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Times (or Milestones) shall be determined by Engineer in accordance with paragraph 9.11 if Owner and Contractor cannot otherwise agree. No claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph 12.1.

12.2. All time limits stated in the Contract Documents are of the essence of the Agreement.

12.3. Where Contractor is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of Contractor, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a claim is made therefore as provided in paragraph 12.1. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

12.4. Should Contractor be obstructed or delayed in the prosecution of or completion of the Work as a result of unforeseeable causes beyond the control of Contractor, and not due to its fault or neglect, including but not restricted to acts of God or of the public enemy, acts of government, fires, floods, epidemics, quarantine regulation, strikes or lockouts, Contractor shall notify the Owner in writing within forty-eight (48) hours after the commencement of such delay, stating the cause or causes thereof, or be deemed to have waived any right which Contractor may have had to request a time extension.

12.5. No interruption, interference, inefficiency, suspension or delay in the commencement or progress of the Work from any cause whatever, including those for which the Owner may be responsible, in whole or in part, shall relieve Contractor of his duty to perform or give rise to any right to damages or additional compensation from the Owner. Contractor expressly acknowledges and agrees that it shall receive no damages for delay. Contractor's sole remedy, if any, against the Owner will be the right to seek an extension to the Contract Time; provided, however, the granting of any such time extension shall not be a

condition precedent to the aforementioned “No Damage For Delay” provision. This paragraph shall expressly apply to claims for early completion, as well as to claims based on late completion.

ARTICLE 13 – TESTS AND INSPECTION: CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1. **Notice of Defects:** Prompt notice of all defective Work of which Owner or Engineer have actual knowledge will be given to Contractor. All defective Work may be rejected, corrected or accepted as provided in this Article 13.

Access to Work:

13.2. Owner, Engineer, Engineer's Consultants, other representatives and personnel of Owner, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's site safety procedures and programs so that they may comply therewith as applicable.

Tests and Inspections:

13.3. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.4. Contractor shall employ and pay for services of an independent testing laboratory to perform all Quality Control inspections, test or approvals required by the contract documents. Contractor shall allow the Engineer access to all work done in the project for Acceptance Testing by the owner. This testing will be in addition to Quality Control Testing required by the Contractor. Owner shall arrange and pay all costs associated with Acceptance Testing done by an independent testing laboratory of the Owners choosing except:

13.4.1. for inspections, tests or approvals covered by paragraph 13.5 below.

13.4.2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.9 below shall be paid as provided in said paragraph 13.9; and

13.4.3. as otherwise specifically provided in the Contract Documents.

13.4.4. Owner shall perform the following test as part of quality assurance / acceptance testing:

All material testing included in the Bidding Documents.

All other required testing is to be completed by the contractor as part of the contractor's quality control procedures and submittals. This section shall take precedence over all other sections that describe testing requirements.

13.5. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection, or approval. Contractor shall also be responsible for arranging and obtaining and shall pay all

costs in connection with any inspections, tests or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Quality Control Testing of materials and equipment shall be the responsibility of the Contractor who shall pay all costs associated with the required testing. Contractor shall provide the Engineer adequate advance notice of intended tests to allow the Engineer to be present during the Testing.

13.6. If any Work (or the work of others) that is to be inspected, tested or approved is covered by Contractor without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation.

13.7. Uncovering Work as provided in paragraph 13.6 shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

Uncovering Work:

13.8. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

13.9. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose or otherwise make available for observation, inspection or testing as Engineer may require that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others; and Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim therefore as provided in Article 11. If, however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent therefore, Contractor may make a claim therefore as provided in Articles 11 and 12.

Owner May Stop the Work:

13.10. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor or any surety or other party.

Correction or Removal of Defective Work:

13.11. If required by Engineer, Contractor shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Engineer, remove it from the site and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.12. Correction Period:

13.12.1. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instruction: (i) correct such defective Work, or, if it has been rejected by Owner, remove it from the site and replace it with Work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor does not promptly comply with the terms of such instructions, or in any emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

13.12.2. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

13.12.3. Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this paragraph 13.12, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

Acceptance of Defective Work:

13.13. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, also Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness). If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, Owner may make a claim therefore as provided in Article 11. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

Owner May Correct Defective Work:

13.14. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work or to remove and replace rejected Work as required by Engineer in accordance with paragraph 13.11, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days' written notice to Contractor, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph Owner shall proceed expeditiously. In connection with such corrective and remedial action, Owner may exclude Contractor from all or part of the site, take possession of all or part of the Work, and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representative, agents and employees, Owner's other contractors

and Engineer and Engineer's Consultants access to the site to enable Owner to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by Owner in exercising such rights and remedies will be charged against Contractor and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, Owner may make a claim therefore as provided in Article 11. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's defective Work. Contractor shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies hereunder.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

Schedule of Values:

14.1. The schedule of values established as provided in paragraph 2.9 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

Application for Progress Payment:

14.2. At least ten days before the date established for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect Owner's interest therein, all of which will be satisfactory to Owner. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

Contractor's Warranty of Title:

14.3. Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

Review of Applications for Progress Payment:

14.4. Engineer will, within ~~ten~~ *fifteen (15)* days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application. ~~Ten~~ *Thirty (30)* days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of the last sentence of paragraph 14.7) become due and when due will be paid by Owner to Contractor.

14.5. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's on-site observations of the executed Work as an experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

14.5.1. the Work has progressed to the point indicated.

14.5.2. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.10, and to any other qualifications stated in the recommendation), and

14.5.3. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

However, by recommending any such payment Engineer will not thereby be deemed to have represented that: (i) exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents or (ii) that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

14.6. Engineer's recommendation of any payment, including final payment, shall not mean that Engineer is responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of Work, or for any failure of Contractor to perform or furnish Work in accordance with the Contract Documents.

14.7. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner referred to in paragraph 14.5. Engineer may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

14.7.1. the Work is defective, or completed Work has been damaged requiring correction or replacement.

14.7.2. the Contract Price has been reduced by Written Amendment or Change Order.

14.7.3. Owner has been required to correct defective Work or complete Work in accordance with paragraph 13.14. or

14.7.4. Engineer has actual knowledge of the occurrence of any of the events enumerated in paragraphs 15.2.1 through 15.2.4 inclusive.

Owner may refuse to make payment of the full amount recommended by Engineer because:

14.7.5. claims have been made against Owner on account of Contractors performance or furnishing of the Work.

14.7.6. Liens have been filed in connection with the Work, except where Contractor has delivered a specific Bond satisfactory to Owner to secure the satisfaction and discharge of such Liens,

14.7.7. there are other items entitling Owner to a set-off against the amount recommended, or

14.7.8. Owner has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.7.1 through 14.7.3 or paragraphs 15.2.1 through 15.2.4 inclusive;

but Owner must give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.

Substantial Completion:

14.8. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion. Within a reasonable time thereafter, Owner, Contractor and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefore. If Engineer considers the Work substantially complete, Engineer will prepare and deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within fourteen days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefore. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said fourteen days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner. At the time of delivery of the tentative certificate of Substantial Completion Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

14.9. Owner shall have the right to exclude Contractor from the Work after the date of Substantial Completion, but Owner shall allow Contractor reasonable access to complete or correct items on the tentative list.

Partial Utilization:

14.10. Use by Owner at Owner's option of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) Owner, Engineer and Contractor agree

constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.10.1. Owner at any time may request Contractor in writing to permit Owner to use any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, Owner, Contractor and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefore. If Engineer considers that part of the Work to be substantially complete, the provisions of paragraphs 14.8 and 14.9 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.10.2. No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of paragraph 5.15 in respect of property insurance.

Owner may at any time request Contractor in writing to permit Owner to take over operation of any such part of the work although it is not substantially complete. A copy of such request will be sent to Engineer and within a reasonable time thereafter Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If Contractor does not object in writing to Owner and Engineer that such part of the Work is not ready for separate operation by Owner, Engineer will finalize the list if items to be completed or corrected and will deliver such lists to Owner and Contractor together with a written recommendation as to the division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Work which will become binding upon Owner and Contractor at the time when Owner takes over such operation (unless they shall have otherwise agreed in writing and so informed Engineer). During such operation and prior to Substantial Completion of such part of the Work, Owner shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.

Final Inspection:

14.11. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or **defective**. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

Final Application for Payment:

14.12. After Contractor has completed all such corrections to the satisfaction of Engineer and delivered in accordance with the Contract Documents all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance required by paragraph 5.4, certificates of

inspection, marked-up record documents (as provided in paragraph 6.19) and other documents, Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by:

- (i) consent of the surety, if any, to final payment.
- (ii) complete and legally effective releases or waivers (satisfactory to Owner) of all Liens arising out of or filed in connection with the Work. In lieu of such releases or waivers of Liens and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and (ii) all payrolls, material and equipment bills and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a Bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.
- (iii) certification from surety that payment and performance bond shall remain in effect one (1) year following final payment.
- (iv) contractor's advertisement of completion – advertisement for a period of four (4) successive weeks in the newspaper or largest circulation published within the county where the work is performed.
- (v) certification from insurance company that any insurance coverage written on a claims-made basis, remain in effect for at least two (2) years following final payment.

Final Payment and Acceptance:

14.13. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of paragraph 14.15. Otherwise, Engineer will return the Application to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. Thirty days after the presentation to Owner of the Application and accompanying documentation, in appropriate form and substance and with Engineer's recommendation and notice of acceptability, the amount recommended by Engineer will become due and will be paid by Owner to Contractor.

14.14. If, through no fault of Contractor, final completion of the Work is significantly delayed and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment and recommendation of Engineer, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

Waiver of Claims:

14.15. The making and acceptance of final payment will constitute:

14.15.1. a waiver of all claims by Owner against Contractor, except claims arising from unsettled Liens, from **defective** Work appearing after final inspection pursuant to paragraph 14.11, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

14.15.12.a waiver of all claims by Contractor against Owner other than those previously made in writing and still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

Owner May Suspend Work:

15.1. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes an approved claim therefore as provided in Articles 11 and 12.

Owner May Terminate:

15.2. Upon the occurrence of any one or more of the following events:

15.2.1. if Contractor persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.9 as adjusted from time to time pursuant to paragraph 6.6);

15.2.2. if Contractor disregards Laws or Regulations of any public body having jurisdiction;

15.2.3. if Contractor disregards the authority of Engineer; or

15.2.4. if Contractor otherwise violates in any substantial way any provisions of the Contract Documents;

15.2.5 *if Contractor commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if Contractor takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency;*

15.2.6 *if a petition is filed against Contractor under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against Contractor under any other federal or state law in effect at the time relating to bankruptcy or insolvency;*

15.2.7 *if Contractor makes a general assignment for the benefit of creditors;*

15.2.8 *if a trustee, receiver, custodian, or agent of Contractor is appointed under applicable law or under contract, whose appointment or authority to take charge of property of Contractor is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of Contractor's creditors;*

15.2.9 *if Contractor admits in writing an inability to pay its debts generally as they become due.*

Owner may, after giving Contractor (and the surety, if any,) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of Contractor, exclude Contractor from the site and take possession of the Work and of all Contractor's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses and damages sustained by Owner arising out of or resulting from completing the Work such excess will be paid to Contractor. If such claims, costs, losses and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and when so approved by Engineer incorporated in a Change Order, provided that when exercising any rights or remedies under this paragraph Owner shall not be required to obtain the lowest price for the Work performed.

15.3. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

15.4. Upon seven days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, elect to terminate the Agreement. In such case, Contractor shall be paid (without duplication of any items):

15.4.1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

15.4.2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

15.4.3. for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and other; and

15.4.4. for reasonable expenses directly attributable to termination.

Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

Contractor May Stop Work or Terminate:

15.5. If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety days by Owner or under an order of court or other public authority, or Engineer fails to act on any Application for Payment within thirty days after it is submitted or Owner fails for thirty days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Agreement and recover from Owner payment on the same terms as provided in paragraph 15.4. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within thirty days after it is submitted, or Owner has failed for thirty days to pay Contractor any sum finally determined to be due, Contractor may upon seven day's written notice to Owner and Engineer stop the Work until payment of all such amounts due Contractor, including interest thereon. The provisions of this paragraph 15.5 are not intended to preclude Contractor from making claim under Articles 11 and 12 for an increase in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping Work as permitted by this paragraph.

ARTICLE 16 – MISCELLANEOUS

Giving Notice:

16.1. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

16.2 Computation of Times:

16.2.1. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

16.2.2. A calendar day of twenty-four hours measured from midnight to the next midnight will constitute a day.

Notice of Claim:

16.3. Should Owner or Contractor suffer injury or damage to person or property because of any error, omission or act of the other part or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party promptly, but in no event later than fifteen (15) days of the first observance of such injury or damage. The provisions of this paragraph 17.3 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

Cumulative Remedies:

16.4. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon Contractor by paragraphs 6.12, 6.16, 6.30, 6.31, 6.32, 13.1,

13.12, 13.14, 14.3 and 15.2 and all of the rights and remedies available to Owner and Engineer thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

Professional Fees and Court Costs Included:

16.5. Whenever reference is made to "claims, costs, losses and damages," it shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs.

Labor Records and Schedules:

16.6 *The Department of Jurisdiction on such public work shall require all Contractors and Subcontractors to keep the following records on the site of the public work project on which such Contractors, and Subcontractors are engaged:*

16.6.1 *Record of hours worked by each worker, laborer, and mechanic on each day.*

16.6.2 *Record of days worked each week by each worker, laborer, and mechanic.*

16.6.3 *Schedule of occupation or occupations at which each worker, laborer, and mechanic on the project is employed during each workday and week.*

16.6.4 *Schedule of hourly wage rates and supplements paid to each worker, laborer, and mechanic for each occupation.*

Wage Schedules:

16.7 *Pursuant to Sections 220.3 and 220-d of the Labor Law, each laborer, worker, or mechanic employed by the Contractor, Subcontractor, or other person shall be paid not less than the prevailing rate of wages for a legal day's work and shall be provided supplements not less than the prevailing supplements as determined by the Industrial Commissioner.*

The Contractor and every Subcontractor shall post in a prominent and accessible place on the site of the work a legible statement of all wage rates and supplements as specified in the Contract to be paid or provided, as the case may be, for the various classes of mechanics, workers, and laborers employed on the work.

The Owner does not represent or warrant that the accompanying schedule of wage rates and supplements with the classification of workers, mechanics, and laborers, as required by Section 220 of the Labor Law, is complete, and it reserves the right to revise such schedule when required. If any occupation is not mentioned in the schedule of wage rates and supplements it shall be requested from the Industrial Commissioner, by the Contractor through the Engineer and such schedules, shall, upon notice to the Contractor, become and be a part of the wage and supplement schedules embodied in the Contract.

Also included is the Federal Wage Rate Determination. Laborers, workmen, and mechanics employed on the work done in performance of said Contract shall be paid not less than the rate of wages listed thereon for the trade or occupation of such laborer, etc.

TECHNICAL SPECIFICATIONS



BID DOCUMENTS
DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

Commissioning shall be included in Bid Alternate No. 2.

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. ASHRAE Standard 90.1-2010, ASHRAE Guidelines 0-2013 (The Commissioning Process), and 1.1-2007 (The HVAC Commissioning Process) and ASHRAE Standard 202-2013 Commissioning Process for Buildings and Systems.
- C. Commissioning Plan (Cx Plan).

1.2 SUMMARY

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- B. Commissioning is systematic processes to provide documented confirmation that building systems perform according to the criteria set forth in the design intent and satisfy the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. The Commissioning process shall comply with ASHRAE Guidelines 0-2013 and 1.1-2010 and ASHRAE Standard 202-2013.
- C. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
 - 1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - 2. Verify and document proper performance of equipment and systems.
- D. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.
- E. Abbreviations. The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.3.

A/E-	Architect and Design Engineers	HVAC-	Heating, Ventilating and Air Conditioning
OPR-	Owner's Project Requirements	BoD	Basis of Design

CxA-	Commissioning authority	MC-	Mechanical contractor
CC	Controls contractor	OR-	Owner's Representative
Cx-	Commissioning	CVC-	Component Verification Checklist
Cx Plan-	Commissioning Plan document	PM-	Project manager (of the Owner)
EC-	Electrical contractor	Subs-	Subcontractors to GC
FPT	Functional performance test	TAB-	Test and Balance contractor
GC	General Contractor		

1.3 DEFINITIONS

- A. Acceptance Phase. Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.
- B. Approval. Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
- C. Engineer (E): The prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.
- D. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- E. CxA: Commissioning Authority. An independent agent, not otherwise associated with the Engineer team members, the GC, hired by the Owner. The CxA directs and coordinates the day-to-day commissioning activities. The CxA does not take an oversight role like the GC. The CxA coordinates with the GC, but shall report directly to the Owner.
- F. Cx Plan: Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process
- G. Datalogging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.
- H. Deferred Functional Tests: FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
- I. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent)
- J. Design Intent: A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
- K. Design Narrative or Design Documentation: Sections of either the Design Intent or Basis of Design.
- L. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

- M. Functional Performance Test (FPT) or (FT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after verification checklists and start-up activities are complete.
- N. General Contractor (GC): Contractor responsible for general work and responsible for coordination of other discipline contractors, including plumbing, mechanical, and electrical.
- O. Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed
- P. Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- Q. Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.
- R. Non-Compliance: See Deficiency.
- S. Non-Conformance: See Deficiency.
- T. Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50°F to 75°F to verify economizer operation). See also "Simulated Signal."
- U. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- V. PM: Construction Project Manager. The construction project manager for this project.
- W. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
- X. Seasonal Performance Tests: FT that are deferred until the system(s) will experience conditions closer to their design conditions.
- Y. Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- Z. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
- AA. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

- BB. Startup: The initial starting or activating of dynamic equipment, including executing verification checklists.
- CC. Subcontractors (Subs): The subcontractors to the General Contractor who provide and install building components and systems.
- DD. Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.
- EE. Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents
- FF. Trending: Monitoring using the building control system.
- GG. Vendor: Supplier of equipment.
- HH. Component Verification Checklist (CVC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CxA to the General Contractor and the Subcontractors. Component verification checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels proper, labels affixed, gages in place, sensors calibrated, etc.). However, some checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor). Component verification checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the verification checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the verification checklist, except for larger or more critical pieces of equipment.
- II. Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.4 COORDINATION

- A. Commissioning Team. The members of the commissioning team consist of the Commissioning Authority (CxA), the Owner's Representative (OR), the Engineers, the General Contractor (GC), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB contractor, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or operator/engineer is also a member of the commissioning team.
- B. Management. The CxA is hired by the Owner directly. The CxA directs and coordinates the commissioning activities and the reports to the OR. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.
- C. Scheduling. The CxA will work with the GC according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

- D. The CxA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan – Construction Phase provides a format for this schedule. As construction progresses, more detailed schedules are developed by the CxA.

1.5 COMMISSIONING PROCESS

- A. Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CxA will update the plan which is then considered the “final” plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.
- B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
 1. Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the with the commissioning team members.
 2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 3. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures.
 4. The CxA works with the GC and the Subcontractors in developing start-up plans and start-up documentation formats, including providing the GC and the Subcontractors with component verification checklists (CVC) to be completed, prior to the start-up process.
 5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with component verification checklists being completed before functional testing.
 6. The Subcontractors, under the direction of the GC, execute and document the component verification checklists and perform startup and initial checkout. The CxA documents that the CVC and startup were completed according to the approved plans. This may include the CxA witnessing start-up of selected equipment.
 7. The CxA develops specific equipment and system Functional Performance test procedures. The OR, the A/E, the GC and the Subcontractors (particularly the CC) review the test procedures.
 8. The procedures are executed by the GC and the Subcontractors, under the direction of, and documented by the CxA.
 9. Items of non-compliance in material, installation or setup are corrected at the Sub’s expense and the system retested.
 10. Commissioning is completed before Substantial Completion.
 11. When applicable, the CxA, the OR and the Engineer review, pre-approve and coordinate the training provided by the GC and the Subcontractors, and verifies that it was completed.
 12. When applicable, the development of systems’ manuals will be coordinated by the GC and CxA with the Owner’s O&M personnel, Engineer and Subcontractors. The GC will be responsible to provide the systems manuals, the CxA will review the Systems Manual and add to the manual the gathered Cx documentation.
 13. When applicable, the CxA, contractors and OR will perform a building review site visit approximately 10 months into the 12-month warranty period. The CxA will report findings to the OR. The GC will be responsible for issues resolution, along with the appropriate Subcontractors.
 14. Deferred testing is conducted, as specified or required.

1.6 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, the General Contractor (GC), including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members Appointed by Owner:
 - 1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. The Owners Representative.
 - 4. Architect and Engineering design professionals.

1.7 OWNER'S RESPONSIBILITIES

- A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- B. Provide the Basis of Design (BoD) documentation, prepared by the Engineer and approved by the Owner, to the CxA for use in developing the: OPR, commissioning specifications, commissioning plan, systems manual (if required), and assist with review of the operation and maintenance manuals and the training plan.
- C. Review the Cx Plan and edit in coordination with project-specific requirements and the CxA. Follow the completed Cx Plan and support the CxA with implementation.
- D. Attend commissioning scoping meetings and additional meetings as necessary.
- E. Manage the contract of the A/E, the CxA, and the GC.
- F. Provide final approval for the completion of the commissioning work.
- G. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
- H. Schedule with the GC, the field training sessions according to the Commissioning Plan.

1.8 ENGINEERS' RESPONSIBILITIES

- A. The Engineer shall participate in and perform commissioning process activities including, but not limited to, the following:
 - 1. Attend the commissioning scoping meeting and selected commissioning team meetings.
 - 2. Perform normal submittal review and approve of the following documents; submittals, shop drawings, as-built drawing, O&M manual, etc., as contracted.

3. Provide all design narrative and sequence documentation requested by the CxA. The designers shall assist (along with the GC) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Review and approve final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals issued by the GC.
6. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.
7. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

1.9 GENERAL CONTRACTOR (GC) RESPONSIBILITIES

- A. The GC shall participate in and perform commissioning process activities including, but not limited to the following:
1. Facilitate the coordination of the commissioning work by the CxA, with complete knowledge of commissioning activities which will be incorporated into the master construction project schedule.
 2. Review and approve the final Commissioning Plan—Construction Phase.
 3. Attend a commissioning scoping meeting and other commissioning team meetings.
 4. Issue Subcontractor submittals for Engineer approval and CxA review.
 5. Furnish a copy of all construction documents, addenda, requests for information, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
 6. Issue O & M manuals to Engineer for approval within 45 days of approved submittals.
 7. Review and approve the Functional Performance test procedures submitted by the CxA, prior to testing.
 8. Review commissioning progress and deficiency reports. Comment on issue resolve.
 9. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
 10. Coordinate with the CxA for resolution of issues recorded in the CxA Issues Log.
 11. Review and accept construction Component verification checklists provided by the CxA.
 12. Complete paper or electronic construction Component verification checklists as work is completed and provide to the CxA. Complete commissioning process test procedures.
 13. Include the cost of coordinating commissioning with the CxA in the total contract price.
 14. Execute seasonal or deferred functional performance testing witnessed by the CxA to facilitate the Cx process.
 15. Provide a list of final settings, setpoints, ranges, schedules, and / or trend logs required by the CxA.
 16. Coordinate with CxA and OR production of systems manuals that will provide future operating staff the information needed to understand and operate the commissioned system.
 17. Follow the Commissioning Plan throughout the entire project duration.

1.10 SUB CONTRACTOR'S RESPONSIBILITIES

- A. The GC shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
1. Include the cost of commissioning in the contract price.
 2. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

3. Assist in equipment testing per agreements with the GC.
4. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the GC, except for stand-alone data logging equipment that may be used by the CxA.
5. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
6. Review test procedures for equipment installed by factory representatives.
7. Follow the Commissioning Plan.
8. Attend commissioning scoping meetings and additional meetings as necessary.

1.11 EQUIPMENT SUPPLIERS RESPONSIBILITIES

- A. The GC shall assign the equipment suppliers & representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
 2. Assist in equipment testing per agreements with the GC and the Subcontractors.
 3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the GC, except for stand-alone datalogging equipment that may be used by the CxA.
 4. Through the GC and the Subcontractors, they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.
 5. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
 6. Review test procedures for equipment installed by factory representatives.
 7. Follow the Commissioning Plan.
 8. Attend commissioning scoping meetings and additional meetings as necessary.

1.12 CxA'S RESPONSIBILITIES

- A. The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving, non-conformance or deficiencies, but ultimately that responsibility resides with the GC, Subs and the Engineer. The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe and document performance – that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The GC and the Subcontractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CxA.
1. Coordinates and directs the commissioning activities using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
 2. Coordinate the commissioning work and, with the GC and the Subcontractors, ensure that commissioning activities are being scheduled into the master schedule.
 3. Revise, as necessary, the Commissioning Plan—Construction Phase.
 4. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
 5. Request and review additional information required to perform commissioning tasks, including O&M materials, subcontractor start-up and checkout procedures.

6. Before startup, gather and review the current control sequences and interlocks and work with subcontractors and Design Engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
7. Review and comment on normal GC and Subcontractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the Engineer reviews / approvals.
8. Write and distribute component verification checklists.
9. Review the start-up and initial systems checkout plan developed by the GC and the Subcontractors.
10. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
11. Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing. Notify owner's representative of any deficiencies in results or procedures.
12. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing. Notify owner's representative of any deficiencies in results or procedures.
13. Approve Component Verification Checklist tests and checklist completion by reviewing component verification checklist reports and by selected site observation and spot checking.
14. Approve systems startup by reviewing start-up reports and by selected site observation.
15. Review TAB execution plan.
16. Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
17. With necessary assistance and review from the GC and installing subcontractors, write the Functional Performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing. Submit to the Engineer, and OR for review and approval.
18. Analyze functional performance trend logs and monitoring data to verify performance.
19. Coordinate, witness and document functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
20. Maintain a master issues (deficiency and resolution) log and a separate testing record. Provide the GC, Subcontractors and OR with written progress reports and test results with recommended actions.
21. When applicable, witness performance testing of smoke control system interfaced with the HVAC systems, by others and all other owner contracted tests or tests by manufacturer's personnel over which the CxA may not have direct control. Document these tests and include this documentation in Commissioning Report.
22. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
23. Compile and maintain a commissioning record.
24. Provide a final commissioning report to the Owner.
25. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
26. Return to the completed project site at 10 months into the 12 month warranty period for measurement and verification (M & V) with Owner personnel and review with facility staff the current building operation and the condition is performing in compliance with design intent of the project design and to ensure issues related to the original and seasonal commissioning are still in tact. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract.

1.13 SYSTEMS TO BE COMMISSIONED

- A. Systems to Commission: The specific systems to be commissioned include but are not necessarily limited to:
 - 1. HVAC and Mechanical
 - a. Building automation systems, (including laboratory controls, where applicable) and linkages to remote monitoring and control sites.
 - b. Graphics, software, firmware, points list, diagnostics, trending, reporting etc.
 - c. Chillers, water pumps, piping, and associated equipment.
 - d. Air handling units.
 - e. Hydronic heating.
 - f. Exhaust and other specialty fans.
 - g. VAV Terminal units.
 - h. Split air conditioning systems
 - i. Fan Coil Units
 - j. Ductwork and piping.
 - k. Fire and smoke dampers.
 - l. Boilers and hot water pumps.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the GC and/or Subcontractors for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the GC.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the GC and/or Owner and left on site, except for stand- alone datalogging equipment that may be used by the CxA.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Scoping Meeting - To be held within 90 days of commencement of construction, the CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. Information gathered from this meeting will allow the CxA to revise the Commissioning Plan to its "final" version, which will also be distributed to all parties.

- B. Miscellaneous Meetings - Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with the GC and the Subcontractors. The CxA will plan these meetings and will minimize unnecessary time being spent by the GC and the Subcontractors.

3.2 REPORTING

- A. The CxA will provide regular reports to the GC and the OR, with increasing frequency as construction and commissioning progresses.
- B. The CxA will regularly communicate with members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
- C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- D. A final summary report by the CxA will be provided to the GC and the OR, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.

3.3 SUBMITTALS

- A. The CxA will provide appropriate contractors with a specific request for the type of submittal documentation the CxA will require to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning authority. All documentation requested by the CxA will be included by the Subcontractors in their O&M manual contributions.
- B. The Commissioning authority will review and provide comment on submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the CM, the GC, the Owner Representative, and/or the Engineer as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.
- C. The CxA may request additional design narrative from the Engineer and the Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.
- D. These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the GC and the Subcontractors.
- E. The GC's and/or Subcontractor's responsibility for deviations in submittals from requirements of the Contract Documents is not relieved by the Commissioning Authority's review.

3.4 START-UP, COMPONENT VERIFICATION CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned, according to Section 1.14, Systems to be Commissioned. Some systems that are not comprised so much of actual dynamic machinery, e.g., electrical system power quality, may have very simplified CVCs and start-up.
- B. General. Component verification checklists are important to ensure that the equipment and systems are connected and operational. These checklists help confirm that Functional Performance Testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
- C. Start-up and Initial Checkout Plan. The CxA may assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for component verification checklists and startup are identified in the commissioning scoping meeting and in the checklist forms. The GC, subcontractors and manufacturer's technicians shall be responsible for executing Functional Performance Tests for their representative equipment and systems.
1. The CxA develops the component verification checklists for all equipment and/or systems to be commissioned and delivers the CVCs to the GC and Subcontractors for completion. These CVCs indicate required procedures to be executed as part of start-up and initial checkout of the systems and the party responsible for their execution.
 2. These CVCs and tests are provided by the CxA to the GC. The GC determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
 3. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CxA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:
 - a. The CxA's Component Verification Checklists.
 - b. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - c. The manufacturer's normally used field checkout sheets.
 4. The subcontractor submits the full start-up plan to the GC and the CxA for review and approval.
 5. The CxA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
 6. The full start-up procedures and the approval form may be provided to the GC for review and approval, depending on management protocol.
- D. Sensor and Actuator Calibration.
1. All field-installed temperature, relative humidity, CO₂ and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test

- instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
2. All procedures used shall be fully documented on the component verification checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
 3. Sensor Calibration Methods.
 - a. All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.
 - b. Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
 - c. Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.
 - d. Critical Applications. For critical applications (process, manufacturing, etc.) more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

Tolerances, Standard Applications

<u>Sensor</u>	<u>Required Tolerance (+/-)</u>	<u>Sensor</u>	<u>Required Tolerance (+/-)</u>
Cooling coil, chilled water temps	0.4°F	Flow rates, water	4% of design
AHU wet bulb or dew point	2.0°F	Relative Humidity	4% of design
Hot water coil, water temp	1.5°F	Oxygen or CO ₂ monitor	0.1 % pts
Outdoor air, space air, duct air temps	0.4°F	Flow rates, air	10% of design
Wattour, voltage & amperage	1% of design	Barometric pressure	0.1 in. of Hg
Pressures, air, water	3% of design		

4. Valve and Damper Stroke Setup and Check.
 - a. BAS Readout. For all valve and damper actuator positions checked, verify the actual position against the BAS readout.
 - b. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper

position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Execution of Component Verification Checklists and Startup.

1. Four weeks prior to start-up, the GC and the Subcontractors and vendors schedule start-up and checkout with the CxA. The performance of the component verification checklists, start-up and checkout are directed and executed by the GC, and the Subcontractors or vendor. When checking off verification checklists, signatures may be required by the CM, the GC and/or their Subcontractors for verification of completion of their work.
2. The CxA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as approved by the CxA and the OR). In no case will the number of units witnessed be less than four, nor less than 20% of the total number of identical or very similar units.
3. For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CxA shall observe a sampling of the prefunctional and start-up procedures. The sampling procedures are identified in the commissioning plan.
4. The GC, and the Subcontractors and vendors shall execute start-up and provide the CxA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
5. Only individuals that have direct knowledge and witnessed that a line item task on the verification (prefunctional) checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

F. Deficiencies, Non-Conformance and Approval in Checklists and Start-up.

1. The GC and the Subcontractors shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CxA within two days of test completion.
2. The CxA shall work with the GC and the Subcontractors and vendors to correct and retest deficiencies or uncompleted items. The CxA will involve the GC and the Subcontractors, as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the GC and the CxA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CxA recommends approval of the execution of the checklists and start-up of each system to the OR using a standard form.
3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back charges to the responsible party. Refer to Part 3.6 herein for details.

3.5 FUNCTIONAL PERFORMANCE TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.
- B. The general list of equipment to be commissioned is found in Section 019113, Part 1.14. The specific system Functional Performance Tests (with required modes and sequences to be tested) will be developed after complete review of the control shop drawings and discussion with the Engineer-of-Record.
- C. The parties responsible to execute each test are the GC's installing subcontractors and associated vendors, manufacturer's representatives and technicians.

- D. Objectives and Scope. The objective of Functional Performance Testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
1. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, no flow, equipment failure, etc. may also be tested.
 2. Development of Test Procedures. Before test procedures are written, the CxA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The GC's Subcontractor or vendor responsible to execute a test shall provide assistance to the CxA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CxA shall provide a copy of the test procedures to the GC, the CC and the Subcontractors who shall review the tests for feasibility, safety, equipment and warranty protection. The CxA will submit the tests to the Engineer and the OR for review.
 3. The CxA shall review owner-contracted, factory testing or required owner acceptance tests, which the CxA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.
 4. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.
 5. The test procedure forms developed by the CxA shall include (but not be limited to) the following information:
 - a. System and equipment or component name(s)
 - b. Equipment location and ID number
 - c. Unique test ID number, and reference to unique component verification checklist and start-up documentation ID numbers for the piece of equipment
 - d. Date
 - e. Project name
 - f. Participating parties
 - g. A copy of the specification section describing the test requirements
 - h. A copy of the specific sequence of operations or other specified parameters being verified
 - i. Formulas used in any calculations
 - j. Required pre-test field measurements
 - k. Instructions for setting up the test.
 - l. Special cautions, alarm limits, etc.
 - m. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
 - n. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
 - o. A section for comments
 - p. Signatures and date block for the CxA

E. Test Methods

1. Functional Performance Testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. The final Functional Performance Test protocols, as developed by the CxA, shall specify which methods shall be used for each test. The CxA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the OR and the GC. This may require a change order and adjustment in charge to the Owner. The CxA will determine which method is most appropriate for tests that do not have a method specified.
 2. Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 3. Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
 4. Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
 5. Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AHU lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout setpoint to be 2°F above the current outside air temperature.
 6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
 7. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Subcontractor executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Subcontractor shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
 8. Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. The specific recommended sampling rates for each type of equipment will be dictated by the CxA. It is noted that no sampling by the GC's Subcontractors is allowed in component verification checklist execution.
- F. Coordination and Scheduling. The GC and the Subcontractors shall provide sufficient notice to the CxA regarding their completion schedule for the verification checklists and startup of all equipment and systems. The CxA will schedule Functional Performance Tests through the GC and the Subcontractors. The CxA shall direct, witness and document the Functional Performance Tests of all equipment and systems. The GC, and the Subcontractors shall execute the tests.

1. In general, Functional Performance Testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CxA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

G. Test Equipment. Refer to Section 019113, Part 2 for test equipment requirements.

H. Problem Solving. The CxA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the GC, the Subcontractors and the Engineer.

3.6 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation. The CxA shall witness and document the results of all Functional Performance Tests (FPT) using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC and the CC for review and approval. The GC shall issue the final FPTs to the Subs for execution. The CxA will include the completed and executed forms in the final Cx report.

B. Non-Conformance.

1. The CxA will record the results of the Functional Performance Test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the GC and the Subs on the Master Issues Log and/or a standard non-compliance form.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner's Representative.
4. As tests progresses, deficiencies are identified, the CxA discusses the issues with the GC and the appropriate Subcontractor(s).
 - a. When there is no dispute on the deficiency and the GC, and the Subcontractor accepts responsibility to correct it:
 - 1) The CxA documents deficiencies on the project Master Issues Log which will be updated as the testing progresses.
 - 2) The CxA reschedules the test and the test is repeated.
 - b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The CxA documents deficiencies on the project Master Issues Log which will be updated as the testing progresses.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the Engineer and the OR. Final acceptance authority is with the Owner's Project Manager.
 - 3) The CxA documents the resolution process on the issues log.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. Cost of Retesting.
 - a. The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
 - b. For a deficiency identified, not related to any verification checklist or start-up fault, the following shall apply: The CxA and GC will direct the retesting of the equipment once at no "charge" to the Subcontractors for their time. However, the CxA's, and GC's time for a second retest will be charged to the Subcontractors.
 - c. The time for the CxA, the GC to direct any retesting required because a specific verification checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the Subcontractors.
 6. The GC, and the Subcontractors shall respond in writing to the CxA at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
 7. Any required retesting by any subcontractor shall not be considered a justified reason for a claim of delay or for a time extension by the GC.
- C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces of equipment (size alone does not constitute a difference) fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the GC, or the OR. In such case, the GC shall provide the Owner with the following:
1. Within one week of notification from the GC or the OR, the subcontractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the GC or the OR within two weeks of the original notice.
 2. Within two weeks of the original notification, the subcontractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 3. The GC, or the OR will determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples of the proposed solution will be installed by the subcontractor and the GC will be allowed to test the installations for up to one week, upon which the GC or the OR will decide whether to accept the solution.
 5. Upon acceptance, the subcontractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- D. Approval. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the Functional Performance Test is made later after review by the CxA and by the GC, and the OR. The CxA recommends acceptance of each test to the GC and the OR using a standard form.
- 3.7 DEFERRED TESTING
- A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the OR. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

3.8 WRITTEN WORK PRODUCTS

- A. The commissioning process generates a number of written work products described in various parts of the Specifications. In summary, the written products are:

<u>Product</u>	<u>Developed By</u>
1. Develop and maintain a commissioning plan	CxA
2. Issue Cx Specifications	CxA
3. Commissioning milestones coordinated into construction schedule.	CxA with GC
4. Equipment documentation submittals	GC and Subcontractors
5. Sequence of Operation clarifications	GC, Subcontractors and Engineer, as needed
6. Develop Component verification checklists	CxA
7. Start-up and initial checkout plan	GC, Subs and CxA
8. Start-up and executed Verification Checklists	GC and Subcontractors with witness of CxA and OR
9. Final TAB report	TAB
10. Develop Cx Issues log (deficiencies)	CxA
11. Commissioning Progress Record	CxA
12. Cx Deficiency reports	CxA
13. Develop Functional Performance tests	CxA with GC and Subs, TAB contractor, Engineer, and OR
14. Execute the functional performance tests	GC and Subcontractors
15. Issue O&M manuals for approval / review	GC and Subcontractors
16. Issue approved O & M manuals	GC and Subcontractors
17. Overall training plan	GC and Subs with Mfgs. Factory Representatives
18. Execute specific training	GC and Subcontractors
19. Final commissioning report	CxA

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SECTION 23 05 01 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Mechanical systems, equipment, devices and accessories shall be installed, finished, tested and adjusted for continuous and proper operation. Any apparatus, material or device not shown on the Drawings but mentioned in these Specifications, or vice versa, or any incidental accessories necessary to make the project complete and operational in all respects, shall be provided. Include all materials, equipment, supervision, operation, methods and labor for the fabrication, installation, start-up and tests necessary for complete and properly functioning systems.

1.3 QUALITY ASSURANCE

- A. Code Compliance: Comply with all rules, laws, statutes, regulations, building codes, and the amendments of local, state and federal governments by the authorities having jurisdiction.
- B. ADA: Comply with the requirements of the Americans with Disabilities Act (ADA).
- C. NFPA: Comply with the National Fire Codes compiled by the National Fire Protection Association.
- D. Conform in strict compliance to the current editions of Florida Building Code; Florida Mechanical Code; Florida Plumbing Code; Florida Fuel Gas Code; and the amendments to these codes which are enforced by the local authority having lawful jurisdiction.

1.4 DRAWINGS AND SPECIFICATIONS

- A. Equipment Placement: The drawings are diagrammatic, intended to show general arrangement, capacity and location of various components, equipment and devices. Reasonable changes in locations ordered by the Engineer prior to the installation may be made at no additional cost.
- B. Drawing Scale: Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets, transitions and fittings may not be shown but shall be provided at no additional cost.

1.5 DEFINITIONS

- A. Concealed: When standing inside a finished room, insulated or non-insulated piping or ductwork not visible after installation, such as inside a chase or above a ceiling.
- B. Exposed: When standing inside a finished room, insulated piping or ductwork is visible after installation, such as inside an equipment room or an air handling unit room.

- C. Protected: The surface of insulated or non-insulated piping or ductwork on the exterior of the building but protected from direct exposure to the weather by an overhang, eave, in an unconditioned parking garage or building crawl space.
- D. Unprotected: The surface of insulated on non-insulated piping or ductwork on the exterior of the building and exposed to the weather.

1.6 SUBMITTALS

- A. Shop Drawings: Shop drawings include piping system layouts, ductwork layouts, fabrication and installation drawings of supports and anchorage for mechanical materials and equipment, and coordination drawings. Shop drawings also include proposed equipment layouts, drawn to scale, indicating that proposed equipment will fit into allotted space, including service access, connections, etc.
 - 1. Piping Systems: Submit shop drawings for piping systems drawn at a minimum scale of ¼ inch per foot to verify clearances and equipment locations. Show required maintenance and operational clearances. Include the following:
 - a. Architectural and structural backgrounds with room names and numbers, including but not limited to plans, sections, elevations and details.
 - b. Fabrication and erection dimensions.
 - c. Arrangements and sectional views.
 - d. Details, including complete information for making connections to equipment.
 - e. Descriptive names of equipment.
 - f. Modifications and options to standard equipment required by Contract Documents.
 - 2. Coordination Drawings: Submit coordination drawings including detailed drawings showing locations and positions of all Architectural, structural, electrical and mechanical elements. Drawings shall be minimum ¼ inch per foot for each mechanical equipment room, mechanical riser, or chase. All other areas shall be a minimum 1/8 inch per foot.
- B. Product Data: Product data includes the manufacturer's printed literature.
- C. Performance Data: Provide performance data, wiring and control diagrams.
- D. Installation Instructions: Installation instructions include detailed information, from the manufacturer, indicating specific installation requirements, instructions, and recommendations. Generic installation instructions are not acceptable. Instructions shall be the same as those included with the product when it is shipped from the factory.
- E. Written Operating Instructions: Operating instructions shall be the manufacturer's written operating instructions for the specified product. If the instructions cover more than one model or type of product they shall be clearly marked to identify the instructions that cover the product delivered to the project.
- F. Maintenance Instructions: Maintenance instructions shall be the manufacturer's printed instructions and parts lists for the equipment furnished. If the instructions cover more than one model or type of equipment they shall be marked to identify the instructions for the furnished product.

1.7 MANUFACTURER'S EQUIPMENT AND SYSTEMS STARTUP AND PERFORMANCE CHECKOUT

- A. At the completion of installation, a factory trained representative of the equipment manufacturer shall provide start-up and checkout services. The manufacturer's representative shall examine performance information and check the equipment in operation.

1.8 INSTRUCTION TO THE OWNER

- A. General: Instructions to the Owner shall be accomplished by representatives of the manufacturers involved. Allow time for complete coverage of all operating procedures. Provide classroom instruction and field training in the design, operation and maintenance of the equipment and troubleshooting procedures. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar provisions of the systems. On the date of substantial completion, turn over the prime responsibility for operation of the mechanical equipment and systems to the Owner's operating personnel.
- B. Training Period: Training period shall encompass a minimum of 4 hours of classroom and 4 hours of hands-on instructions with a maximum period of 4 hours per day.
- C. Scheduling: Submit any remaining required items for checking at least one week before final inspection of the work. When submittal items are found acceptable, notify the Owner, in writing, that an "Instruction Conference" may proceed. Conference will be scheduled by the Owner. After the conference, copies of a memo certifying that the "Instruction Conference" and "Completed Demonstration" have been made will be signed by the Owner and the instructors, and one copy will be inserted in each submittal binder.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Products: Manufacturer's names and product model numbers indicated on the drawings and in these specifications establish the type, style, quality, performance, and sound rating of the desired product. Listing of other manufacturers indicates that their equivalent products would be acceptable if they meet the specification requirements, the specific use and installation shown on the drawings, including space and clearance requirements, and the energy consumption and efficiency of the specified product.
- B. Space Requirements: All manufactured products furnished on this project must have the required space and service areas indicated in the manufacturer's printed literature or shown on their approved shop drawings. When the manufacturer does not indicate the space required for servicing the equipment, the space shown on the drawings or as required by the Engineer must be provided.

2.2 MATERIAL AND EQUIPMENT

- A. General: Material and equipment used shall be produced by manufacturers regularly engaged in the production of similar items, and with a history of satisfactory use as judged by the Engineer.
- B. Specified Equipment: Equipment shall be the capacity and types indicated. Equipment and material furnished shall be the manufacturer's standard item of production unless specified or required to be modified to suit job conditions. Sizes, material, finish, dimensions and the capacities for the specified application shall be published in catalogs for national distribution. Ratings and capacities shall be certified by a recognized rating bureau. Products shall be complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

- C. Compatibility: Material and equipment of one and the same kind, type or classification and used for identical or similar purposes shall be made by the same manufacturer. Where more than one choice is available, select the options which are compatible with other products already selected. Compatibility is a basic general requirement of product selection.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. General: Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.
- B. Performance: Material and equipment installations not in compliance with the Contract Documents, or installed with substandard workmanship in the opinion of the Engineer, shall be removed and reinstalled.

3.2 CLEANING AND PROTECTION

- A. Housekeeping: Keep interiors of duct and pipe systems clean and free from dirt, rubbish and foreign matter. Close open ends of piping and ductwork at all times throughout the installation. Install 30% efficient filter media over each return air grille and open return duct opening; change media regularly during construction when dirty to keep duct interiors clean. Prevent dust, debris and foreign material from entering the piping and ductwork.
- B. Equipment Protection: Protect fan motors, switches, equipment, fixtures, and other items from dirt, rubbish and foreign matter. Do not operate air handling equipment if the building is not clean or if dust can enter the coils or the fan housings.
- C. Equipment Cleaning: Thoroughly clean equipment and entire piping systems internally upon completion of installation and immediately prior to Submittal Completion. Open dirt pockets and strainers, blow down each piping system and clean strainer screens of accumulated debris. Remove accumulated dirt, scale, oil and foreign substances. Thoroughly wipe clean internal surfaces of ductwork and air handling units prior substantial completion. Refer to Section 23 21 13, Pipe and Fittings, for detailed requirements for piping systems' flushing and cleaning.
- D. Fixture Cleanup: Remove temporary labels, stickers, etc., from fixtures and equipment. Do not remove permanent name plates, equipment model numbers, ratings, etc.
- E. Filter Replacement: Provide filters, with the same efficiency rating as required for the final installation, for the protection of the air moving equipment and ductwork continuously throughout the construction phase. Provide a new set of clean filters for the test and balance of the air side equipment.
- F. Protection of Finished Installation: Where installation is required in areas previously finished by other trades, protect the area from marring, soiling or other damage.

3.3 CORRECTION OF WORK

- A. General: At no additional cost to the Owner, rectify discrepancies between the actual installation and Contract Documents when in the opinion of the Testing and Balancing Agency (T&B Agency) or the Engineer the discrepancies will affect system balance and performance.

- B. Drive Changes: Include the cost of all pulley, belt, and drive changes, as well as balancing dampers, valves and fittings, and access panels to achieve proper system balance recommended by the T&B Agency.

3.4 COORDINATION AND ASSISTANCE

- A. General: Provide all labor, equipment, tools and material required to operate the equipment and systems necessary for the testing and balancing of the systems and for the adjustment, calibration and repair of all electric or pneumatic automated control devices and components. These services shall be available on each working day during the period of final testing and balancing.
- B. Drawings and Specifications: Provide to the T&B Agency a complete set of project record drawings and specifications and an approved copy of all HVAC shop drawings and equipment submittals. The T&B Agency shall be informed of all changes made to the system during construction, including applicable change orders.
- C. Coordination: Coordinate the work of all trades and equipment suppliers to complete the modifications recommended by the T&B Agency and accepted by the Engineer. Cut or drill holes for the insertion of air measuring devices as directed for test purposes; repair to as-new condition, inserting plastic caps or covers to prevent air leakage. Repair or replace insulation and re-establish the integrity of the vapor retardant.

3.5 PREPARATIONS FOR PERFORMANCE VERIFICATION

- A. Verification: Prior to commencement of balancing by the T&B Agency, verify the following in writing:
 1. Strainers have been removed, cleaned and replaced, and that temporary construction strainers have been removed.
 2. Air vents at coils and high points of the piping systems have been inspected and installed and operating freely.
 3. Automatic valves, hand valves, and balancing valves have been placed in a fixed open position for full flow through all devices.
 4. Linkages between valves and their actuators are secure, non-overloading and non-binding.
 5. Pressures for hydronic reducing valves have been set.
 6. Operating temperatures have been set for chillers and regulating valves.
 7. Pumps are operating at the correct rotation and specified horsepower.
 8. Piping has been pressure tested and accepted and piping systems have been cleaned, flushed, sterilized and refilled with chemicals and prescribed treated water and vented.
 9. Operating safety features (such as thermal overloads, firestats, freezestats, smoke detectors and relief valves), are installed and fully functional.
 10. Equipment has been lubricated and can be operated without damage.
 11. Systems are operational and complete.
 12. No latent residual work remains to be completed.

3.6 PROTECTION OF MATERIALS AND EQUIPMENT

- A. Requirements: Do not store fiberglass insulation or any equipment within the building until it has been "dried in". If dry space is unavailable and the insulation and equipment must be installed or stored before the building is "dried in" and completely enclosed, provide polyethylene film cover for protection.
- B. Replacement of Damaged Stored Material and Equipment: Any material and equipment that has been wet or otherwise damaged prior to installation shall be replaced with new material regardless of the condition of the material and equipment at the time of installation.

- C. Repair of Damaged Installed Material and Equipment: After installation correct or repair dents, scratches and other visible blemishes. At the direction of Engineer replace or repair to "as new" condition equipment which has been damaged during construction.

3.7 COORDINATION OF SERVICES

- A. Interruption of existing services: Provide shutoff valves at points of interconnection to minimize downtime.

END OF SECTION 23 05 01

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.
- B. Basic Requirements: Provisions of Section 23 05 01, BASIC MECHANICAL REQUIREMENTS are part of this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 ELECTRIC MOTOR MANUFACTURERS:

- A. Manufacturers:
 - 1. General Electric Inc.
 - 2. Westinghouse Electric
 - 3. Baldor Electric Company

2.3 MOTOR CHARACTERISTICS

- A. Duty: Provide motors for continuous duty conditions in which they will be required to perform; i.e., general purpose, splash-proof, explosion proof, standard load, high torque, or any other special type as required by the equipment motor manufacturer's recommendations. Unless otherwise indicated or required, motors shall be open drip-proof type. Continuous duty at ambient temperature of 95 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Unless otherwise indicated or required, motors shall be open drip-proof type.
- D. Motors installed outdoors shall be totally enclosed fan cooled (TEFC) type.
- E. Motor enclosures shall be of the type recommended by the equipment manufacturer for the specific application.
- F. All motors shall be furnished for starting in accordance with the electric utility company's requirements and shall be compatible with the motor starter and driven load. Motors shall not exceed full-rated nameplate load when operated at any point along the driven equipment's characteristic performance curve. The motor service factor shall not be used to justify exceeding nameplate amperage.
- G. Unless otherwise indicated, motors 1/3 horsepower and less shall be single phase. Motors 1/2 horsepower and larger shall be 3 phase, squirrel-cage induction type.
- H. Sound power levels for motors shall be no greater than the guidelines recommended by NEMA MG 1-2007. A motor which generates excessive noise within an occupied area of the building shall be replaced with a quieter operating motor at no additional cost to the Owner.
- I. Verify the circuit voltage and phase being furnished to the motor. All motors shall be 1800 rpm unless noted otherwise. Motors shall operate with electrical input voltage variations of plus or minus 1 percent of nameplate rating or frequency variations of plus or minus 5 percent of nameplate rating.

2.4 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class F.
- H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.6 SINGLE - PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 1. Permanent-split capacitor.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Single phase motors for hard starting applications including outdoor installations shall be capacitor start/induction run or capacitor start/capacitor run type designed for the application. Motors for fans and pumps located indoor may be split phase with permanently lubricated sealed ball bearings and shall be selected for quiet operation. Motors 1/8 horsepower and below may be shaded pole type with permanently sealed bearings.
- D. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- E. Motors 1/20 HP and Smaller: Shaded-pole type.
- F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.7 POWER FACTOR

- A. All equipment furnished utilizing a combined electrical load of greater than 1000 watts shall have a power factor of not less than 0.90 under rated load conditions.

1. Where motors are not available with a minimum 0.90 power factor, provide motor mounted power factor correction capacitor to improve power factor to at least 0.90 under rated load condition.

2.8 MOTOR STARTERS

- A. Compliance: Motor starters included as an integral part of a factory pre-wired control panel shall be provided by the manufacturer of the equipment it serves and shall comply with the requirements of Division 26.
- B. Overload Protection: Unless otherwise indicated, all 3 phase motor starters shall be provided with thermal overload relays on each phase sized in accordance with the actual nameplate full load ampere rating. Single phase motors shall be furnished with built-in thermal protection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install material and equipment in accordance with details shown on the drawings, submittals drawings and manufacturer's instructions.

3.2 SCHEDULED HORSEPOWER

- A. Nominal Size: The horsepower scheduled or specified are those nominal sizes estimated to be required by the equipment when operating at specified duties and efficiencies. In the case of pumps and fans, these motors shall be non-overloading at any point of the performance curve.
- B. Minimum Size: Motor horsepowers shall not be reduced from the scheduled size regardless of the requirements of the selected or submitted equipment.
- C. Increased Size: If the actual motor horsepower for the equipment furnished is larger than the scheduled size indicated, the proper size feeder, breaker, starter, etc. shall be provided at no additional cost to the Owner.
- D. Vibration: Motor vibration in any direction as measured at the bearing housings, when tested in accordance with NEMA Standard MG 1, shall be within the following table:

1. TABLE - VIBRATION LIMITS

UNFILTERED VIBRATION LIMITS		
Speed, rpm	Rotational Frequency, Hz	Velocity, in/s peak (mm/s)
3600	60	0.15 (3.8)
1800	30	0.15 (3.8)
1200	20	0.15 (3.8)
900	15	0.12 (3.0)
720	12	0.09 (2.3)
600	10	0.08 (2.0)

2. If balance weights are added to the rotor, they shall be permanently secured by welding or riveting. Machine nuts, bolts and screws are prohibited.

3.3 WIRING

- A. Power: All power wiring including safety disconnect switches, motor starters, over-current protection, connection to equipment, etc. shall be installed according to the requirements of Division 26, ELECTRICAL.
- B. Interlock: Unless otherwise noted, all interlock wiring, such as remote line voltage thermostats, fan speed controllers, etc. shall be installed by the supplier of that equipment. Interlock wiring shall be installed according to the requirements of Division 26, ELECTRICAL.
- C. Control: All control wiring exposed in mechanical equipment rooms, fan rooms, return air plenums, etc. shall be in conduit. Low voltage control wiring may be installed without conduit in return air plenums provided the cable is plenum rated and the installation is acceptable to the authority having jurisdiction.

3.4 WEATHER PROTECTION

- A. Wiring: All electrical wiring exposed to the weather or in damp locations shall be enclosed in weatherproof fittings as required in Division 26, ELECTRICAL.
- B. Enclosures: Enclosures for electrical equipment shall be NEMA 3R unless indicated otherwise.

END OF SECTION 23 05 13

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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 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 a minimum of 6 hours training for owner's operators.

- J. Provide full three-year on-site parts and labor warranty including travel time and expense. Warranty period shall begin at date of AFD shipment.
- K. 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.
- D. Submit in accordance with Division 01 Requirements.

1.5 WARRANTY

- A. Provide a full parts & labor warranty for 36 months from ship date.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Adjustable Frequency Drive Units:
 - 1. Danfoss/Graham
 - 2. ASEA Brown Bovari (ABB)
 - 3. Cutler Hammer

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 stepless 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 sinecoded PWM technology, and an input power factor near unity over the entire speed range. The AFD shall not produce excessive or objectionable motor 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. Provide shaft grounding protection on all motors driven by VFDs.
 4. 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.
 5. The AFD maximum output current rating shall be as follows:

<u>Horsepower (HP)</u>	<u>FLA @ 208 V</u>	<u>FLA @ 460 V</u>
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

6. AFD shall be a minimum of 97% efficient at 100% rated output power, 60 HZ.
7. 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, 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.
8. 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.

9. The AFD shall be designed and constructed to operate within the following service conditions:
 - a. Elevation up to 3300 feet without derating.
 - 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.
10. Bases of Design: Danfoss FC102.

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 remote 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., Unistrut 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 Unistrut 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"

12. Adjustable frequency drives shall be accessible.
13. Provide housekeeping pad for all floor mounted adjustable frequency drives.
14. Provide construction phase dust protection for all AFDs.

END OF SECTION 23 05 17

SECTION 23 05 19 - METERS AND GAGES 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.
- B. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.
 - 5. Test plugs.
 - 6. Test-plug kits.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 23 05 01.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID – IN – GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Terice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Winters Instruments - U.S.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Stainless Steel and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Terice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum; 4-1/2-in nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 as applicable, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 as applicable, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flow Design, Inc.
 2. Peterson Equipment Co., Inc.
 3. Terice, H. O. Co.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.6 TEST - PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flow Design, Inc.

2. Peterson Equipment Co., Inc.
 3. Trerice, H. O. Co.
- B. Furnish one test-plug kit containing one thermometer, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:
 1. Industrial-style, liquid-in-glass type.

2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE - RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.

3.6 PRESSURE - GAGE SCHEDULE

A. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:

1. Liquid-filled, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.

3.7 PRESSURE – GAGE SCALE - RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 30 psi.

END OF SECTION 23 05 19

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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.
- B. Basic Requirements: Provisions of Section 23 05 01 - Basic HVAC Requirements are part of this Section.

1.2 SUMMARY

- A. General: Provide valves, cocks and specialties which are required for piping systems specified in other sections of these specifications.
- B. Section Includes:
 - 1. Bronze ball valves.
 - 2. Iron, grooved-end ball valves.
 - 3. Iron, single-flange butterfly valves.
 - 4. Iron, grooved-end butterfly valves.
 - 5. Bronze swing check valves.
 - 6. Iron swing check valves.
 - 7. Iron, grooved-end swing-check valves.
 - 8. Chainwheels.
 - 9. Flow Balancing Valves
- C. Related Sections:
 - 1. Section 23 05 53 Identification for HVAC Piping and Equipment for valve tags and schedules.

1.3 DEFINITIONS

- A. EPDM: Ethylene propylene copolymer rubber.
- B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- C. NRS: Nonrising stem.
- D. OS&Y: Outside screw and yoke.
- E.RS: Rising stem.
- F. SWP: Steam working pressure.

1.4 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with Section 230010.
- B. Pressure and Temperature Rating: Valves shall have a pressure and temperature rating equal to or exceeding the piping in which they are installed, except that valves shall be designed for a minimum steam working pressure (SWP) of 125 psi; water-oil-gas (WOG) pressure of 200 psi.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.
- B. General: Include the following data:
 - 1. Manufacturers Literature:
 - a. Dimensional outline drawing of each valve listed in this section including sizes available and pressure limitations.
 - b. Outline drawing of each calibrated balancing and flow measuring valve including flow and pressure limitations.
 - c. Outline drawing of each safety and pressure relief valve including discharge capacity and pressure limitations.
 - 2. Installation Instructions: Manufacturer's printed installation instructions for all valves including copies shipped with the valves.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:

1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.8 BASIC VALVE REQUIREMENTS

- A. General: Valves and cocks may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary for the proper operation of the system shall be furnished and installed. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equivalent material and pressure class will be accepted. Valves shall have the manufacturer's name or trademark, recommended service pressure, and size indicated by raised letters cast on the valve body.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 2. Handwheel: For valves other than quarter-turn types.
 3. Handlever: For quarter-turn valves NPS 6 and smaller.
 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Grooved: With grooves according to AWWA C606.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Brass or Stainless Steel Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Flow-Tek

2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze, Stainless Steel
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze, Stainless Steel
 - i. Stem Seals: Double O-ring
 - j. Ball: Chrome-plated brass or Stainless Steel
 - k. Port: Standard.

2.3 IRON, GROOVED – END BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic
 - b. Anvil International
 - c. Gustin-Bacon

2. Description:
 - a. SWP Rating: 800 psi.
 - b. Body Design: Two piece, Standard Port.
 - c. Body Material: Ductile Iron conforming to ASTM A-536, painted black enamel.
 - d. Ends: Ductile Iron conforming to ASTM A-536, painted black enamel.
 - e. Seats: TFE.
 - f. Stem: Micro-finished Steel.
 - g. Ball: Micro-finished Nickel-Plated Carbon Steel.
 - h. Port: Standard.

2.4 IRON BALL VALVES

A. Class 125, Iron/Carbon Steel Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Kitz Corporation.

d. Flow-Tek F 15

2. Description:

- a. Standard: MSS SP-72.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Split body.
- d. Body Material: ASTM A 126, gray iron, carbon steel
- e. Ends: Flanged.
- f. Seats: PTFE or TFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel.
- i. Port: Full.

2.5 IRON, SINGLE – FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

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

- a. Bray Controls; a division of Bray International.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. Milwaukee Valve Company.
- d. NIBCO INC.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: stainless steel.

2.6 IRON, GROOVED – END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

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

- a. Kennedy Valve; a division of McWane, Inc.
- b. Tyco Fire Products LP; Grinnell Mechanical Products.
- c. Victaulic Company.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 175 psig.
- c. Body Material: Coated, ductile iron.

- d. Stem: Two-piece stainless steel.
- e. Disc: stainless steel.
- f. Seal: EPDM.

2.7 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Powell Valves.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Powell Valves.

2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
 - c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.

B. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
 - c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.

2.9 IRON, GROOVED -END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire Products LP; Grinnell Mechanical Products.
 - c. Victaulic Company.
2. Description:
 - a. CWP Rating: 300 psig (2070 kPa).
 - b. Body Material: ASTM A 536, ductile iron.
 - c. Seal: EPDM.
 - d. Disc: Spring operated, ductile iron or stainless steel.

2.10 FLOW BALANCING VALVES

- A. Automatic Flow Control Valve: Provide automatic flow control valves with variable openings which respond to pressure, factory set to control the water flow over an operating pressure differential at least 10

times the minimum required for full flow conditions. Valves shall be tamper proof when installed, and shall have body pressure tappings with a set of pressure and temperature test ports. Valves shall have flanged or grooved ends or a union either integral or directly adjacent to permit replacement of the control element. The automatic flow controls shall be selected for the project by the manufacturer to provide flow rates matching the equipment requirements, including any increased or decreased flow rates that are indicated. The control range pressure differential shall not exceed 3 to 40 psi.

- B. Manufacturer:
 - 1. Griswold
 - 2. Approved substitution
- C. Calibration Meter: Provide one portable differential pressure gauge calibration meter kit of same manufacturer as valves. Kit shall be housed in a hand-carrying case and shall contain all devices required, including pressure gauges, 5 foot meter hoses with disconnect ends, positive shutoff valves, operating instructions, and flow versus pressure drop curves, to enable testing and balancing of each size and type of balancing valve installed.

2.11 CHAINWHEELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Babbitt Steam Specialty Co.
 - 2. Roto Hammer Industries.
 - 3. Trumbull Industries.
- B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - 2. Attachment: For connection to butterfly valve stems.
 - 3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve.
 - 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for butterfly valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install isolation/shutoff valve at all main risers and main branch takeoffs, to permit isolation of piping sections for drainage.
- G. Install isolation/shutoff valves on each inlet and outlet of each piece of equipment to which water is piped to allow isolation, venting and drainage. Provide a flange, union, or groove between the valve and the equipment to permit disconnection, removal and service.
- H. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Y-pattern horizontal swing check valves shall be used in vertical lines.
 - 3. Horizontal swing check valves shall be used with ball valves;
 - 4. Wafer check valves shall be used with butterfly valves.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Ball or butterfly valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

3.5 CHILLED - WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller above-grade:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, standard port, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger above-grade:

1. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, stainless steel disc and stem
3. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
4. Iron Swing Check Valves: Class 125, metal seats.
5. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.

3.6 FLOW BALANCING VALVES

- A. Location: Provide flow balancing valves where indicated. The exact location shall be determined using field measurements relating to the specific piping arrangement and the manufacturer's recommendations.
- B. Manufacturer' Recommendation: Install in accordance with manufacturer's recommendations including valve orientation and increases or decreases in pipe size at points of installation, together with minimum recommended lengths of straight pipe before and after points of installation.
- C. Calibration Meter: At the conclusion of the system test and balance and prior to final completion the meter shall be turned over to, and shall become the property of, the Owner.

3.7 DRAIN VALVES

- A. Location: Install drain valves at the base of all water piping risers (both supply and return) and at all low points in the piping system. Drain valves shall be fitted with schedule 80 hose connection end with cap unless otherwise indicated.

END OF SECTION 23 05 23

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.
- B. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of this Section.

1.2 WORK INCLUDED

- A. Inserts, Shells and Upper Attachments.
- B. Pipe Hangers, Rods, Supports and Accessories.
- C. Pipe Sleeves.
- D. Pipe Seals.
- E. Duct Hangers and Supports.
- F. Duct Sleeves.
- G. Fabricated Steel Support.
- H. Grout

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.
- G. Steel supports for ducts, pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

1.4 APPLICABLE PUBLICATIONS

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

1.5 SUBMITTALS

- A. Submit schedule indicating type of hanger to be used by system and pipe size. Include 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. Inserts, Shells and Upper Attachments:
 - 1. Anvil International, Inc.
 - 2. Cooper B-Line®, Inc.
 - 3. PHD Manufacturing, Inc.
- B. Pipe Hangers, Rods, Supports and Accessories:
 - 1. Anvil International, Inc.
 - 2. Cooper B-Line®, Inc.
 - 3. PHD Manufacturing, Inc.
- C. Pipe Sleeves:

1. Metraflex – Metraseal
2. Thunderline Corporation - Link Seal
3. Owner Approved Substitution

D. Pipe Seals:

1. Metraflex – Metraseal
2. Thunderline Corporation - Link Seal
3. Owner Approved Substitution

E. Fabricated Steel Support: As Detailed on Drawings.

2.2 FABRICATION

A. Inserts, Shells and Upper Attachments:

1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs.
2. Shells: Steel shell and expander plug, snap off end fastener.
3. Upper Attachments:
 - a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size..
 - b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size.
 - c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size.
 - d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size.
 - e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size.

B. Pipe Hangers, Rods, Supports and Accessories:

1. Pipe Hangers:

- a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation and/or outer diameter of piping. Rating is contingent on rod and bolt size. Inside diameter of clevis hanger should match outside diameter of pipe with insulation.
- b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel, sized to accommodate required insulation. Rating is contingent on rod and bolt size.
- c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size.

2. Rods:

- a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

<u>Copper Tube, Plastic Fiberglass Reinforced Pipe Size</u>	<u>Steel, Cast Iron or Glass Pipe Size</u>	<u>Rod Size</u>	<u>Max Equip. Load</u>
¼" to 2"	¼" to 2"	3/8"	730 lbs.
2-1/2" to 5"	2-1/2" to 3"	½"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs.
8" to 12 "	6"	¾"	3230 lbs.
14"	8" to 12"	7/8"	4480 lbs.
16"	14" to 16"	1"	5900 lbs.
18" to 20"	18" to 20"	1-1/4"	9500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

- b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" is maintained.

3. Supports:

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

4. Accessories:

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

C. Galvanized-Steel-Pipe Sleeves:

1. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

- D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40°F to +250°F.
- E. Fabricated Steel Supports:
 - 1. Field or shop fabricated. See details on drawings.
 - 2. If not detailed on drawings the contractor is to provide suitable supports as required.
- H. Grout
 - 1. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 - 2. Characteristics: Nonshrink; recommended for interior and exterior applications.
 - 3. Design Mix: 5000-psi 28-day compressive strength.
 - 4. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

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

3.2 INSTALLATION

- A. Inserts, Shells and Upper Attachments:
 - 1. Inserts:

- a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
 - b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
 - c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.
2. Shells: Size shell length to assure a minimum of 1" solid concrete remaining from shell end to concrete face.
 3. Upper Attachment:
 - a. Select proper attachment for building construction.
 - b. For plain steel devices, prime with black paint prior to installation.
 - c. Adjust attachment location for proper alignment and no more than 4 deg. offset from a perpendicular alignment.
 - d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.
- B. Pipe Hanger, Rods, Supports and Accessories:
1. Select proper hanger for piping systems.
 2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
 3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
 4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
 5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
 6. For vibration isolation hanger intermediate attachment requirements for isolated equipment refer to Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.
 7. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
 8. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
 9. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING TABLE

a.	Steel Pipe (Schedule 40 & 80):	
	Up to 1":	7 ft. on center
	1-1/4" and larger:	10 ft. on center
b.	Copper Pipe (Types L, K and M):	
	Up to 1" size:	5 ft. on center
	1-1/4" and larger:	7 ft. on center

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

C. Pipe Sleeves:

1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
2. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - a. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - b. Cut sleeves to length for mounting flush with both surfaces.
 - c. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
3. Install sleeves for pipes passing through interior partitions.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - b. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - c. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 "Joint Sealants."
4. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 "Penetration Firestopping."
5. Sleeve and Sleeve Seal Schedule
 - a. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1) Exterior Concrete Walls above Grade:
 - 2) Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
 - 3) Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
 - b. Concrete Slabs above Grade:
 - 1) Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.

- 2) Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
- c. Interior Partitions:
 - 1) Verify, with fire authorities having jurisdiction, that PVC materials are allowed for sleeves.
 - 2) Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
 - 3) Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
- D. Pipe Seals:
1. Provide pipe seals for all pipe sleeves used in:
 - a. External walls.
 - b. Floor slabs on grade.
 - c. Upper floors where spillage may occur.
- E. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.
- H. Grout: Install per manufacturer's instructions.

END OF SECTION 23 05 29

SECTION 23 05 31 - SLEEVES AND SLEEVE SEALS 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.
- B. Basic Requirements: Provisions of Section 23 05 01, BASIC MECHANICAL REQUIREMENTS are part of this Section.

1.2 SUMMARY

- A. Section includes sleeves and grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 "Joint Sealants."
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 "Penetration Firestopping."
- E. Install material and equipment in accordance with details shown on the drawings, submittals drawings and manufacturer's instructions.

3.2 SLEEVE AND SLEEVE – SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
 - 2. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
 - 3. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.

END OF SECTION 23 05 31

SECTION 23 05 48 – VIBRATION AND SEISMIC CONTROLS FOR HVAC

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. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of this Section.

1.2 WORK INCLUDED

- A. Vibration isolators.
- B. Bases.
- C. Grooved-Joint Flexible pipe connectors.
- D. Braided Flexible pipe connectors.
- E. Neoprene 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.
- D. Where grooved-joint flexible pipe connectors are specified, manufacturer shall design the isolation system and include drawings showing all supports, restraints, etc. as required to ensure performance.

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.

B. Bases:

1. Amber/Booth Company
2. Mason Industries, Inc.
3. Peabody Noise Control, Inc. - Kinetics.

C. Grooved-Joint Flexible Pipe Connectors:

1. Central Sprink
2. Grinnell (Gruv-Lok), Anvil International, Inc.
3. Victaulic Co. of America

D. Braided Flexible Pipe Connectors:

1. Flexonics
2. Keflex, Inc.
3. Mason Industries, Inc.

E. Neoprene Flexible Pipe Connectors:

1. Flexonics
2. Keflex, Inc.
3. Mason Industries, 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.

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.
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.
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.
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 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.
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.

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.
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.
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 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.

C. Flexible Pipe Connectors:

1. Grooved-joint flexible pipe connectors shall consist of a minimum of three flexible pipe couplings. Coupling shall contain a resilient elastomeric gasket conforming to the internal cavity of the coupling housing and providing a pressure responsive seal against the pipe to create a permanent leaktight seal. Assembly shall permit expansion, contraction and deflection and shall dampen noise and vibration.
2. 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.
3. Flexible neoprene connectors shall be used on all equipment as indicated on the drawings or on the equipment schedule. They shall be manufactured of multiple plies of nylon tire cord fabric and neoprene both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement. Straight connectors shall have two spheres. Connectors up to and including 1-1/2" diameter may have threaded ends. Connectors 2" and larger shall be manufactured with floating galvanized flanges recessed to lock the connector's raised face neoprene flanges. Hoses shall be installed on the equipment side of the shut-off valves. Connectors shall be rated a minimum of 150 psi at 220°F. Flanged equipment shall be directly connected to neoprene elbows in the size range 2-1/2" through 12" if the piping makes a 90° turn at the equipment. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. 12" and larger sizes operating above 100 psi shall employ control cables with end fittings isolated by means of 1/2" thick bridge bearing neoprene washer bushings designed for a maximum of 1000 psi.

4. Seismic Restraints:

- a. Seismic Restraint Type AA: All directional seismic restraints shall consist of interlocking steel members restrained by bridge bearing neoprene bushings. Bushings shall be replaceable and a minimum of 3/4" thick. A minimum air gap of 1/8" shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surface. Snubbers shall be installed with factory set clearances.
- b. Seismic Restraint Type BB: Restraints of all suspended piping, ductwork, equipment and curb mounted units shall consist of steel cables arranged to achieve the required all directional restraint, and sized to resist seismic loads. Submittal drawing shall indicate proposed method of achieving vertical restraint where required. Cables shall be installed with sufficient slack to avoid short circuiting the vibration isolators. "Cable location should be carefully coordinated with relation to other utility systems so that in the event of a seismic shock the cable cannot snap tight and damage such nearby utility systems".

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 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 representatives 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. Chillers (Roof Level):

- 1. Base Type: Mounted on Existing Structural Frame.
- 2. Isolator type: "C"
- 3. Deflection: 2" (per Manufacturer's Recommendations)
- 4. Accessories: Flexible pipe connector.

B. Pumps (Grade Level):

- 1. Base Type: Housekeeping Pad.
- 2. Isolator type: None Required.
- 3. Deflection: N/A
- 4. Accessories: Flexible Pipe Connectors.

C. Pumps (Upper Level):

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

D. 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.

END OF SECTION 23 05 48

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING 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.
- B. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of this Section.

1.2 WORK INCLUDED

- A. Piping and equipment identification.
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated
 - 1. Piping and equipment
- B. Valve numbering scheme

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Piping and Equipment Identification:
 - 1. EMED Co., Inc.

2. Marking Services, Inc.
3. Seton Name Plate Corp.

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 over-laminated 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.
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 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
3. Valve tags: Contractors Option:
 - a. Indoor:
 - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link.
 - 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.
 - b. Outdoor:
 - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link.
 - 2) 19 gauge Type 304 stainless steel, 1-1/2" round, with 1/4 inch high pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link.
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. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically-resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.

2.3 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.4 CEILING GRID TAGS FOR EQUIPMENT LOCATED ABOVE HARD OR LAY - IN CEILING

A. Description: 3/4" x 3" vinyl label, 3.0 Mil self adhesive vinyl similar to DuraLabel Pro. Label color shall be black text on a white background. The label shall contain the following information:

1. Equipment name: Per Scheduled Equipment Naming convention.

B. All scheduled equipment above finish hard or lay-in ceiling shall be identified with an Equipment Tag.

2.5 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F .
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches , 1/2 inch for viewing distances up to 72 inches , and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.6 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches.

2.7 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

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

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 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.
8. Refrigeration System - Additional Requirements:
 - a. Marking and Signage:
 - (1) Provide a permanent sign containing the following information:
 - (a) Name and address of installer.
 - (b) Kind of refrigerant.
 - (c) Lbs. of refrigerant.
 - (d) Field test pressure applied.
 - (2) Provide a permanent sign: Main electrical supply, i.e., main compr. disc.
 - (3) Provide metal tags with 0.5" letters:
 - (a) Shut-off valves to each vessel, i.e., L.P. receiver shut-off.
 - (b) Relief valve.
 - (4) Piping shall be marked as either:
 - (a) Refrigerant - High Pressure - Liquid or Hot Gas.

- (b) Refrigerant - Low Pressure - Suction, Pumped Liquid Supply or Pumped Liquid Return.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.
- C. All mechanical equipment, located above the ceiling and requiring maintenance or accessibility, shall be labeled on the ceiling or ceiling grid, directly below the indicated equipment.
 - 1. Provide ceiling grid tags to locate scheduled equipment above T-bar type panel ceilings. Locate in corner of grid closest to equipment.
 - 2. Provide ceiling tags to locate scheduled equipment above access panels in hard ceilings. Locate in corner of access panel closest to equipment.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping shall be the following:
 - 1. Blue for Chilled Water Piping (match existing labeling)
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Chilled-Water Piping:
 - a. Background Color: White.
 - b. Letter Color: Blue.

3.5 VALVE- TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Chilled Water: 2 inches, square.
 - 2. Valve-Tag Color:
 - a. Chilled Water: Natural.
 - 3. Letter Color:
 - a. Chilled Water: Black.

3.6 WARNING – TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

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

PART 1 – GENERAL

Base Bid shall include TAB of complete chilled water hydronic systems. Air side TAB shall include air handlers only to verify EAT and LAT to meet design conditions.

Bid Alternate 1 shall include TAB of chilled water hydronic system related to the installation of chilled water pump CHWP-3 and HVAC controls upgrade. Air side TAB shall include any related items to the HVAC controls upgrade.

Bid Alternate 2 shall include full airside TAB and water side TAB related to commissioning of the HVAC systems.

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. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of this Section.
- C. Commissioning Requirements: Provisions of Sections 01 91 13 – General Commissioning Requirements and 23 08 01 – Commissioning of HVAC Systems are part of this Section.

1.2 WORK INCLUDED

- A. Balancing Air Systems:
 - 1. Constant-volume air systems.
 - 2. General exhaust systems.
 - 3. Outside Air Exhaust systems.
- B. Balancing Hydronic Piping Systems:
 - 1. Variable-flow hydronic systems.
- C. Checking installation for conformity to design.
- D. Checking each piece of equipment for proper installation and operation.
- E. Balancing air and water distribution systems to provide design fluid quantities.
- F. Measuring and recording of fluid quantities.
- G. Electrical measurement.
- H. Verification of performance of all equipment and sequence of operation of automatic controls.
- I. Checking sound levels and vibration isolators for proper function and measurement and correction where a problem or question of acceptability exists.

- J. 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.
- D. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- E. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- F. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- G. Certified TAB reports.
- H. Sample report forms.
- I. Instrument calibration reports, to include the following:
 - J. Instrument type and make.
 - K. Serial number.
 - L. Application.
 - M. Dates of use.
 - N. Dates of calibration.

1.5 QUALITY ASSURANCE

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

- B. Test and balance personnel shall be qualified to perform testing and balancing in accordance with AABC or NEBB procedures.
 - C. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.
 - D. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
 - E. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.
 - F. TAB Conference: Meet with Architect, Owner Representative, General Contractor, Engineer and Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 - G. Agenda Items:
 - H. The Contract Documents examination report.
 - I. The TAB plan.
 - J. Coordination and cooperation of trades and subcontractors.
 - K. Coordination of documentation and communication flow.
 - L. Certify TAB field data reports and perform the following:
 - M. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - N. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
 - O. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
 - P. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - Q. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."
- 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 COORDINATION
- A. Notice: Provide seven (7) days' advance notice for each test. Include scheduled test dates and times.
 - B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 GENERAL COMMENTS

- C. 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.
- D. 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.
- E. 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 VERIFICATION

- A. Prior to commencement of balancing by the Test and Balancing Agency, verify the following in writing:
 - 1. Air filters have been replaced and are clean.
 - 2. Linkages between dampers and their actuators are secure, non-overloading and non-binding.
 - 3. Ductwork specialties are in their normal operating positions.
 - 4. Fans are operating at the correct rotation and specified RPM.
 - 5. Ductwork has been pressure tested and accepted.
 - 6. Strainers have been removed, cleaned and replaced, and that temporary construction strainers have been removed.
 - 7. Compression or expansion tanks have been inspected, are not air-bound or water-logged and are pre-charged, and that the piping systems have been completely vented and filled with water.
 - 8. Air vents at coils and high points of the piping systems have been inspected and installed and operating freely.
 - 9. Automatic valves, hand valves, and balancing valves have been placed in a fixed open position for full flow through all devices.
 - 10. Linkages between valves and their actuators are secure, non-overloading and non-binding.
 - 11. Pressures for hydronic reducing valves have been set.
 - 12. Operating temperatures have been set for chillers and regulating valves.
 - 13. Pumps are operating at the correct rotation and specified horsepower.
 - 14. Piping has been pressure tested and accepted and piping systems have been cleaned, flushed, sterilized and refilled with chemicals and prescribed treated water and vented.
 - 15. Operating safety features (such as thermal overloads, firestats, freezestats, smoke detectors and relief valves), are installed and fully functional.
 - 16. Equipment has been lubricated and can be operated without damage.
 - 17. Systems are operational and complete.
 - 18. No latent residual work remains to be completed.

3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine system pumps to ensure absence of entrained air in the suction piping.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 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.

3.4 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.5 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2010, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.6 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.

- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed.

3.7 PROCEDURES FOR CONSTANT - VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Engineer and Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 1. Open all manual valves for maximum flow.
 2. Check liquid level in expansion tank.
 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.

6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURE FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Engineer and Airport and comply with requirements in Section 23 2123 "Hydronic Pumps."
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

3.10 PROCEDURES FOR VARIABLE – FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.11 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.12 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
 - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 - 2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
 - 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 - 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
 - 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
 - 6. Capacity: Calculate in tons of cooling.
 - 7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.13 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.14 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB contractor.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:

- a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Balancing stations.
 6. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches .
 - j. Number, make and size of belts.
 - k. Number, type and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Cooling-coil static-pressure differential in inches wg.
 - g. Heating-coil static-pressure differential in inches wg.
 - h. Outdoor airflow in cfm.
 - i. Return airflow in cfm.

- j. Outdoor-air damper position.
- k. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft.
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in **cfm**.
 - b. Total system static pressure in **inches wg**.
 - c. Fan rpm.
 - d. Discharge static pressure in **inches wg**.
 - e. Suction static pressure in **inches wg**.

- H. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in **deg F**.
 - d. Duct static pressure in **inches wg**.
 - e. Duct size in **inches**.
 - f. Duct area in **sq. ft**.
 - g. Indicated air flow rate in **cfm**.
 - h. Indicated velocity in **fpm**.
 - i. Actual air flow rate in **cfm**.
 - j. Actual average velocity in **fpm**.
 - k. Barometric pressure in **psig**.

- I. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in **gpm**.
 - g. Water pressure differential in **feet of head or psig**.
 - h. Required net positive suction head in **feet of head or psig**.
 - i. Pump rpm.
 - j. Impeller diameter in **inches**.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.

 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.

- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

J. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.16 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Commissioning Authority.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.
3. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.17 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

3.18 COMMISSIONING

- A. Test and Balance contractor shall provide necessary support to complete necessary Pre-functional testing, Functional Testing, and any retesting required as required to complete the commissioning process of the chiller/pumping systems to be performed by Engineering Team.
- B. Test and Balance contractor shall provide Test and Balance during the commissioning process on an as needed basis during that commissioning effort.

3.19 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.
- C. Variable flow pumping systems having two way control valves and using automatic pressure independent system of flow control for secondary 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.

3.20 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.
 - 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.
- E. Fan Powered Terminals for Cold Air Distribution System:
 - 1. Series Fan Powered Terminals:
 - a. The terminals have been selected so that the fans operate continually during occupied operation. Because the primary air is colder than normal, the fan CFM has been selected for greater flow than the primary air CFM. The fans have been specified with manual solid state speed controllers.
 - b. The primary air flow may be determined by one of two methods:
 - (1) Pitot tube traverse of the primary air supply duct to the terminal.
 - (2) Set the fan speed as required so that the fan CFM is equal to the primary air CFM, i.e., no flow from fan plenum to or from the ceiling. Measure CFM delivered from grilles or diffusers with flow hood. Enter constant in DDC control program so that CFM from DDC is equal to flow hood measurement.

- c. If method b.2. is used for primary air measurement, after balancing primary air, reset fan speed so as to deliver proper scheduled total supply air to diffusers with the primary air set at full design air flow.

3.21 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.

3.22 REFRIGERATION SYSTEM PERFORMANCE TESTING

- A. Recognizing that it will be unlikely that the performance testing will be done on a design day, refrigeration system including heat rejection equipment performance shall be recorded as follows.
 - 1. With pumps delivering design water flow, read and record entering and leaving water conditions, pressure losses, evaporator and condenser temperature and pressures, oil pressures and temperatures and compressor motor KW or amps.
 - 2. Through the contractor, request performance data from the equipment supplier based on the measured flow, leaving chilled water temperature, entering condenser water temperature or condensing temperature and calculated tonnage. Submit this data with test data for review.
 - 3. With heat rejection equipment delivering design air flow, read and record entering and leaving air drybulb and wetbulb temperatures and air flow, water temperature and condensing temperatures as appropriate.
 - 4. 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.

3.23 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.

3.24 CONTRACTOR'S RESPONSIBILITIES

- A. Final testing and balancing of the HVAC systems shall be performed as specified in this section. It is the responsibility of the Contractor to be completely familiar with all the provisions and responsibilities of the Balancer, and to provide such certification, cooperation, and support required.
- B. The Contractor shall repair all deficiencies noted by the Balancer in a timely manner. The Balancer will notify the contractor in writing, on a daily basis, of any deficiencies discovered and Contractor will notify the Balancer immediately, in writing, upon completion of the repairs. The cost for extra re-testing by the Balancer due to un-repaired items that were certified as repaired, will be the responsibility of the Contractor. The final testing and balancing report will contain no punch list items. All deficiencies will have been corrected prior to submission of the final report. Preliminary reports are not to be submitted to the Owner.
- C. The Contractor shall:
 - 1. Allow adequate time in the construction schedule to perform the Testing and Balancing work.
 - 2. Notify the Balancer upon commencement of work related to the HVAC system.
 - 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. 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.
 - 7. 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.
 - 8. 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.
 - 9. Work harmoniously with the Balancer, providing all courtesies normally extended to professional consultants.
 - 10. Remove and replace ceilings as necessary to permit test and balance operations.
 - 11. 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.
 - 12. Provide completed start-up forms on each piece of equipment.
 - 13. 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.
 - 14. Adjust fan speed as required not to exceed RFLA of motor.
 - 15. Open all manually adjustable dampers and test dampers for smooth, vibration-free operation.
 - 16. Verify that all controls are installed and operating in accordance with the sequence of operation.
 - 17. Before requesting final testing and balancing, submit signed statement that HVAC systems are installed, adjusted, fully lubricated, operating satisfactorily, and are ready for use.

3.25 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. In the case of off season performance testing of air handling equipment and refrigeration equipment, include manufacturer's projected performance for comparison.
1. Motors:
 - a. Designation.
 - b. Nameplate HP, voltage and full load amperes.
 - c. RPM.
 - d. Motor amperes and voltage under operating conditions.
 - e. For belt drive applications, motor amperes and voltage under no load condition.
 2. Fans:
 - a. Designation.
 - b. Nameplate data.
 - c. RPM.
 - d. Static pressure, inlet and discharge.
 - e. CFM from pitot tube traverse of discharge duct.
 - f. Final pitot tube traverse sheets showing all readings.
 3. Main and Sub-Main Ducts:
 - a. Designation and location.
 - b. CFM from pitot tube traverse.
 - c. Final pitot tube traverse sheets showing all readings.
 4. Variable or Constant Volume Boxes:
 - a. Designation.
 - b. Nameplate data.
 - c. Static pressure, entering and leaving air.
 - d. CFM, maximum setting on regulator.
 - e. CFM, minimum setting on regulator. Note: If there is no minimum flow shown on the schedule on the drawing then the unit is to go to full shut-off at the minimum setting.
 - f. CFM, maximum as measured by flow hood readings on air outlets and CFM maximum and minimum measured by pitot tube traverse of discharge duct on 10% of boxes. Note: if these readings are not within $\pm 10\%$ of setting on boxes advise contractor and engineer so that a decision can be made on how to proceed with the air balance.
 - g. Final pitot tube traverse sheets showing all readings.
 5. 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.
 6. 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.
7. 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.
8. Chillers - Water Cooled:
- a. Designation.
 - b. Nameplate data.
 - c. Refrigerant type.
 - d. Pressure, entering and leaving chilled water.
 - e. Temperature, entering and leaving chilled water.
 - f. Pressure and/or temperature, evaporator, refrigerant.
 - g. Pressure and/or temperature, condenser refrigerant.
 - h. Total unit amperes and volts, each phase.
 - i. Calculated GPM, chilled water.
 - j. Calculated power, KW.
 - k. Heat balance: evaporator tons plus motor tons = condenser tons.

3.26 OPERATING TESTS

- A. Operate systems to demonstrate that systems have been properly adjusted and balanced, and to demonstrate that the systems' performance conforms with the intent of the specifications and drawings.
- B. The balancing contractor shall make available to the Owner's operating personnel a Certified Test and Balance Engineer for a minimum of 16 hours, two working days, not necessarily consecutive, with all necessary equipment to demonstrate that all systems operate as intended and that the balancing reports are accurate.
- C. This demonstration will occur after the balancing contractor has submitted his reports to confirm that all systems or portions of the systems that coincide with the building's occupancy schedule, are adjusted and balanced.
- D. Conduct tests with natural building heating and/or cooling loads for a minimum 4 hours duration.

END OF SECTION 23 05 93

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SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Basic Requirements: Provisions of Section 23 05 01 - Basic HVAC Requirements are part of this Section.

1.2 WORK INCLUDED

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

1.3 QUALITY ASSURANCE

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

1.4 SUBMITTALS

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

1.5 GENERAL REQUIREMENTS

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

1.6 DEFINITIONS

- A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.
- 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
- 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 Substitution

E. Insulation Coatings, Mastics, Adhesives, and Sealants

1. Foster
2. Pittsburgh Corning
3. Armacell

2.2 MATERIALS

A. Pipe Insulation (to 450F):

1. 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.

B. 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.
2. Rigid fiberglass board factory laminated to an all service jacket (ASJ) vapor barrier, 6 pounds per cubic foot density, with a thermal conductivity of 0.25 Btu-in./hr.-sq.ft.-deg.F at 75°F in accord with ASTM C 518. Boards shall be V-grooved where required to allow the insulation to conform readily to curved surfaces.
3. 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.

C. Insulation Accessories:

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

D. Cold Pipe Hanger Support Blocks: Lightweight, rigid, closed cell material having 100 lb/sq.in. compressive strength when capped with hot asphalt according to ASTM C240.

E. Accessories:

1. Aluminum Pipe Jacket and Fitting Covers: Jacket .016" thick (28 ga.) embossed aluminum sized to provide a minimum 2" lap joint both longitudinal and circumferentially, minimum 3/4 inch x .015 inch thick (30 ga) draw bands. Covers .024 inch thick.
2. PVC pipe jacket and fitting covers used with insulation for pipe, elbows, tees, couplings, 25/50 flame/smoke ratings, suitable for temperatures to 500°F.
3. Glass Cloth Pipe, Duct and Equipment Jacket: Glass lagging cloth, 8 oz/sy treated weight. Secure with elastomeric insulating adhesive on elastomeric insulation, for fiberglass insulation use Childers CP-50AMV1 or Foster 30-36 lagging adhesive.
4. Corner angles shall be minimum 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch

- heavy kraft paper.
5. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
 6. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated or Owner Approved Substitution.
 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 Owner Approved Substitution.
 9. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
 10. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Foster 85-75, Childers CP-82 or Armaflex 520 adhesive or Owner Approved Substitution.
 11. Vapor Barrier Coating: Air drying flexible water based coating used for applying a vapor barrier coating with reinforcing mesh at all below ambient piping/equipment insulated elbows, fittings, and valves. All vapor retarder film (ASJ) seams on below ambient piping/equipment shall also be vapor sealed with vapor barrier coating. Suitable for temperatures to -20F and 180°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08 as tested by ASTM E96, Procedure A at 45 mils dry. Childers CP-34 Vapor Retardant coating, Foster 30-65 Vapor Fas® Coating, or Owner Approved Substitution
 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 Owner Approved Substitution.
 13. Acrylic Finish and Vapor Barrier Coatings:
 - a. Elastomeric Insulations: acrylic coating, air drying flexible water based finish used for finishing flexible elastomeric insulation. Suitable for coating temperatures to 200°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex or Foster 30-64 elastomeric finish.
 - 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 ASTM E96, Procedure A at 45 mils dry. Childers CP-34 Vapor Retardant coating, Foster 30-65 Vapor Fas® Coating,

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.
- 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. 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 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. Insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.
- d. 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.
- e. Cover fittings, flanges, unions, valves, anchors, and accessories with premolded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Apply vapor barrier coating and reinforcing mesh in two coats to a minimum dry thickness of 32 mils on all below ambient piping. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of premolded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.
- f. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
- g. Seal all raw edges of insulation with vapor barrier coating or lagging adhesive.
- h. 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. Refer to insulation schedule in Section 3.3. All chilled water piping insulation shall be foamglas.
 - b. Below ambient piping: All joints, both longitudinal and circumferential shall be sealed with an insulation joint sealant.
 - c. Thickness shown for refrigeration pipe to be obtained by use of two layers of insulation with staggered joints.
 - d. Above ambient piping finish: Weather barrier breather mastic. Foster 46-50, Childers CP-10 or Pittcote 404.
 - e. 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.
- B. Equipment Insulation:
1. Vessel and Large Pipe Insulation:
 - a. Insulation shall be of the same material as the piping which serves it and it shall be layered to obtain the required thickness. Maximum of 1-1/2" thick per layer.
 - b. All joints shall be staggered to avoid thermal gaps.
 - c. Sheet size shall be as large as possible to minimize seams. Do not use "scraps".
 - d. Securing shall be by welded studs and/or non-corrosive banding wire. Do not weld brackets, clips or other devices to ASME coded pressure vessels or piping. Insulation pins or studs shall be as specified and installed in accordance with NCIA standards.
 - e. Finish shall be with PVC jacket or galvanized steel mesh wire and a finish coat of insulating cement minimum of 1/4" thick. After cement has cured apply glass lagging cloth and proper coating as directed by manufacturer. All corners shall have metal corner beads and provide acrylic latex finish.
 3. Removable Covers:
 - a. Chilled water pumps to have removable covers shall have insulation 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.
 - f. Pipe strainers shall also have removable covers for insulation to facilitate service and maintenance.
4. Chilled Water Filtering Systems: Surfaces shall be insulated with 1 inch thick closed cell elastomeric insulation board or pipe insulation, as applicable. Finish as specified for vessel and large pipe insulation.

C. 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.

D. Aluminum Pipe Jacket:

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

E. PVC Jacket:

1. Provide PVC sheet jacket over all exposed, indoor piping or insulation.
2. Provide PVC pipe jacket over all exposed, indoor 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.

F. Glass Cloth Jacket:

1. Provide where specified.
2. Provide acrylic latex finish.

G. Flexible Acrylic Latex:

1. Apply two coats to glass cloth jacket, concealed foamglas and closed cell elastomeric insulation.
2. Refer to Division 09 for color to be used. If no instructions are given, provide a white finish.

3.3 INSULATION SCHEDULE

- A. Pipe insulation shall be cellular glass.
- B. The insulation thickness in inches shall be in accordance with the following table:

CELLULAR GLASS PIPING INSULATION THICKNESS					
Pipe Size, Inches	Up to 1	1-1/4 to 2	2-1/2 to 4	5 to 6	8 & Up
Chilled Water	1-1/2	1-1/2	1-1/2	2	2

- C. For piping exposed to the outdoor air, increase insulation thickness by 1/2 inch.

3.4 MISCELLANEOUS ITEMS

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

END OF SECTION 23 07 00

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SECTION 23 08 01 – COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Alternate 2 Bid:

1. Mechanical Contractor to provide: Commissioning process support, task requirements and roles and responsibilities for implementing building systems commissioning for Ventilating, Air Conditioning and related systems, assemblies and equipment.
2. Controls Contractor to provide: Commissioning process support, task requirements and roles and responsibilities for implementing building systems commissioning for Heating, Ventilating, Air Conditioning and Refrigeration control systems, assemblies and equipment.

1.2 SUMMARY

A. This section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Work / Sections:

1. Section 019113 - "General Commissioning Requirements" for general commissioning process requirements.
2. ASHRAE Standard 90.1-2010, ASHRAE Guidelines 0-2013 (The Commissioning Process), and 1.1-2007 (The HVAC Commissioning Process) and ASHRAE Standard 202-2013 Commissioning Process for Buildings and Systems.
3. Commissioning Plan (Cx Plan)

1.3 DESCRIPTION

A. Refer to Section 01 91 13 "General Commissioning Requirements" for the description of commissioning.

1.4 DEFINITIONS

A. Refer to Section 019113 "General Commissioning Requirements" for definitions.

1.5 SUBMITTALS

A. Refer to Section 019113 "General Commissioning Requirements" for CxA's role.

B. Refer to Section 013300 "Submittals" for specific requirements.

C. In addition, provide the following:

1. Certificates of readiness
2. Certificates of completion of installation, pre-start, and start-up activities.
3. Test reports

D. Control Drawings Submittal

1. The control drawings shall have a key to all abbreviations.
2. The control drawings shall contain graphic schematic depictions of the systems and each component.
3. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Provide a full points list with at least the following included for each point:
 - a. Controlled system
 - b. Point abbreviation
 - c. Point description
 - d. Display unit
 - e. Control point or set point (Yes / No)
 - f. Monitoring point (Yes / No)
 - g. Intermediate point (Yes / No)
 - h. Calculated point (Yes / No)

1.6 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

- A. Refer to Section 019113 "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the heating, ventilating and controls contractors shall ultimately be responsible for all standard testing equipment for the HVAC&R system and controls system specified, except for equipment specific to and used by TAB in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each subcontractor.
- B. Special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price and left on site, except for stand-alone data logging equipment that may be used by the CxA.
- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Using Agency upon completion of the commissioning process.

- D. Data logging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Using Agency.
- E. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5F and a resolution of + or - 0.1F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

- A. With assistance from the installing contractors, the CxA will prepare construction Verification Checklists for all commissioned components, equipment, and systems
- B. Red-lined Drawings:
 - 1. The contractor will verify all equipment, systems, instrumentation wiring and components are shown correctly on red-lined drawings.
 - 2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
 - 3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.
 - 4. The contracted party, as defined in the Contract Documents will create the as-built drawings.

3.2 CONTRACTOR'S RESPONSIBILITIES

- A. Heating, Ventilating, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the heating, ventilating, controls and TAB contractors are as follows (all references apply to commissioned equipment only):
- B. Perform commissioning tests at the direction of the CxA.
- C. Attend construction phase controls coordination meetings.
- D. Attend testing, adjusting, and balancing review and coordination meetings.
- E. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- F. Provide information requested by the CxA for final commissioning documentation.
- G. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.
- H. Prepare preliminary schedule for mechanical system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.

- I. Update schedule as required throughout the construction period.
- J. During the startup and initial checkout process, execute the related portions of the Component Verification Checklists for all commissioned equipment.
- K. Assist the CxA in all verification and functional performance tests.
- L. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- M. Coordinate with the CxA to provide (48) hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
- N. Notify the CxA a minimum of (2) weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.
- O. Participate in, and schedule vendors and contractors to participate in the training sessions.
- P. Provide written notification to the GC and CxA Authority that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
 - 1. Primary HVAC&R equipment including chillers, pumps, heat exchangers, piping and all other equipment under their control.
 - 2. Secondary HVAC&R equipment including all fans, air handling units, ductwork, dampers, terminals, and all other equipment their control.
 - 3. Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
 - 4. Fire detection and smoke detection devices in related technical sections of the specifications.
- Q. The equipment supplier shall document the performance of his equipment.
- R. Test, Adjust and Balance Contractor
 - 1. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
 - 2. Submit the site-specific testing and balancing plan to the CxA and A/E for review and acceptance.
 - 3. Attend the testing and balancing review meeting scheduled by the CxA. Be prepared to discuss the procedures that shall be followed in testing, adjusting, and balancing the HVAC&R system.
 - 4. At the completion of the testing and balancing work, and the submittal of the final testing and balancing report, notify the HVAC&R contractor and the GC.
 - 5. Participate in verification of the testing and balancing report, which will consist of repeating measurements contained in the testing and balancing reports. Assist in diagnostic purposes when directed.
- S. Provide training of the Using Agency's operating staff using expert qualified personnel, as specified.

T. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Using Agency, to keep warranties in force.
2. Assist in equipment testing per agreements with contractors.
3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

U. Refer to Section 01 91 13 “General Commissioning Requirements” for additional contractor responsibilities.

3.3 DESIGN PROFESSIONAL'S RESPONSIBILITIES

- A. Refer to Section 01 91 13 “General Commissioning Requirements” for Design Professional’s Responsibilities.

3.4 CxA'S RESPONSIBILITIES

- A. Refer to Section 01 91 13 “General Commissioning Requirements” for CxA’s Responsibilities.

3.5 TESTING PREPARATION

- A. Certify in writing to the CxA that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing to the CxA that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.6 TESTING, ADJUSTING AND BALANCING VERIFICATION

- A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing subcontractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.7 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA, along with the Heating and Ventilating Contractors, Testing and Balancing Subcontractor, and the Controls Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to representatives of Okaloosa County. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.8 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual technical sections. Provide submittals, test data, inspector record, and certifications to the CxA.
- B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 23 09 13 "Instrument and Control Devices for HVAC". Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in piping specifications. Heating Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
 - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 - 2. Description of equipment for flushing operations.
 - 3. Minimum flushing water velocity.
 - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- E. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.
- F. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:
 - 1. Air Handling Units
 - 2. Air Terminal Units
 - 3. Building Automation System (see below)
 - 4. Chilled Water System
 - 5. Pumps
 - 6. Split system air conditioning units
 - 7. Supply and exhaust fans
 - 8. Electric Duct Heaters, Hydronic Heating
 - 9. Fan Coil Units
 - 10. Testing, Adjusting and Balancing
 - 11. Variable Frequency Drives (VFD)

3.9 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

- A. Refer to Section 019113 “General Commissioning Requirements” for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.10 APPROVAL

- A. Refer to Section 019113 “General Commissioning Requirements” for approval procedures.

3.11 DEFERRED TESTING

- A. Refer to Section 019113 “General Commissioning Requirements” for requirements pertaining to deferred testing.

END OF SECTION 23 08 00

SECTION 23 09 13 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units.
- B. Related Sections include the following:
 - 1. Division 23 Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
 - 2. Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.
 - 3. Division 26 "Electrical".

1.3 DEFINITIONS

- A. Standard
 - 1. ASHRAE: American Society Heating, Refrigeration, Air Conditioning Engineers
 - 2. AHU: Air Handling Unit
 - 3. BACnet: Building Automation Controls Network
 - 4. BMS: Building Management System
 - 5. DDC: Direct Digital Control
 - 6. EIA: Electronic Industries Alliance
 - 7. GUI: Graphical User Interface
 - 8. HVAC: Heating, Ventilation, and Air Conditioning
 - 9. IEEE: Institute Electrical Electronic Engineers
 - 10. MER: Mechanical Equipment Room
 - 11. PID: Proportional, Integral, Derivative
 - 12. VAV: Variable Air Volume Box
- B. Communications and protocols
 - 1. ARP: Address Resolution Protocol
 - 2. CORBA: Common Object Request Broker Architecture
 - 3. CSMA/CD: Carrier Sense Multiple Access/Collision Detect
 - 4. DDE: Dynamic Data Exchange
 - 5. FTT: Free Topology Transceivers
 - 6. HTTP: Hyper Text Transfer Protocol
 - 7. IIOP: Internet Inter-ORB Protocol

8. LAN: Local Area Network
9. LON: Echelon Communication – Local Operating Network
10. MS/TP: Master Slave Token Passing
11. ODBC: Open Database Connectivity
12. ORB: Object Request Broker
13. SNVT: Standard Network Variables Types
14. SQL: Structured Query Language
15. UDP: User Datagram Protocol
16. XML: eXtensible Markup Language

C. Controllers

1. ASD: Application Specific Device
2. AAC: Advanced Application Controller
3. ASC: Application Specific Controller.
4. MNB: MNB-1000 Plant Controller
5. MNB3: MNB-300 Unit Controller
6. CAC: Custom Application Controller.
7. DCU: Distributed Control Unit
8. LCM: Local Control Module
9. MC: MicroControllers
10. MCI: MicroInterface
11. MN-II: Microzone II direct digital controller
12. MN-FLO: Micronet 2000 Pressure Independent VAV Controller
13. MFLO2: Micro Flow II Pressure Independent VAV Controller
14. NSC: Network Server Controller
15. PEM: Package Equipment Module
16. PPC: Programmable Process Controller
17. SDCU: Standalone Digital Control Units
18. SLC: Supervisory Logic Controller
19. UEC: Unitary Equipment Controller
20. VAVDDC: Variable Air Volume Direct Digital Controller

D. Tools and Software

1. AMBCx: Automated Monitoring Based Commissioning
2. APEO: Automated Predictive Energy Optimization
3. DR: Demand Response
4. CCDT: Configuration, Commissioning and Diagnostic Tool
5. BPES: BACnet Portable Engineering Station
6. LPES: LON Portable Engineering Station
7. POT: Portable Operator's Terminal

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.

4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute BAS PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F.
 - b. Water Flow: Plus or minus 2 percent of full scale.
 - c. Water Pressure: Plus or minus 5 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F.
 - e. Ducted Air Temperature: Plus or minus 1 deg F.
 - f. Outside Air Temperature: Plus or minus 2 deg F.
 - g. Dew Point Temperature: Plus or minus 3 deg F.
 - h. Temperature Differential: Plus or minus 0.25 deg F.
 - i. Relative Humidity: Plus or minus 2 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - l. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - m. Air Pressure (Space): Plus or minus 0.01-inch wg.
 - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
 - o. Electrical: Plus or minus 5 percent of reading.

1.5 SEQUENCE OF OPERATION

- A. See Control Diagrams on Design Documents and Specification Section 23 09 93 Sequence of Operations for HVAC for Sequences of Operations.

1.6 SUBMITTALS

- A. All shop drawings shall be prepared in Visio Professional or AutoCAD software. In addition to the drawings, the Contractor shall furnish a CD containing the identical information. Drawings shall be B size or larger.
- B. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typical will be allowed where appropriate.
- C. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.
- D. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be bound or in a three ring binder with an index and tabs. Diagrams shall be on 11" by 17" foldouts. If color has been used to differentiate information, the printed copies shall be in color.

- E. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor, prior to submitting, shall check all documents for accuracy.
- F. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.
- G. The following is a list of post construction submittals that shall be updated to reflect any changes during construction and re-submitted as "As-Built".
 - 1. System architecture drawing.
 - 2. Layout drawing for each control panel
 - 3. Wiring diagram for individual components
 - 4. System flow diagram for each controlled system
 - 5. Instrumentation list for each controlled system
 - 6. Sequence of control
 - 7. Binding map
 - 8. Operation and Maintenance Manuals
- H. Information common to the entire system shall be provided. This shall include but not be limited to the following.
 - 1. Product manuals for the key software tasks.
 - 2. Operating the system.
 - 3. Administrating the system.
 - 4. Engineering the operator workstation.
 - 5. Application programming.
 - 6. Engineering the network.
 - 7. Setting up the web server.
 - 8. Report creation.
 - 9. Graphics creation.
 - 10. All other engineering tasks.
 - 11. System Architecture Diagram.
 - 12. List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.
 - 13. Define the task.
 - 14. Recommend a frequency for the task.
 - 15. Reference the product manual that includes instructions on executing the task.
 - 16. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
 - 17. Licenses, guarantees, and warranty documents for equipment and systems.
 - 18. Submit one copy for each building, plus two extra copies.
- I. Information common to the systems in a single building shall be provided.
 - 1. System architecture diagram for components within the building annotated with specific location information.
 - 2. As-built drawing for each control panel.
 - 3. As-built wiring design diagram for all components.
 - 4. Installation design details for each I/O device.
 - 5. As-built system flow diagram for each system.
 - 6. Sequence of control for each system.
 - 7. Binding map for the building.
 - 8. Product data sheet for each component.

9. Installation data sheet for each component.
10. Submit two copies for each building and two extra copies.

1.7 QUALITY ASSURANCE

- A. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.
- B. Siemens shall set in operating condition all major equipment replacements and systems, such as the chilled water, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Engineer's representatives.
- C. Siemens shall provide a technician for manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall coordinate all requirements to provide a complete TAB with the Balancing Contractor and shall include all labor and materials in his contract.
- D. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded.
- E. Required elements of the startup testing include:
 1. Measurement of voltage sources, primary and secondary
 2. Verification of proper controller power wiring.
 3. Verification of component inventory when compared to the submittals.
 4. Verification of labeling on components and wiring.
 5. Verification of connection integrity and quality (loose strands and tight connections).
 6. Verification of bus topology, grounding of shields and installation of termination devices.
 7. Verification of point checkout.
 8. Each I/O device is landed per the submittals and functions per the sequence of control.
 9. Analog sensors are properly scaled and a value is reported
 10. Binary sensors have the correct normal position and the state is correctly reported.
 11. Analog outputs have the correct normal position and move full stroke when so commanded.
 12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.
 13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).
 14. Documentation of Loop tuning (sample rate, gain and integral time constant).
- F. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following.
 1. Graphics navigation.
 2. Trend data collection and presentation.
 3. Alarm handling, acknowledgement and routing.
 4. Time schedule editing.
 5. Application parameter adjustment.
 6. Manual control.
 7. Report execution.

- 8. Automatic backups.
- 9. Web Client access.

G. A Startup Testing Report and a Performance Verification Testing Report shall be provided upon test completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.9 COORDINATION

- A. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- B. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.
- C. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

1.10 WARRANTY AND MAINTENANCE

- A. The temperature contractor shall provide a one-year warranty that will commence from the point of project acceptance by the Owner.
- B. The temperature control contractor shall provide a three (3) year extended warranty and preventative maintenance agreement for the temperature control system, as part of the original bid. Any manufacturing defects arising during this extended warranty period shall be corrected without cost to the Owner. The preventative maintenance agreement shall include a minimum of quarterly service visits, include defective parts replacement and commence upon completion of the temperature control system installation.
- C. This agreement shall include 24-hour emergency service.
- D. The temperature control contractor shall provide a manufacturer's standard scope description of the extended warranty/preventative maintenance agreement, as part of the temperature control submittal. This agreement shall contain manufacturer's standard schedules of service procedures, work task definitions, and recommended frequencies of performance. The preventative maintenance agreement shall include the temperature control system and its peripherals as specified in this section. This agreement shall include the provision and installation of all manufacturer's standard Host software and product firmware upgrades released during the term of this agreement. The temperature control submittal will not be approved without the warranty/preventative maintenance agreement. There will be no charge to the customer for preventative maintenance of the control system during the extended warranty period.

1.11 TRAINING

- A. Siemens shall provide both on-site and classroom training to the Owner's representative and maintenance personnel per the following description:

- B. On-site training shall consist of a minimum of (32) hours over a 2-week period with maximum daily training period of (4) hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include
1. System Overview
 2. System Software and Operation
 3. System access
 4. Software features overview
 5. Changing setpoints and other attributes
 6. Scheduling
 7. Editing programmed variables
 8. Displaying color graphics
 9. Running reports
 10. Workstation maintenance
 11. Viewing application programming
 12. Operational sequences including start-up, shutdown, adjusting and balancing.
 13. Equipment maintenance.
- C. All training sessions will be recorded via video and turned over to VPS for future reference.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Building automation contractors in the business of installing direct digital control building automation systems for a minimum of 10 years with extensive experience working on operational, aviation facilities.
- B. The Building Management System contractor shall have a full-service facility within 50 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The contractor's technicians shall be fully capable of providing instructions and routine emergency maintenance service on all controllers listed in 1.5 controllers.
- C. The system shall be an updated version of the existing Siemens BCS. No other exception will be allowed.

2.2 SCOPE OF WORK

- A. Siemens shall furnish and install an upgraded building automation system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification and as shown on the plans. All components of the system – workstations, servers, application controllers, unitary controllers, etc. shall communicate using the BACnet protocol, as defined by ASHRAE Standard 135-2007, or Modbus protocol. No gateways shall be used for communication to controllers furnished under this section. At a minimum, provide controls for the following:
1. Chilled water system including pumps, chillers
 2. Variable Frequency Drives
 3. Power wiring to DDC devices, and BAS panels except as otherwise specified

- B. Except as otherwise noted, the control system shall consist of all necessary Ethernet Network Controllers, Standalone Digital Control Units, workstations, software, sensors, transducers, relays, valves, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Except as otherwise specified, provide operators for equipment such as motorized valves if the equipment manufacturer does not provide these. Coordinate requirements with the various Contractors.
- C. All interlocking wiring, wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. When the BAS system is fully installed and operational, the BAS Contractor and representatives of the Owner will review and check out the system – see System Acceptance and Testing section of this document. At that time, the BAS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.
- D. All work performed under this section of the specifications will comply with all governing codes, laws and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor, with guidance from the engineer, shall submit a proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.

2.3 SYSTEM DESCRIPTION

- A. In accordance to the scope of work, the system shall also provide a graphical, web-based, operator interface that allows for instant access to any system through a standard browser. The contractor must provide PC-based programming workstations, operator workstations and microcomputer controllers of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

For this project, the system shall consist of the following components:

1. Administration and Programming Workstation(s): The BAS Contractor shall furnish one (1) Administration and Programming Workstation Computer as described in Part 2 of the specification. These workstations must be running the standard workstation software developed and tested by the manufacturer of the network server controllers and the standalone controllers. No third party front-end workstation software will be acceptable. Workstations must conform to the B-OWS BACnet device profile.
2. Web-Based Operator Workstations: The BAS Contractor shall furnish licenses for web connection to the BAS system. Web-based users shall have access to all system points and graphics, shall be able to receive and acknowledge alarms, and shall be able to control setpoints and other parameters. All engineering work, such as trends, reports, graphics, etc. that are accomplished from the Work-Station shall be available for viewing through the web browser interface without additional changes. The web-based interface must conform to the B-OWS BACnet device profile. There will be no need for any additional computer based hardware to support the web-based user interface.
3. Ethernet-based Network Router and/or Network Server Controller(s): Existing Router and Network Server Controller shall be reused to the extent possible.
4. Network Controllers shall be tested and certified by the BACnet Testing Laboratory (BTL) as Network Server Controllers (B-BC).
5. Standalone Digital Control Units (SDCUs): Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment. Each BACnet protocol SDCU shall conform to the BACnet device profile B-AAC.

6. BACnet SDCUs shall be tested and certified by the BACnet Testing Laboratory (BTL) as Advanced Application Controllers (B-AAC).
 - B. The software tools required for network management of the ANSI / ASHRAE™ Standard 135-2008, BACnet protocol must be provided with the system. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans and are required to meet the functional intent, shall be provided without additional cost to the Owner. Minimum BACnet compliance is Level 4; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet IP or MS/TP.
 - C. The system shall support Modbus TCP and RTU protocols natively, and not require the use of gateways.
 - D. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives.
 1. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs.
 2. Data shall reside on a supplier-installed server for all database access.
 3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network.
 - E. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office a. The approved manufacturer's local field office shall have a minimum of 10 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer when requested. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 50 miles of the site with factory certified technicians and engineers, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.
 - F. Provide the Commissioning, configuration and diagnostic tool (CCDT), color display personnel computer, software, and interfaces to provide uploading/downloading of High Point Count Controllers (AAC), monitoring all BACnet objects, monitoring overrides of all controller physical input/output points, and editing of controller resident time schedules.
- 2.4 WORK BY OTHERS
- A. Siemens shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.
 - B. Siemens shall furnish all control valves, sensor wells, flow meters and other similar equipment for installation by the Mechanical Contractor.

2.5 SYSTEM ARCHITECTURE

A. General Requirements

1. The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.

B. Fieldbus Level with Standalone Digital Control Units (SDCUs)

1. The fieldbus layer shall be support all of the following types of SDCUs:
 - a. BACnet SDCU requirements: The system shall consist of one or more BACnet MS/TP field buses managed by the Network Server Controller. Minimum speed shall be 76.8kbps. The field bus layer consists of an RS485, token passing bus that supports up to 50 Standalone Digital Control Units (SDCUs) for operation of HVAC and lighting equipment. These devices shall conform to BACnet standard 135-2007.
 - b. Modbus SDCU requirements: The system shall consist of one or more Modbus RTU (RS-485 or RS-232) field buses managed by the Network Server Controller. The field bus layer shall consist of up to 62 SDCUs for operation of HVAC, power metering, and lighting equipment. If utilizing Modbus TCP, the field bus layer shall consist of up to 100 SDCUs for operation of HVAC, power metering, and lighting equipment.
 - c. NETWORK 8000 SDCU requirements: The system shall consist of one or more ASD or LCM field buses managed by the Network Server Controller. The field bus layer shall consist of up to 128 ASD SDCUs or 31 LCM SDCUs for operation of HVAC, power metering, and lighting equipment.
 - d. I/NET SDCU requirements: The system shall consist of one or more controller LANs and subLANs managed by the Network Server Controller. The network shall consist of up to 100,000 I/NET points capable through numerous links and devices for operation of HVAC, power metering, and lighting equipment.

C. System Expansion

1. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.
2. Web-based operation shall be supported directly by the NSCs and require no additional software, other than a Java supported network browser.
3. The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.

D. Support For Open Systems Protocols

1. All Network Server Controllers must natively support the BACnet IP, BACnet MS/TP, LonWorks FTT-10, Modbus TCP, Modbus RTU (RS-485 and RS-232), and Modbus ASCII protocols.

2.6 OPERATOR WORKSTATION REQUIREMENTS

A. General

1. The operator workstation portion of the BAS shall consist of one or more full-powered configuration and programming workstations, and one or more web-based operator workstations. For this project provide a minimum of 10 concurrent operator users and/or 2 concurrent engineering users within the enterprise server.
2. The programming and configuration workstation software shall allow any user with adequate permission to create and/or modify any or all parts of the NSC and/or Enterprise Server database.
3. All configuration workstations shall be personal computers operating under the Microsoft Windows operating system. The application software shall be capable of communication to all Network Server Controllers and shall feature high-resolution color graphics, alarming, trend charting. It shall be user configurable for all data collection and data presentation functions.
4. A minimum of 1 Workstation shall be allowed on the Ethernet network. In this client/server configuration, any changes or additions made from one workstation will automatically appear on all other workstations since the changes are accomplished to the databases within the NSC. Systems with a central database will not be acceptable.

B. Administration/Programming Workstation Requirements

1. The workstation shall consist of the following:
 - a. Processor
 - 1) Minimum: 2.0 GHz
 - 2) Recommended: 2.5 GHz or higher
 - b. Memory
 - 1) Recommended: 6GB or higher
 - c. Operating systems:
 - 1) Microsoft Windows 10 Pro 32-bit
 - 2) Microsoft Windows 10 Pro 64-bit
 - d. Serial port, parallel port, USB port
 - e. 10/100MBPS Ethernet NIC
 - f. 500 GB solid state hard drive
 - g. DVD drive
 - h. High resolution (minimum 1280 x 1024), 24" flat panel display monitor
 - i. Optical mouse and full function keyboard
 - j. Audio sound card and speakers
 - k. GTX Nvidia Graphics
 - l. License agreement for all applicable software.

C. Web-Based Operator PC Requirements

1. Any user on the network can access the system, using the following software:
 - a. Internet Explorer 11 or Edge
 - b. Firefox 4.0 (32-bit) and above
 - c. Java-enabled

D. General Administration and Programming Workstation Software

1. System architecture shall be truly client server in that the Workstation shall operate as the client while the NSCs shall operate as the servers. The client is responsible for the data presentation and validation of inputs while the server is responsible for data gathering and delivery.
2. The workstation functions shall include monitoring and programming of all DDC controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments.
3. Programming of SDCUs shall be capable of being done either off-line or on-line from any operator workstation. All information will be available in graphic or text displays stored at the NSC. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

E. User Interface:

1. The BAS workstation software shall allow the creation of a custom, browser-style interface linked to the user when logging into any workstation. Additionally, it shall be possible to create customized workspaces that can be assigned to user groups. This interface shall support the creation of “hot-spots” that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface must be able to be configured to become a user’s “PC Desktop” – with all the links that a user needs to run other applications. This, along with the Windows user security capabilities, will enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BAS software, but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shutdown the active alarm viewer and/or unable to load software onto the PC.
2. System shall be able to automatically switch between displayed metric vs. imperial units based on the workstation/webstations localization.
3. The BMS workstation/webstations shall be capable of multiple language display, including English, Spanish, German, French, Japanese, Finnish, Swedish, and traditional and simplified Chinese.

F. User Security

1. The software shall be designed so that each user of the software can have a unique username and password. This username/password combination shall be linked to a set of capabilities within the software, set by and editable only by, a system administrator. The sets of capabilities shall range from View only, Acknowledge alarms, Enable/disable and change values, Program, and Administer. The system shall allow the above capabilities to be applied independently to each and every class of object in the system. The system must allow a minimum of 256 users to be configured per workstation. Additionally, the software shall enable the ability to add/remove users based upon Microsoft Windows Security Domains that enable the customer IT department to assist in user access.

G. Configuration Interface

1. The workstation software shall use a familiar Windows Explorer-style interface for an operator or programmer to view and/or edit any object (controller, point, alarm, report, schedule, etc.) in the entire system. In addition, this interface shall present a “network map” of all controllers and their associated points, programs, graphics, alarms, and reports in an easy to understand structure. All object names shall be alphanumeric and use Windows long filename conventions.
2. The configuration interface shall also include support for user defined object types. These object types shall be used as building blocks for the creation of the BAS database. They shall be created from the base object types within the system input, output, string variables, setpoints, etc., alarm

algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of user defined object types shall be able to be set up as a predefined aggregate of subsystems and systems. The configuration interface shall support copying/pasting and exporting/importing portions of the database for additional efficiency.

H. Color Graphic Displays

1. The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These graphics shall contain point information from the database including any attributes associated with the point (engineering units, etc.). In addition, operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.
2. Requirements of the color graphic subsystem include:
 - a. At a minimum, the user shall have the ability to import .gif, .png, .bmp, .jpeg, .tif, and CAD generated picture files as background displays, and layering shall be possible.
 - b. It shall be possible for the user to use JavaScript to customize the behavior of each graphic.
 - c. The editor shall use Scalable Vector Graphics (SVG) technology.
 - d. A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, and graphs which can be “dropped” on a graphic through the use of a software configuration “wizard”. These objects shall enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels.
 - e. Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.
 - f. Status changes or alarm conditions must be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
 - g. Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators must be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.
 - h. It shall be possible to create and save graphical components and JavaScript code in reusable and transferrable, customized libraries.
 - i. Graphics should rescale based on whatever monitor or viewing device is being used.
 - j. Be able to create graphics on varying layers that can be moved and repeated.
 - k. Be able to create graphics within varying window panes that can be moved and/or referenced. For example, creating the graphical menu within a pane and referencing it on every graphics page, therefore not rebuilding thus allowing for a single spot for updates that get pushed to all the pages that reference it.
3. Additionally, the Graphics Editor portion of the Engineering Software shall provide the following capabilities:
 - a. Create and save pages.
 - b. Group and ungroup symbols.
 - c. Modify an existing symbol.
 - d. Modify an existing graphic page.
 - e. Rotate and mirror a symbol.
 - f. Place a symbol on a page.
 - g. Place analog dynamic data in decimal format on a page.
 - h. Place binary dynamic data using state descriptors on a page.
 - i. Create motion through the use of animated .gif files or JavaScript.
 - j. Place test mode indication on a page.
 - k. Place manual mode indication on a page.

- l. Links to other graphics.
 - m. Links to notes.
 - n. Links to time schedules.
 - o. Links to .doc files.
 - p. Assign a background color.
 - q. Assign a foreground color.
 - r. Place alarm indicators on a page.
 - s. Change symbol/text/value color as a function of an analog variable.
 - t. Change a symbol/text/value color as a function of a binary state.
 - u. Change symbol/text/value as a function of a binary state.
 - v. All symbols used by Siemens Controls in the creation of graphic pages shall be saved to a library file for use by the owner.
- I. Automatic monitoring
- 1. The software shall allow for the automatic collection of data and reporting from any controller or NSC. The frequency of data collection shall be user-configurable.
- J. Alarm Management
- 1. The software shall be capable of accepting alarms directly from NSCs or controllers, or generating alarms based on evaluation of data in controllers and comparing to limits or conditional equations configured through the software. Any alarm (regardless of its origination) will be integrated into the overall alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports.
- K. Report Generation
- 1. Minimum supplied reports shall include
 - a. Activities Per User Report
 - b. Alarm Amount by Category Report
 - c. Alarm Amount by Type Report
 - d. Alarms Per Sever Report
 - e. Current Alarm Report
 - f. Most Active Alarm Report
 - g. Top Activities Report
 - h. Top Alarms Report
 - i. Top System Errors Report
 - j. Trend Log Comparison Report
 - k. User Logins Report
 - l. Users and Groups Reports
- L. Scheduling
- 1. From the workstation or webstation, it shall be possible to configure and download schedules for any of the controllers on the network.
 - 2. Time of day schedules shall be in a calendar style and viewable in both a graphical and tabular view.
 - 3. Schedules shall be programmable for a minimum of one year in advance.
 - 4. To change the schedule for a particular day, a user shall simply select the day and make the desired modifications.
 - 5. Additionally, from the operator webstations, each schedule will appear on the screen viewable as the entire year, monthly, week and day. A simple mouse click shall allow switching between views. It shall also be possible to scroll from one month to the next and view or alter any of the schedule times.

6. Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.
 7. It shall be possible to assign a lead schedule such that shadow/local schedules are updated based upon changes in the Lead.
 8. It shall be possible to assign a list(s) of exception event days, dates, date ranges to a schedule.
 9. It shall be possible to view combined views showing the calendar and all prioritized exemptions on one screen.
 10. Values should be able to be controlled directly from a schedule, without the need for special program logic.
- M. Saving/Reloading
1. The workstation software shall have an application to save and restore NSC and field controller memory files.
 2. For the NSC, this application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.
- N. Audit Trail
1. The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.
 2. It shall be possible to view a history of alarms, user actions, and commands for any system object individually or at least the last 5000 records of all events for the entire system from Workstation.
 3. It shall be possible to save custom filtered views of event information that are viewable and configurable in Workstation.
- O. Web-based Operator Software
1. General:
 - a. Day-to-day operation of the system shall be accessible through a standard web browser interface, allowing technicians and operators to view any part of the system from anywhere on the network.
 - b. The system shall be able to be accessed on site via a mobile device environment with, at a minimum, access to overwrite and view system values.
 2. Graphic Displays
 - a. The browser-based interface must share the same graphical displays as the Administration and Programming Workstations, presenting dynamic data on site layouts, floor plans, and equipment graphics. The browser's graphics shall support commands to change setpoints, enable/disable equipment and start/stop equipment.
 - b. Through the browser interface, operators must be able to navigate through the entire system, and change the value or status of any point in any controller. Changes are effective immediately to the controller, with a record of the change stored in the system database.

3. Alarm Management

- a. Systems requiring additional client software to be installed on a PC for viewing the webstation from that PC will not be considered.
- b. Through the browser interface, a live alarm viewer identical to the alarm viewer on the Administration and Programming workstation shall be presented, if the user's password allows it. Users must be able to receive alarms, silence alarms, and acknowledge alarms through a browser. If desired, specific operator text must be able to be added to the alarm record before acknowledgement, attachments shall be viewable, and alarm checklists shall be available.

P. Groups and Schedules

1. Through the browser interface, operators must be able to view pre-defined groups of points, with their values updated automatically.
2. Through the browser interface, operators must be able to change schedules – change start and stop times, add new times to a schedule, and modify calendars.

Q. User Accounts and Audit Trail

1. The same user accounts shall be used for the browser interface and for the operator workstations. Operators must not be forced to memorize multiple passwords.
2. All commands and user activity through the browser interface shall be recorded in the system's activity log, which can be later searched and retrieved by user, date, or both.

2.7 NETWORK SERVER CONTROLLERS (Automation Server)

- A. Safely manage account and database information with fully secure integration into Windows Domain user accounting, making one less IT admin tool, and ensuring policy adherence
- B. Complete audit trail records changes, time, and user to facilitate thorough post situation analysis
- C. Network Router Controllers shall combine both network routing functions, control functions, and server functions into a single unit.
- D. The BACnet NSC shall be classified as a “native” BACnet device, supporting the BACnet Network Server Controller (B-BC) profile. Controllers that support a lesser profile such as B-SA are not acceptable. NSCs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Network Server Controllers (B-BC).
- E. The Network Server Controller shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NRS.
- F. They shall also be responsible for monitoring and controlling their own HVAC equipment such as an AHU or boiler.
- G. They shall also contain graphics, trends, trend charts, alarm views, and other similar presentation objects that can be served to workstations or web-based interfaces. A sufficient number of NSCs shall be supplied to fully meet the requirements of this specification and the attached point list.
- H. It shall be capable of executing application control programs to provide:
 1. Calendar functions

2. Scheduling
 3. Trending
 4. Alarm monitoring and routing
 5. Time synchronization by means of an Internet site including automatic synchronization
 6. Native integration of LonWorks controller data and Modbus controller data or BACnet controller data and Modbus controller data
 7. Network Management functions for all LonWorks based devices
- I. Hardware Specifications
1. Memory:
 - a. The operating system of the controller, application programs, and all other portions of the configuration database, shall be stored in non-volatile, FLASH memory. Servers/Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.
 2. Each NRC shall provide the following on-board hardware for communication:
 - a. One 10/100bT Ethernet for communication to Workstations, other NRCs and onto the Internet
 - b. Two RS-485 ports for communication to BACnet MSTP bus or serial Modbus (software configurable)
 - c. One TP/FT port for communication to LonWorks devices.
 - d. One Device USB port
 - e. Two host USB Ports
 3. The NSC shall conform to a small footprint no larger than 100W x 125H x 75D mm (3.94W x 4.92H x 2.95D in).
- J. Modular Expandability:
1. The system shall employ a modular I/O design to allow expansion. Input and output capacity is to be provided through plug-in modules of various types. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.
 2. One shall be able to “hot-change” (hot-swap) the I/O modules preserving the system on-line without any intervention on the software; addressing and configuration shall be automatic
- K. Hardware Override Switches:
1. All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition, each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.
- L. Universal Input Temperatures
1. All universal inputs directly connected to the NSC via modular expansion shall be capable of using the following thermistors for use in the system without any external converters needed.
 - a. 10 kohm Type I (Continuum)
 - b. 10 kohm Type II (I/NET)

- c. 10 kohm Type III (Satchwell)
 - d. 10 kohm Type IV (FD)
 - e. Linearized 10 kohm Type V (FD w/11k shunt)
 - f. Linearized 10 kohm (Satchwell)
 - g. 1.8 kohm (Xenta)
 - h. 1 kohm (Balco)
 - i. 20 kohm (Honeywell)
 - j. 2.2 kohm (Johnson)
2. In addition to the above, the system shall be capable of using the below RTD sensors, however it is not required that all universal inputs be compatible with them.
- a. PT100 (Siemens)
 - b. PT1000 (Sauter)
 - c. Ni1000 (Danfoss)
- M. Local Status Indicator Lamps:
- 1. The NSC shall provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each input or output, provide LED indication of the value of the point (On/Off). The LED indication shall support software configuration to set whether the illumination of the LED corresponds to On or Off or whether the color when illuminated is Red or Green.
- N. Real Time Clock (RTC):
- 1. Each NSC shall include a battery-backed, real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. Each NSC will allow for its own UTC offset, depending upon the time zone. When the time zone is set, the NSC will also store the appropriate times for daylight savings time.
- O. Power Supply:
- 1. The 24 VDC power supply for the NSCs shall provide 30 watts of available power for the NSC and associated IO modules. The system shall support the use of more than one power supply if heavily power consuming modules are required.
 - 2. The power supply, NSC, and I/O modules shall connect power wise and communication wise via the separate terminal base allowing for ease of replacement and no separate or loose wiring.
- P. Automatic Restart After Power Failure:
- 1. Upon restoration of power after an outage, the NSC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.
- Q. Battery backup:
- 1. The NSC shall include an on-board battery to back up the controller's RAM memory. The battery shall provide accumulated backup of all RAM and clock functions for at least 30 days. In the case of a power failure, the NSC shall first try to restart from the RAM memory. If that memory is corrupted or unusable, then the NSC shall restart itself from its application program stored in its FLASH memory.

R. Software Specifications

1. The operating system of the controller, application programs, and all other portions of the configuration database such as graphics, trends, alarms, views, etc., shall be stored in non-volatile, FLASH memory. There will be no restrictions placed on the type of application programs in the system. Each NSC shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.
2. Each NSC shall have an available capacity of 4 GB of memory. This shall represent 2 GB for application and historical data and 2 GB dedicated for backup storage.

S. User Programming Language:

1. The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be either a script-based structured text or graphical function block based and fully programmable by the user. The language shall be structured to allow for the configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, and histories. Users shall be able to place comments anywhere in the body of either script or function block programs.
2. Network Server Controllers that use a “canned” program method will not be accepted.

T. Control Software:

1. The NSC shall have the ability to perform the following pre-tested control algorithms:
 - a. Proportional, Integral plus Derivative Control (PID)
 - b. Two Position Control
 - c. Digital Filter
 - d. Ratio Calculator
 - e. Equipment Cycling Protection

U. Mathematical Functions:

1. Each controller shall be capable of performing basic mathematical functions (+, -, *, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.

V. NSCs shall have the ability to perform any or all of the following energy management routines:

1. Time of Day Scheduling
2. Calendar Based Scheduling
3. Holiday Scheduling
4. Temporary Schedule Overrides
5. Optimal Start
6. Optimal Stop
7. Night Setback Control
8. Enthalpy Switchover (Economizer)
9. Peak Demand Limiting
10. Temperature Compensated Duty Cycling
11. CFM Tracking

12. Heating/Cooling Interlock
13. Hot/Cold Deck Reset
14. Hot Water Reset
15. Chilled Water Reset
16. Condenser Water Reset
17. Chiller Sequencing

W. History Logging:

1. Each NSC controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. A minimum of 1000 logs, with a minimum of 100,000 records, shall be stored. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to a higher level NSC long term archiving based upon user-defined time intervals, or manual command.
2. For extended trend logging a minimum of 1500 trends shall be capable, with a minimum number of 600,000 records within.
3. Management of a power meter replacement to ensure meter log data is accurate shall be possible in the NSC.
4. Every hardware input and output point, hosted within the NSC and attached I/O modules, shall be trended automatically without the requirement for manual creation, and each of these logs shall log values based upon a change of value and store at least 500 trend samples before replacing the oldest sample with new data.
5. The presentation of logged data shall be built into the server capabilities of the NSC Presentation can be in time stamped list formats or in a chart format with fully configurable pen colors, weights, scales and time spans.

X. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms will be tested each scan of the NSC and can result in the display of one or more alarm messages or reports.
2. There is no limit to the number of alarms that can be created for any point
3. Alarms can be configured to be generated based upon a single system condition or multiple system conditions.
4. Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc. These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.
5. The alarm management system shall support the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists shall also be possible in order to present to an operator a suggested mode of troubleshooting. When acknowledging an alarm, it shall be possible to assign it to a user of the system such that the user is notified of the assignment and is made responsible for the alarm resolution.
6. Alarms must be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

Y. Embedded Web Server

1. Each NSC must have the ability to serve out web pages containing the same information that is available from the WorkStation. The development of the screens to accomplish shall not require any additional engineering labor over that required to show them at the WorkStation itself.

2.8 BACNET FIELDBUS AND BACNET SDCU'S

A. Field Bus Wiring and Termination

1. The wiring of components shall use a bus or daisy chain concept with no tees, stubs, or free topology.
2. Each field bus shall have a termination resistor at both ends of each segment.
3. The field bus shall support the use of wireless communications.

B. Repeaters

1. Repeaters are required to connect two segments.
2. Repeaters shall be installed in an enclosure. The enclosure may be in an interstitial space.

C. Field Bus Devices

1. General Requirements

- a. Devices shall have a light indicating that they are powered.
- b. Devices shall be locally powered. Link powered devices (power is furnished from a central source over the field bus cable) are not acceptable.
- c. Application programs shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration parameter settings. (Battery backup, flash memory, etc.)

D. Advance Application Controllers (B-AAC)

1. The key characteristics of a B-AAC are:

- a. They have physical input and output circuits for the connection of analog input devices, binary input devices, pulse input devices, analog output devices, and binary output devices. The number and type of input and output devices supported will vary by model.
- b. They may or may not provide support for additional input and output devices beyond the number of circuits that are provided on the basic circuit board. Support for additional I/O shall be provided by additional circuit boards that physically connect to the basic controller.
- c. The application to be executed by a B-AAC is created by an application engineer using the vendor's application programming tool.
- d. If local time schedules are embedded, the B-AAC shall support the editing of time schedule entries from any BACnet OWS that supports the BACnet service for writing of time schedule parameters.
- e. If local trend logging is embedded, the B-AAC shall support the exporting of trend log data to any BACnet OWS that supports the read range BACnet service for trending.
- f. If local alarm message initiation is embedded, the B-AAC shall:
 - 1) Deliver alarm messages to any BACnet OWS that supports the BACnet service for receiving alarm messages and is configured to be a recipient off the alarm message.
 - 2) Support alarm acknowledgement from any BACnet OWS that supports the BACnet service for executing alarm/event acknowledgement.
- g. Shall support the reading of analog and binary data from any BACnet OWS or Building Controller that supports the BACnet service for the reading of data.

- h. Shall support the control of the out of service property and assignment of value or state to analog and binary objects from any BACnet OWS that supports writing to the out of service property and the value property of analog and binary objects.
 - i. Shall support the receipt and response to Time Synchronization commands from a BACnet Building Controller.
 - j. Shall support the “Who is” and “I am.” BACnet services.
 - k. Shall support the “Who has” and “I have.” BACnet services.
2. Analog Input Circuits
- a. The resolution of the A/D chip shall not be greater than 0.01 Volts per increment. For an A/D converter that has a measurement range of 0 to 10 VDC and is 10 bit, the resolution is 10/1024 or 0.00976 Volts per increment.
 - b. For non-flow sensors, the control logic shall provide support for the use of a calibration offset such that the raw measured value is added to the (+/-) offset to create a calibration value to be used by the control logic and reported to the Operator Workstation (OWS).
 - c. For flow sensors, the control logic shall provide support for the use of an adjustable gain and an adjustable offset such that a two-point calibration concept can be executed (both a low range value and a high range value are adjusted to match values determined by a calibration instrument).
 - d. For non-linear sensors such as thermistors and flow sensors the B-AAC shall provide software support for the linearization of the input signal.
3. Binary Input Circuits
- a. Dry contact sensors shall wire to the controller with two wires.
 - b. An external power supply in the sensor circuit shall not be required.
4. Pulse Input Circuits
- a. Pulse input sensors shall wire to the controller with two wires.
 - b. An external power supply in the sensor circuit shall not be required.
 - c. The pulse input circuit shall be able to process up to 20 pulses per second.
5. True Analog Output Circuits
- a. The logical commands shall be processed by a digital to analog (D/A) converter chip. The 0% to 100% control signal shall be scalable to the full output range which shall be either 0 to 10 VDC, 4 to 20 milliamps or 0 to 20 milliamps or to ranges within the full output range (Example: 0 to 100% creates 3 to 6 VDC where the full output range is 0 to 10 VDC).
 - b. The resolution of the D/A chip shall not be greater than 0.04 Volts per increment or 0.08 milliamps per increment.
6. Binary Output Circuits
- a. Single pole, single throw or single pole, double throw relays with support for up to 230 VAC and a maximum current of 2 amps.
 - b. Voltage sourcing or externally powered triacs with support for up to 30 VAC and 0.5 amps at 24 VAC.

7. Program Execution

- a. Process control loops shall operate in parallel and not in sequence unless specifically required to operate in sequence by the sequence of control.
- b. The sample rate for a process control loop shall be adjustable and shall support a minimum sample rate of 1 second.
- c. The sample rate for process variables shall be adjustable and shall support a minimum sample rate of 1 second.
- d. The sample rate for algorithm updates shall be adjustable and shall support a minimum sample rate of 1 second.
- e. The application shall have the ability to determine if a power cycle to the controller has occurred and the application programmer shall be able to use the indication of a power cycle to modify the sequence of controller immediately following a power cycle.

8. Local Interface

- a. The controller shall support the connection of a portable interface device such as a laptop computer or vendor unique hand-held device. The ability to execute any tasks other than viewing data shall be password protected. Via this local interface, an operator shall be able to:
 - 1) Adjust application parameters.
 - 2) Execute manual control of input and output points.
 - 3) View dynamic data.

E. Application Specific Devices

1. Application specific devices shall have fixed function configurable applications.
2. If the application can be altered by the vendor's application programmable tool, the device is an advanced application controller and not an application specific device.
3. Application specific devices shall be BTL certified.

F. Field Hardware – MCs

1. MicroControllers (MCs) shall be connected to the Controller LAN via a MicroController Interface (MCI). The MCI shall be a DCU without any directly connected points. MCs shall be connected to the MCI via a high speed, RS-485 sub-network. For system reliability, distribution of risk, and high throughput, not more than 64 MCs shall be connected to any single MCI, and this MCI shall not share processors or Controller LAN interfaces with a DCU that is hardwired to primary equipment.
2. The MCI shall provide common and memory intensive functions for locally connected MCs, including: time scheduling, custom or global calculations, and historical data collection. The operator interface for all MCI database entry and application programs shall be fully integrated and consistent with other DCUs.
3. The MCI shall support sub-networks consisting of counter-scanning loops for increased system availability. Upon a single break (i.e., severed wire) the MCI shall scan the loop in both the primary and secondary directions and maintain communications with all MCs -not just those located between the MCI and the fault.
4. Micro Controllers (MCs) shall be utilized for zone or terminal equipment only. Applications requiring more than 8 inputs and 8 outputs are not considered zone or terminal and must be treated as "Primary" equipment applications, which require direct connection to a DCU on the Controller LAN. Micro applications include:
 - a. Fan-coils, unit ventilators, unit heaters

2.9 DDC SENSORS AND POINT HARDWARE

A. Temperature Sensors

1. Acceptable Manufacturers: Veris Industries or Owner Approved Substitution.
2. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of -30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
3. Pipe Immersion Sensor: Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Provide sensor probe length suitable for application. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications. Basis of Design: Veris TI Series
4. Outside Air Sensor: Provide the sensing element on the building's north side. Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure. Operating range -40 to 122 F, Basis of Design: Veris TO Series
5. A pneumatic signal shall not be allowed for sensing temperature.

B. Humidity Outdoor Transmitter

1. Acceptable Manufacturer: Veris Industries or Owner Approved Substitution.
2. Transmitters shall be accurate to +/- 2% at full scale.
3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure.
4. Transmitter shall have replaceable sensing element.
5. Sensor type shall be thin-film capacitive.
6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
8. Output shall be 4-20 mA or 0-5/0-10 VDC.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
10. Transmitter shall be available with a certification of NIST calibration
11. Transmitter shall have integrated temperature sensor
12. Basis of Design: Veris HO Series

C. Liquid Differential Pressure Transmitters:

1. Acceptable Manufacturer: Veris Industries or Owner Approved Substitution.
2. Transmitter shall be microprocessor based
3. Transmitter shall use two independent gauge pressure sensors to measure and calculate differential pressure
4. Transmitter shall have 4 switch selectable ranges
5. Transmitter shall have test mode to produce full-scale output automatically.
6. Transmitter shall have provision for zeroing by pushbutton or digital input.
7. Transmitter shall have field selectable outputs of 0-5V, 0-10V, and 4-20mA.
8. Transmitter shall have field selectable electronic surge damping
9. Transmitter shall have an electronic port swap feature
10. Transmitter shall accept 12-30 VDC or 24 VAC supply power
11. Sensor shall be 17-4 PH stainless steel where it contacts the working fluid.
12. Performance:
 - a. Accuracy shall be $\pm 1\%$ F.S. and $\pm 2\%$ F.S. for lowest selectable range
 - b. Long term stability shall be $\pm 0.25\%$
 - c. Sensor temperature operating range shall be -4° to 185° F

- d. Operating environment shall be 14° to 131°F; 10-90% RH noncondensing
 - e. Proof pressure shall be 2x max. F.S. range
 - f. Burst pressure shall be 5x max. F.S. range
- 13. Transmitter shall be encased in a NEMA 4 enclosure
 - 14. Enclosure shall be white powder-coated aluminum
 - 15. Transmitter shall be available with a certification of NIST calibration
 - 16. Transmitter shall be preinstalled on a bypass valve manifold
 - 17. Basis of Design: Veris PW
- D. Current Sensors
- 1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris Industries
- E. Current Status Switches for Constant Load Devices
- 1. Acceptable Manufacturer: Veris Industries or Owner Approved Substitution.
 - 2. General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on constant loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.
 - 3. Visual LED indicator for status.
 - 4. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 0.5 A to 175 A.
 - 5. Normally open current sensor output. 0.1A at 30 VAC/DC.
 - 6. Basis of Design: Veris Model H608.
- F. Current Status Switches for Constant Load Devices (Auto Calibration)
- 1. Acceptable Manufacturer: Veris Industries. or Owner Approved Substitution.
 - 2. General: Microprocessor based, self-learning, self-calibrating current switch. Calibration-free status for both under and overcurrent, LCD display, and slide-switch selectable trip point limits. At initial power-up automatically learns average current on the line with no action required by the installer
 - 3. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 2.5 A to 200 A.
 - 4. Display: Backlit LCD; illuminates when monitored current exceeds 4.5A
 - 5. Nominal Trip Point: ±40%, ±60%, or on/off (user selectable)
 - 6. Normally open current sensor output. 0.1A at 30 VAC/DC.
 - 7. Basis of Design: Veris Model H11D.
- G. Current Status Switches for Variable Frequency Drive Application
- 1. Acceptable Manufacturer: Veris Industries or Owner Approved Substitution.
 - 2. General: Microprocessor controlled, self-learning, self-calibrating current sensor to detect motor undercurrent and overcurrent situations such as belt loss, coupling shear, and mechanical failure on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory and relearn.
 - 3. Visual LED indicator for status.
 - 4. Alarm Limits: ±20% of learned current in every 5 Hz freq. band
 - 5. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 1.5 A to 150 A and from 12 to 115 Hz.
 - 6. Normally open current sensor output. 0.1A at 30 VAC/DC.
 - 7. Basis of Design: Veris Model H614.

H. Liquid Flow/Energy Transmitter, Non-invasive Ultrasonic (Clamp-on):

1. Acceptable Manufacturer: Onicon or Owner Approved Substitution.
2. General: Clamp-on digital correlation transit-time ultrasonic flow meter designed for clean liquids or liquids containing small amounts of suspended solids or aeration. Optional temperature sensors for BTU calculations.
3. Liquid: water, brine, raw sewage, ethylene, glycol, glycerin, others. Contact manufacturer for other fluid compatibility
4. Pipe Surface Temperature: Pipe dia 1/2" to 2": -40-185°F; Pipe dia > 2": -40-250°F
5. Performance:
 - a. Flow Accuracy:
 - 1) Pipe dia 1/2" to 3/4" 1% of full scale
 - 2) Pipe dia 1" to 2" 1% of reading from 4-40 FPS
 - 3) Pipe dia 2" to 100" 1% of reading from 1-40 FPS
 - b. Flow Repeatability $\pm 0.01\%$ of reading
 - c. Velocity Range: (Bidirectional flow)
 - 1) Pipe dia 1/2" to 2" 2 to 40 FPS
 - 2) Pipe dia 2" to 100" 1 to 40 FPS
 - d. Flow Sensitivity 0.001 FPS
 - 1) Temperature Accuracy (energy): 32-212°F; Absolute 0.45°F; Difference 0.18°F
 - 2) Temperature Sensitivity: 0.05°F
 - 3) Temperature Repeatability: $\pm 0.05\%$ of reading
6. Transmitter:
 - a. Power Supply: 95 to 264 VAC, 47 to 63 Hz or 10 to 28 VDC.
 - b. Output: BACnet/IP
 - c. Temperature Range: -40 to +185°F
 - d. Display: 2 line backlit LCD with keypad
 - e. Enclosure: NEMA 4, (IP65), Powder-coated aluminum, polycarbonate
7. Agency Rating: UL 1604, EN 60079-0/15, CSA C22.2, CSA Class 1 (Pipe > 2")
8. Basis of Design: Veris FST & FSR series

I. Control Valves

1. Provide automatic control valves suitable for the specified controlled media (steam, water or glycol). Provide valves which mate and match the material of the connected piping. Equip control valves with the actuators of required input power type and control signal type to accurately position the flow control element and provide sufficient force to achieve required leakage specification.
2. Control valves shall meet the heating and cooling loads specified, and close off against the differential pressure conditions within the application. Valves should be sized to operate accurately and with stability from 10 to 100% of the maximum design flow.
3. Trim material shall be stainless steel for steam and high differential pressure applications.
4. Electric actuation should be provided on all terminal unit reheat applications unless electric heat is provided.
5. Basis of Design: Belimo or Owner Approved Substitution.
1. Basis of Design: Veris E3xxx series.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that power supply is available to control units and operator workstation.

3.2 INSTALLATION

- A. Building Automation controllers can be organized into a hierarchy structure that allows for multiple IP addresses.
 - 1. The only devices allowed at the IP level shall be those that meet or exceed the minimum BIBB requirements of the latest BTL listed B-BC class PICS.
 - 2. All other devices must reside at a lower tier.
 - 3. Any device that is dependent on another device for emergency operation, life safety, etc. must have a means of a direct I/O for the needed points.
 - 4. All installations shall utilize one controller for each piece of equipment or system. However, two pumps for a chilled water system can utilize a common controller.
- B. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- C. Connect and configure equipment and software to achieve sequence of operation specified.
- D. Install labels and nameplates to identify control components according to Division 23 05 53 Section "Identification for HVAC Piping and Equipment."
- E. Install hydronic instrument wells, valves, and other accessories according to Division 23 21 13 Section "Hydronic Piping."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
 - D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
 - E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- 3.4 FIELD QUALITY CONTROL
- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 - B. Perform the following field tests and inspections and prepare test reports:
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 2. Test and adjust controls and safeties.
 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 6. Test each system for compliance with sequence of operation.
 7. Test software and hardware interlocks.
 - C. BAS Verification:
 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 2. Check instruments for proper location and accessibility.
 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 4. Check instrument tubing for proper fittings, slope, material, and support.
 5. Check installation of air supply for each instrument.
 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 8. Check temperature instruments and material and length of sensing elements.
 9. Check control valves. Verify that they are in correct direction.
 10. Check BAS system as follows:
 - a. Verify that BAS controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that BAS controllers are protected from power supply surges.
 - D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument.
Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.6 PROCEDURE FOR HYDRONIC SYSTEMS

- A. Systems installed with pressure independent characteristic control valves shall not require hydronic system balancing. Flow shall be verified and adjusted for the pressure independent valve assembly for field conditions using the pressure independent control valve manufacturer's documented procedure for 100% of the total installed product.

3.7 MEASUREMENT AND VERIFICATION

- A. The following building systems will be measured and trended through the building automation. The contractor shall provide all necessary measuring devices and programming to accomplish the monitoring and trending of these systems. The monitoring and trending shall be polled every 5 minutes at a minimum.
 - 1. Building cooling load is monitored through the BAS DDC through the building's BTU meter that will be provided. BTU meter will monitor flow in, by-pass flow, supply water temperature and return water temperatures.
 - 2. Chilled Water Plant cooling load will be trended through the BAS DDC for waterside. The outside air temperatures and AHU discharge temperatures are recorded to document cooling loads within the building. The BTU meter information is trended to document cooling loads, also.

3.8 DEMONSTRATION AND TRAINING

- A. Provide 32 hours of instruction to be conducted at the project site with manufacturer's representative. The training shall be conducted at 8 sessions at 4 hours a piece. Contractor to also provide two sets of control operation manuals for use at the training session and then provide to the Owner after completion of the session.

END OF SECTION 23 09 13

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

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. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of this Section.
- C. Commissioning Requirements: Provisions of Sections 01 91 13, General Commissioning Requirements and 23 08 01, Commissioning of HVAC Systems are part of 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. Note that the existing Siemens BCS shall be modified for the updated Sequence of Operations shown on the plans as related to replacement of the chillers, pumps, and variable flow pumping system.

1.3 RELATED WORK

- A. Section 23 09 13 – Instrumentation and Control Devices for HVAC.

1.4 APPLICABLE PROVISION

- A. Where 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 BCS 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 BCS 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 BCS when the HOA switch is in the auto position.

- E. 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.
- F. 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.
- G. 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.
- H. All wiring required to provide the Sequence of Operation shall be included.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 SEQUENCE OF OPERATION – Refer to Construction Documents.

END OF SECTION 23 09 93

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.
- B. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of this Section.

1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
 - 1. Chilled-water piping.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved. Submit shop drawings for piping systems drawn at a minimum scale of 1/4 inch per foot to verify clearances and equipment locations. Show required maintenance and operational clearances. Include the following:
 - 1. Architectural and structural backgrounds with room names and numbers, including but not limited to plans, sections, suspended ceiling components, elevations, details and structural members.
 - 2. Fabrication and erection dimensions.
 - 3. Arrangements and sectional views.
 - 4. Details, including complete information for making connections to equipment.
 - 5. Descriptive names of equipment.
 - 6. Modifications and options to standard equipment required by Contract Documents.
- B. Qualification Data: For Installer.
- C. Welding certificates.
- D. Field quality-control reports.
- E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.
- F. General: Provide shop drawing and manufacturer's data sheet for the following items:
 - 1. Manufacturers Literature:
 - a. Complete design and construction data for dielectric unions and flanges.
 - b. Complete design and construction data for grooved mechanical fittings and couplings for steel piping systems.
 - c. Complete design and construction data for grooved mechanical fittings and couplings for copper piping systems.

- d. Manufacturer's data on piping and fittings used, with an indication of each specific application
2. Performance Data: Submit a copy of the Welding Procedure Specification with the Procedure Qualification Record and certificates of the welders and welding operators required by Section IX of the ASME Boiler and Pressure Vessel Code.
3. Installation Data:
 - a. Manufacturer's printed instructions for the installation of grooved mechanical fittings and couplings for steel pipe.
 - b. Manufacturer's printed instructions for the installation of grooved mechanical fittings and couplings for copper pipe.
 - c. UL approval number, installation materials, and procedures for pipe penetrations of fire-rated walls and floor.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.5 APPLICABLE STANDARDS

A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the applicable standards and codes listed in paragraph entitled "Code Compliance" in Section 23 05 01.

B. Quality and Weight: The quality and weight of materials shall comply with requirements and specifications of the appropriate standards of the American Society of Testing and Materials, American National Standards Institute, American Society of Mechanical Engineers, and the American Welding Society.

C. Piping System: All pressurized piping systems shall conform to ASME B31.9, Code for Pressure Piping, Building Services Piping. All piping systems with services exceeding 250°F, 160 psig and steam and condensate exceeding 15 psig shall meet ASME B13.9, Power Piping.

D. Welder Certification: Welders shall be tested and certified within the last 2 years by the National Certified Pipe Welding Bureau or recognized testing agency acceptable to the Designer. Competent certified

welders shall perform all welding operations. Each welder shall possess a stamp to identify his work and shall stamp each weld. A copy of the certification shall be available at the jobsite for each welder.

- E. Welding Installation: Welding shall be in accordance with the welding procedures and requirements set forth in "Welding of Pipe Joints" of the "Code for Pressure Piping" in the American Welding Society Welding handbook. Pipe welding shall comply with the provisions of the latest revision of the applicable code, whether ASME Boiler and Pressure Vessel Code, ANSI Code for Pressure Piping, or state or local requirements as may supersede these codes.
- F. Brazing: Brazing of copper tubing shall be in accordance with the standards of the American Welding Society, the Copper Development Association Copper Tube Handbook instructions on brazing, and ASME Boiler code Section IX.
- G. Soldering: Soldering of copper tubing shall be done in accordance with the Copper Development Association, Copper Tube Handbook instructions on Joining and Forming Copper Tube, Soldered Joints.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Chilled-Water Piping: 150 psig at 200 deg F.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Anvil International, Inc.
 - b. Star Pipe Products.
 - c. Victaulic Company.
 - 2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
 - 3. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F (110 deg C) for use with housing, and steel bolts and nuts.
- C. Copper or Bronze Pressure-Seal Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Viega
 - b. Owner approved Substitution

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

D. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

D. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

E. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Anvil International, Inc.
- b. Star Pipe Products.
- c. Victaulic Company.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

3. Couplings: Ductile- or malleable-iron housing and EPDM gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 - C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 - D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BA9-1, silver alloy for joining copper with bronze or steel.
 - E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- 2.5 DIELECTRIC FITTINGS
- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 - B. Dielectric Unions:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Viega Pro-Press
 - b. Owner approved substitution
 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Viega Pro-Press or Owner approved substitution.
 - C. Dielectric Flanges:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Viega Pro-Press
 - b. Owner Approved Substitution
 2. Description:
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 125 psig minimum at 180 deg F.
 - d. End Connections: Viega Pro-Press or Owner approved substitution.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Chilled-water piping, aboveground, NPS 2 and smaller, shall be the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper, Viega Pro-Press fittings or Owner approved substitution.
- B. Chilled-water piping, aboveground, NPS 2-1/2 to 4 shall be any of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper Viega pro-press fittings or approved substitution.
- C. Chilled-water piping, aboveground, 6 and larger, shall be any of the following:
 - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 - 2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- D. Air-Vent Piping:
 - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
 - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- E. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- F. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- I. Install piping to permit valve servicing.
- J. Install piping at indicated slopes.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install piping to allow application of insulation.
- N. Select system components with pressure rating equal to or greater than system operating pressure.
- O. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

- P. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- Q. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- R. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- S. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- T. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- U. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- V. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- W. Install shutoff valve immediately upstream of each dielectric fitting.
- X. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- Y. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- Z. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

3.2 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.3 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices.
- B. Comply with requirements in Section 23 05 48 "Vibration and Seismic Controls for HVAC" for seismic restraints.

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- I. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.5 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 23 05 19 "Meters and Gages for HVAC Piping."

3.6 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

- B. Installation: Pipe and fittings shall be installed as specified in this section unless specific installation instructions are provided in the individual sections covering the piping system. Install each run with a minimum of joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated using reducing fittings. Align piping at connections within 1/16 inch misalignment tolerance.
- C. Routing and Placement: Piping shall be run without traps or pockets and pitched a minimum 1 inch per 40 feet in the direction of flow, unless indicated or required to be pitched steeper. Grade piping so that air in the mains and risers will be carried up and discharged at venting points. Coordinate installation with structural features, and with other piping, equipment and the work of other trades. All piping shall be installed as close to the structure overhead as possible.
- D. Prohibited Installation: Do not run piping through transformer vaults, elevator equipment rooms, other electrical or electronic equipment spaces and enclosures. Do not run piping over electrical panels. Where pipe joints or valves in water lines occur within two feet in horizontal directions from electrical panels or equipment, provide drip pans sized to afford protection. Pans shall be 20-gauge galvanized steel with edges turned up 2-1/2 inches on all sides, reinforced with galvanized steel angles or by rolling edges over 1/4-inch diameter steel wire. Provide a drain with 3/4-inch flange and pipe to nearest floor drain, and support the pan assemblies as required to prevent sagging or swaying.
- E. Interior Piping: Interior piping shall be run parallel to the walls and ceilings; avoid diagonal runs. Provide a minimum 6 inch clearance between walls and horizontal piping.
- F. Exterior Piping: Exterior piping shall essentially be routed and located as indicated on the drawings; however, actual placement shall be verified by confirming exact location of structures and other utilities in the field and by careful layout prior to execution of the work.
- G. Insulated Piping: Pipe requiring insulation shall be installed with sufficient clearances to permit proper application of insulation.
- H. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- I. Perform the following before operating the system:
1. Open manual valves fully.
 2. Set makeup pressure-reducing valves for required system pressure.
 3. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type).

4. Set temperature controls so all coils are calling for full flow.

END OF SECTION 23 21 13

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.
- B. Basic Requirements: Provisions of Section 23 05 01, Basic HVAC Requirements are part of 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. Additional submittal requirements:
 - 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. Bell & Gossett
 - 2. Aurora
 - 3. Armstrong Pump Company

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.
 - 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

A. End Suction, Base Mounted Pumps:

1. Support pipe and valve assembly independent of pump housing.
2. Install concrete base weighing a minimum of 2- 1/2 times the weight of the pump, level pump base and fill base with non-shrinking grout (equipment base is existing).
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

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SECTION 23 64 23 – AIR-COOLED WATER CHILLER

PART 1 – GENERAL

1.1 SCOPE

- A. Section includes design, performance criteria, controls and control connections, chilled water connections, electrical power connections and refrigerants of the chiller package.

1.2 REFERENCES

- A. Products shall be designed, rated and certified in accordance with applicable section of the following Standards and Codes:
 - 1. To comply with the most recent version of applicable Standards and Codes of Air-Conditioning, Heating & Refrigeration Institute (AHRI) 550/590.
 - 2. AHRI 370 – Standard for Sound rating of Large Outdoor Refrigerating and Air-Conditioning Equipment.
 - 3. To comply with the most recent version of applicable Standards and Codes of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 15.
 - 4. Units shall meet the efficiency standards of AHRAE 90.1 – 2010 and FMC.
 - 5. To comply with seismic application in accordance with the most recent versions of the Florida Building Code.

1.3 QUALITY ASSURANCE

- A. Underwriters’ Laboratories (UL) 1995 – Standard for Heating and Cooling Equipment.
- B. Manufactured facility to be International Organization for Standardization (ISO) 9001.
- C. Factory Functional Test: The chiller shall be pressure tested, evacuated and fully charged with HFC R-410A refrigerant and oil. In addition, a factory functional test to verify correct operation by cycling condenser fans, closing compressor contacts and reading data points from temperature pressure sensors.
- D. Chiller manufacturer shall have a factory trained and supported service organization within a 75 mile (120.7 km) radius of the site.
- E. Warranty: The manufacturer shall warrant all equipment and material of its manufacture against defects in workmanship and material for a period of one year from date of initial start-up or eighteen months from date of shipment; whichever occurs first.
- F. A 5 year parts and labor warranty shall be provided on any speed increasing or decreasing compressor.
- G. Provide whole unit parts warranty (less motor/transmission/compressor) for the duration of the 1st year.
- H. Provide whole unit labor warranty for the duration of the 1st year.

1.4 SUBMITTALS

- A. Submit shop drawings and product data in accordance with the specifications.
- B. Submittals shall include the following:
 - 1. Dimensioned plan and elevation view drawings, required clearances and location of all field connections.
 - 2. Weights and loading document.
 - 3. Product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

1.5 OPERATION AND MAINTENANCE DATA

- A. Include manufacturer's descriptive literature, installation checklist, start-up instructions and maintenance procedure.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Units shall be delivered to job site fully assembled and charged with refrigerant (unless selected with nitrogen charge) and oil by the manufacturer.
- B. Unit shall be stored and handled per manufacturer's instructions.
- C. During shipment, provide protective covering over vulnerable components. Fit nozzles and open pipe ends with enclosures.
- D. Unit controls shall be capable of withstanding 158°F (70°C) storage temperature in the control compartment for an indefinite period of time.

1.7 WARRANTY

- A. Provide a full parts warranty for one-year from start-up or 18-months from shipment, whichever occurs first.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. York, Trane, or Carrier

2.2 GENERAL UNIT DESCRIPTION

- A. Factory assembled, single-piece chassis, air-cooled liquid chiller. Contained within the package shall be all factory wiring, piping, controls, and refrigerant charge (R-134A).

2.3 CABINET

- A. Frame shall be heavy-gage, with a powder coated paint finish for both aesthetic appeal and to offer more resistance to corrosion.
- B. Units shall be constructed out of galvanized steel frame with galvanized steel panels and access doors. Component surfaces shall be finished with a powder-coated paint. The coating or paint system shall withstand a 1000-consecutive-hour salt spray application in accordance with standards ASTM B117.

2.4 COMPRESSORS

- A. Semi-hermetic screw type compressors with R-134A, discharge shut-off service valves, machined cast iron housing, 350 psi working pressure, variable speed.
- B. Direct drive motor cooled by suction gas with completely enclosed compression chamber.
- C. Each compressor shall have overload protection internal to the compressor.
- D. Each compressor shall include: external oil separator, 450 psi working pressure, refrigerant system differential pressure shall provide oil flow.
- E. Each compressor shall have temperature actuated off-cycle heater.

2.5 EVAPORATORS

- A. Evaporator shall be shell and tube, hybrid falling film type to optimize efficiency and refrigerant charge. Tubes shall be high-efficiency, internally and externally enhanced copper tubes with 0.035" (0.89 mm) minimum wall thickness at all intermediate tube supports to provide maximum tube wall thickness at all intermediate tube supports to provide maximum tube wall thickness at the support area. Each tube shall be roller expanded into the tube sheets providing a leak proof seal, and be individually replaceable. Independent refrigerant circuits shall be provided per compressor.
- B. Constructed, tested, and stamped in accordance with applicable sections of the ASME pressure vessel code for minimum 235 psig (16 barg) refrigerant-side design working pressure and 150 psig (10 barg) liquid-side design working pressure.
- C. The evaporator shall be protected with an etched foil heater and insulated with 0.75 inch (19.05 mm) insulation. This combination shall provide freeze protection down to -20°F (-6.67°C) ambient temperatures while the heater is powered. Contractor shall provide separate power to energize heater and protect evaporator while chiller is disconnected.

2.6 CONDENSER

- A. Construct condenser coils of microchannel all-aluminum, brazed-fin construction. The condenser coils shall have an integral sub-cooling circuit and shall be designed for at least 350 psig (44.8 bar) working pressure. Coils can be cleaned with high pressure water.
- B. Provide a complete, flexible epoxy dip of microchannel condenser coils.
 - 1. Coil with coating shall be able to handle 5,000-hour salt spray test.
 - 2. All coil surfaces shall be coated with epoxy material giving uniform coverage to a minimum of 0.6 mils (0.015 mm) without bridging between fins.

3. Any coating showing bridging will be unacceptable.
 4. Coatings not covering any part of the coil and/or condenser frame will be unacceptable.
 5. Backed phenolic coatings are unacceptable because of their brittle nature and performance loss of up to 5%.
 6. Coating shall be able to withstand corrosive environments in the pH range of 3 – 12.
 7. Coating shall be flexible so that bare surfaces will not form.
 8. The coating shall be able to handle temperatures ranging from -40°F (-40°C) to 150°F (65.6°C) without degradation.
 9. UV protection shall be applied on surface of coating to prevent degradation from sunlight.
- C. Low Sound Fans shall be dynamically and statically balanced, direct-drive, corrosion resistant glass fiber reinforced composite blades molded into a lower noise fan blade.
- D. Low speed fan motors shall be three-phase with permanently lubricated ball bearings and individually protect by circuit breakers.
- E. Unit shall be capable of starting and operating at outdoor ambient temperatures from 0°F to 125°F (-18°C to 52°C).

2.7 ENCLOSURES

- A. Mount starters in a UL1995 rated panel for outdoor use.
- B. Motor starters shall be zero electrical inrush current (variable speed drives).
- C. Unit shall have a single point power connection for main incoming unit power.
- D. A control power transformer shall be factory-installed and factory-wired to provide unit control power.
- E. Power line connection type shall be a circuit breaker.

2.8 REFRIGERATION COMPONENTS

- A. Each refrigerant circuit shall include a filter drier, electronic expansion valve with site glass, liquid line service valves and a complete operating charger of both refrigerant R-134A and compressor oil.
- B. Each refrigerant circuit shall include a discharge line service valve to allow the refrigerant to be isolated in the condenser.

2.9 CONTROLS, SAFETIES AND DIAGNOSIS

- A. The microprocessor-based unit controller shall be factory-installed and factory-tested.
- B. The unit display shall provide the following data:
1. Water and air temperatures.
 2. Refrigerant levels and temperatures.
 3. Flow switch status.
 4. Compressor starts and run times.
 5. Display diagnostics.
- C. The unit controller shall provide chilled water reset based on return water as an energy saving options.

- D. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer. Controls shall include the following readouts and diagnostics:
 - 1. Low evaporator refrigerant temperature and/or pressure.
 - 2. High condenser refrigerant pressure.
 - 3. Low oil flow.
 - 4. Motor current overload.
 - 5. High compressor discharge temperature.
 - 6. Electronic distribution faults: phase loss, phase imbalance or phase reversal.
- E. Unit shall be shipped with factory control and power wiring installed.
- F. Provide gateway for communication with BCS, including BACnet, MODBUS, N2, Lon communication protocols.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Align chiller package on steel or roof supports.
- C. Install units on isolators, factory provided.
- D. Connect to electrical service.
- E. Connect to chilled water piping.

3.2 MANUFACTURER'S FIELD SERVICES

- A. OEM Startup is performed by factory trained and authorized servicing technicians confirming equipment has been correctly installed and passes specification checklist prior to equipment becoming operation and covered under OEM warranty.
 - 1. Included OEM Factory Startup:
 - a. Rotary Screw Chillers
- B. Applied Chiller manufacturers shall maintain service capabilities no more than 75 miles from the jobsite.
- C. The manufacturer shall furnish complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END OF SECTION 23 64 23

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SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DESCRIPTION

- A. Provide and install all equipment, labor, material and accessories, and mounting hardware for a complete and operating system as described within these Division 26 Specification Sections.
- B. 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 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. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.
- D. Only trained, and licensed personnel shall perform work. No Work shall be performed which violates applicable Codes, even if called for in the Contract Documents.
- E. Coordinate and verify power and telephone company service requirements. Submitted bid shall include all work required.
- F. Make connections of all items in the Work using electric power including 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 or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with the Project Engineer.

1.5 QUALITY ASSURANCE

- A. Install Work in locations shown or described in the Contract Documents, unless prevented by Project conditions.
- B. Install all equipment so that all Code and Manufacturer recommended working and servicing clearances are maintained. Properly arrange and install all equipment within designated spaces. If a departure from the Contract Documents is necessary, submit to the Project Engineer for approval, detailed drawings of the proposed changes with written reasons for the changes. No change shall be implemented without the issuance of a change order or other directive permitted by the General Conditions.
- C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

1.6 INVESTIGATION OF SITE

- A. Investigate the site and existing conditions thoroughly before bidding. Advise Project Engineer of discrepancies or questions noted.
- B. During the course of his site visit, the electrical bidder shall become familiar with all aspects of the proposed work and existing field conditions of the work. No compensation or reimbursement for additional expenses for failure to investigate the existing facilities will be authorized. 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.

1.7 CONTRACT DOCUMENTS

- A. 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. Provide 1/4" scale coordination drawings per specifications prior to start of work.
- B. Contractor shall provide 1/4" scale coordination drawings for all electrical, mechanical and communications rooms during the shop drawing submittal phase, utilizing detailed dimensions from equipment actually submitted (all disciplines) and field-measured/verified existing conditions. These drawings are also required for any room where conduits equal to or over 1-1/4" in size, equipment (panels, HVAC, disconnects, comm. racks) or other large objects are being installed. Drawings shall show all electrical, mechanical, plumbing, fire protection, structural, etc. coordinated so that problems are discovered/prevented prior to installation. Claims during construction for additional funding in rooms where properly coordinated drawings were not submitted will not be considered.
- C. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All such items incidental to a complete and operating system shall be provided.

- D. Submit specific shop drawings which indicate the fabrication, assembly, installation, and erection of particular systems' 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.
- E. Locations indicated for outlets, switches, and equipment are approximate and shall be coordinated with the Contract Documents. Where instructions or notes are insufficient to locate the item, notify the Project Engineer.

1.8 MATERIALS AND EQUIPMENT

- A. Unless otherwise noted, all material shall be new and UL listed or labeled. In lieu of UL listing or labeling, a statement or data demonstrating compliance with contract documents from a nationally recognized testing agency shall be submitted to the Project Engineer.
- B. Where Contract Documents list design selection, manufacturer or 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 Designers/Project Engineer review and approval. Where Contract Documents list approved substitutions, these items shall comply with Division 1 requirements for substitutions.
- C. When a product is specified to be in accordance with a trade association or government standard and at the request of Designers/Project Engineer 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 the same Manufacturer.
- E. Prior to placing equipment orders, verify the physical size of specified equipment to fit spaces allotted on the drawings and with NEC working clearances. Internal access for proposed equipment substitutions shall be provided. Provide 1/4" scale drawings showing that this coordination has taken place.
- F. Electrical equipment shall be protected from the weather, during shipment, storage, and construction per manufacturer's recommendations. 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.
- G. 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.
- H. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material 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.
- I. Where tamperproof screws are specified or required, Phillips head or Allen head devices shall not be accepted. For each type used, provide Project Engineer with three tools. Project Engineer will designate the specific hardware design to correspond with existing devices elsewhere in the building, to limit special tool requirements.

- J. Communications backboards shall be 3/4" A/B grade, Class A, flame spread, painted with light gray fire retardant paint. Neatly mask off a minimum of one (1) plywood Manufacturer's pre-printed certified fire rating stamp per section of board prior to application of paint. Remove masking after paint has cured.

1.9 SUPERVISION OF THE WORK

- A. Reference the General Conditions for additional requirements.
- B. A qualified and experienced electrical superintendent shall be in charge of the work in progress at all times. If, in the judgment of the Project Engineer, the electrical superintendent is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the Project Engineer. Once a satisfactory electrical superintendent has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the Project Engineer.
- C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable sizes and complexity. Superintendent shall be present at all times that work under this Division is being installed or affected. All work performed by a non-licensed Journeyman shall be under the direct supervision (in the presence of) of a Licensed Journeyman as specified herein. Increase the quantity of licensed Journeymen as required for supervision of all areas where direct contact is not possible. At least one member of the electrical contracting firm shall hold a State Master Certificate of Competency. Each Journeyman shall have possession of licensing documentation at all times during work. Display to designer/Project Engineer when requested.
- D. Superintendent shall be employed by a State Registered (Type "E.R." License) or State certified (Type "E.C." License) electrical contractor.

1.10 COORDINATION

- A. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner.
- B. Provide electrical subcontractor a set of Contract Documents for all areas of Electrical Work.
- 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 Project Engineer prior to installation of the equipment.
- D. Coordination drawings shall be prepared prior to the start of work. Drawings shall show the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Location of conduit racking, etc., shall be provided. Coordination drawings shall be provided for all areas. Comply with the requirements of Division 1.
- E. Secure approved shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on approved 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.

- G. Coordinate the exact location of floor outlets, floor ducts, floor stub-ups, etc. with Project Engineer and Designer (and receive their approval) prior to rough-in. Locations indicated in Contract Documents are only approximate locations.
- 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.). 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. 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 shall be made at no additional cost to the Owner.

1.11 PROVISION FOR OPENINGS

- A. Locate openings required for work. Provide sleeves, guards or other approved methods to allow passage of items installed.
- B. Coordinate with roofing Contractor on installation of electrical items which penetrate the roof. Roof penetrations shall be installed so as to 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.

1.12 CONCRETE PADS

- A. Furnish and install reinforced concrete pads for transformers, switchgear, generators, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4, 6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Provide 3000 psi concrete.

1.13 SURFACE MOUNTED EQUIPMENT

- A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have finish or shall be painted as directed by designer. Paint shall be in accordance with applicable sections and/or divisions of these specifications.

1.14 CUTTING AND PATCHING

- A. Reference Division 1 - General Requirements.
- B. New Construction:
 - 1. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.
 - 2. Backfill new grades to match adjacent undisturbed surface.

1.15 INSTALLATION

- A. Erect equipment to minimize interference and delays with the 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 designer/Project Engineer at no additional cost to the Owner.
- C. Equipment requiring electrical service shall not be energized or placed in service until Project Engineer is notified and is present or have waived their right to be present. Where equipment to be placed in service involves service or connection from another Contractor or the PROJECT ENGINEER, notify the Project Engineer in writing as appropriate when the equipment will be ready.
- D. Equipment supports shall be secured and supported from structural members unless written approval is granted by Project Engineer.
- 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. 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 layout made for setting or embedment thereof so as to cause no delay.
- G. Conduit or piping systems that contain water or liquid of any kind shall not be installed over the top of any electrical equipment, transformers, racks, cabinets, or enclosures without prior written approval from the Project Engineer.

1.16 AS-BUILT DOCUMENTS

- A. As-Built Documents: As-built Documents include Drawings, Shop Drawings, Specifications, Addenda, Change Orders, and other modifications permitted by the General Conditions.
- B. Comply with all requirements of Division 1
- C. Verify aspects of redlined as-builts for accuracy. As-Built Documents shall show all components including but not limited to:
 - 1. All raceways 1-1/4" and above, cable tray systems, and grouped raceway racking as installed, including dimensions from fixed building lines such as column lines.
 - 2. All site underground raceways indicating burial depths and distances from fixed building lines or global tracking coordinates.
 - 3. Underground pull boxes including elevations. Detail pull boxes, conduit terminations including conduit sizes, designated systems and cabling description.
 - 4. General conduit routing from receptacle to receptacle, fixture to fixture, device to device. (Exact routing is not required for raceways 1" and smaller.)
 - 5. Lighting: Diagrammatically show junction boxes that are located above accessible ceiling with flexible conduit connections to luminaries.
 - 6. All junction boxes for Sections 28 31 00 and 27 00 00 shall be shown exactly where installed.
 - 7. Junction box splices shall be shown in exact location and clearly noted referring to the written authorization by the Project Engineer.

8. The first junction box within each homerun, regardless of size shall be shown in the installed location.
 9. All junction boxes and pull boxes located above non-accessible ceilings shall be shown in exact location. All junction boxes 6"X6" and larger shall be shown in exact location.
 10. Any combining of circuits (which is only allowed by specific permission) or change in homerun outlet box shall be indicated.
 11. Any circuit number changes.
 12. All conductors and cables, conductors and cable sizes, raceway sizes, etc not shown on contract documents and any changes from the documents.
 13. Any switchboard, panelboard, motor control center, relay panel, or dimming control panel schedule changes, including load changes.
 14. All access panels.
 15. All existing conditions.
 16. Location of lighting control devices such as photocell controls, space occupancy sensors, etc.
 17. Exact quantity of conductors and cables shall be shown for all raceway systems.
 18. All devices, wall outlet boxes, and control components.
 19. Exact location of all driven grounding electrodes including burial depths and dimensions from fixed building lines. Location of all grounding system busbars.
 20. All building automation system (BAS) control panels and associated electrical devices, connections, power supplies, and dampers.
 21. Riser diagrams exactly as installed.
 22. Switchboard, panelboards, motor control center, motor control devices, terminal cabinets, equipment racks, relays, disconnects and switches and surge protection devices.
 23. Change the equipment schedules (i.e. symbol legends, light fixture schedule, etc) to agree with items actually furnished.
 24. Change plan notes to agree with items actually furnished, actual installation methods, etc. respectfully.
 25. Cross-out all items, circuitry, devices, etc. not applicable.
- D. As-Built red line information shall not compromise the clarity of the Contract Documents and Shop Drawings. Major components such as grouped raceway assemblies, cable tray systems, larger conduits, duct banks, racking, elevations, dimensions, etc. shall be shown on a clean architectural base plan(s) separate from the Contract Electrical Documents, as required to clearly delineate work. Obtain electronic base plan file from Project Engineer.
- 1.17 "OBSERVATION OF WORK" REPORT
- A. Reference the General Conditions.
 - B. Items noted by designer/Project Engineer 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 action. Correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item. 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. The electrical project superintendent shall be present at all required observation of work reviews as project progresses. Provide the Project Engineer with equipment for access and review of all Work in place, as well as personnel fully familiar with all aspects of the work. Provide access to all electrical components such as junction boxes, panelboards, switchboards, devices and fixtures for their review by the designer/Project Engineer.

- D. Prior to start of Substantial Completion inspection, provide access to and prepare all electrical equipment and related components complete and ready for review by designer/Project Engineer including but not limited to the following:
1. All panelboard covers removed
 2. Switchboard and distributions panelboards readily for immediate removal of covers
 3. Terminal cabinet covers open or removed.
 4. Underground pull boxes ready for immediate removal of cover(s)
 5. Access to rated wall and through floor fire stopping
 6. Access to all control systems for the CCTV, Voice, Data, and Fire Alarm.
 7. Access to mechanical equipment, electrical connection points, and control devices
 8. Access to all raceways crossing structural expansion/deflection joints.
 9. Access to all components of the fire alarm control system including control devices and fire dampers.
 10. Removal of access panels
 11. Removal of a minimum of one (1) acoustical lay-in ceiling tile throughout each area of work. Larger areas shall have one (1)-ceiling tile removed for every 30-square foot of ceiling area.
 12. Each and every item deemed necessary by A/E to perform a comprehensive review of the work as installed relative to the contract documents.
- E. 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. Warranty shall be by the Contractor to the Owner and shall cover for a period of one year from the date of the Substantial Completion. Warranty shall not include light bulbs in service after one month from date of substantial completion of the System.
1. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Project Engineer 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 Guarantees 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. Include in base bid the transport and disposal or recycling of all waste materials generated by this project in accordance with all rules, regulations and guidelines applicable. Lamps, ballasts and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal. Provide Project Engineer with written certification of approved disposal.

1.20 PROHIBITION OF ASBESTOS AND PCB

- A. 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 26 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 00

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SECTION 26 05 05 - TESTS AND PERFORMANCE VERIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.

1.3 DESCRIPTION

- A. Operate system for a 3-day period. Do performance verification work as required to show that the system is operating correctly in accordance with design. Supply instruments required to read data. Adjust system to operate at the required performance levels.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TESTS

- A. System:
 - 1. General: After installation of all conductors, and before final acceptance, make required tests to determine proper function of all circuits. Furnish all necessary instruments required to make tests, and correct any deficiencies found. Prior to energizing, circuits shall be tested to verify opens, intentional and non-intentional grounds, and continuity and detect short circuits by approved constant "megger".
 - 2. Procedure:
 - a. Insulation resistance of all circuit conductors shall be tested. This is to include all new conductors and all existing conductors that are connected 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.
 - b. Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using a megohmmeter at not less than 1000 volts DC. Resistance shall be measured from each conductor to all other conductors and from each conductor to conduit (ground). Test duration shall be one minute. Investigate any values which deviate from similar connections by more than 50 percent of the lowest value. Testing methodology shall conform to National Electrical Testing Association (NETA). Acceptable insulation resistance of conductors rated at 600 volts shall not be less than the recommended wire manufactures accepted values and test equipment manufacture, or 50 megohms, which ever is greater.

- c. Conductors that do not satisfy test requirements (b. above) shall be removed, replaced, and testing repeated on new cable, at no additional costs to the Owner. All tests shall be performed by a licensed electrician trained in the use of the test instrument.
- d. Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed and complete "Conductor Insulation Resistance Test" form and submit five (5) copies to Designer/Project Engineer for approval. Test shall be witnessed by Project Engineer and designer (if designer so desires). Final approval data is to be submitted in O&M Manual.
- e. Test reports shall identify each feeder conductor tested, date, time, and result of test, weather conditions, and range, test voltage, and serial number of the megger instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced, and additional test shall be performed.
- f. Observe all safety instructions set by testing equipment manufacturer to minimize 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 and voltage.
2. Test run each motor furnished in the Work and all existing motors specifically noted in the Contract Documents 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 +/- 5% from the nameplate ratings, the condition shall be corrected. Notify the designer immediately should deviations occur.
 - b. Record results of existing motors tested and submit values to Project Engineer in writing.
 - c. Tabulate readings, complete "Motor Test Information" form included in Division 1 of the General Requirements. Final approved 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.
2. Test each grounding system used in the project as called for in Section 26 05 26.
4. Grounding resistance shall be as called for in Section 26 05 26.
5. Testing shall be three (3) point method in accordance with IEEE recommended practice.

D. Communications:

1. See specific sections of these specifications for requirements.

E. Equipment:

1. Equipment items requiring check-out memos are all major items of equipment such as (but not limited to):
 - a. Panels, distribution panels, switchboards.
 - b. Equipment/system installed per Division 26.
 - e. Checkout and test any other equipment the designer/Project Engineer deems necessary to insure system integrity and safety during construction, regardless if previous testing has been performed.
2. At completion of construction after all performance verification and testing information has been gathered, submitted, and approved, provide one copy of this information to the authorized manufacturer's representative of the equipment.

- a. Manufacturer's authorized representative must be trained by the manufacturer and authorized to inspect, adjust, test, and repair equipment.
3. Manufacturer's authorized representative shall examine the performance verification information, check the equipment in the field while it is operating, and sign a check-out memo for a record.
 - a. Check out of equipment is to include examining performance and certifying equipment has been installed per manufacturer's recommendations, that all necessary adjustments have been performed and that equipment is operating properly.
4. Submit memo on each major item of equipment. Approved memos shall be inserted in each O & M manual with the performance verification information and submittal data. Memos shall be submitted and approved before instruction to Owner or a request for final inspection.
5. Do not submit Check-out Memo form at the time Submittal Brochures are submitted.
6. Completion of Construction "Check Out Memo" form included in Division 1.

3.2 DATA PROCESSING

- A. Tabulate data for submission.
- B. Submit data on 8 1/2" x 11" sheets with date and name of checker with one copy for each operation and maintenance manual.
- C. Where specific performance verification information is called for in the specifications, use copies of the sheets provided for recording readings.
- D. Data shall be submitted and approved before Check Out memos are signed or a request for final inspection is made.

PART 4 – METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 05

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SECTION 26 05 08 - SAFETY PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements to establish the proper safety guidelines necessary to protect aircraft, passengers, crews, the general public, all workmen, and vehicles involved in their daily tasks.

1.3 SAFETY WITH ELECTRICAL CIRCUITS AND EQUIPMENT

- A. No one may disconnect or cause to be disconnected any electrical circuit before permission is requested and granted by the Engineer/Project Engineer.
- B. Before any circuit supplying radar, ILS, weather, VORTAC, airport beacon, runway/taxiway lighting equipment or any other equipment vital to airport operations can be disconnected, permission must first be granted by FAA Sector Field Office.

- 1. After such permission is granted, Items C, D, and F must be followed.

- C. Work shall not commence on any circuit above 600 volts until the circuit is correctly identified in the presence of the Electrical Contractor's Superintendent or foreman, the Project Engineer, Airport Electrical Superintendent or his authorized representative, and Resident Project Engineer's representative.

- D. After identity of the circuit is established, FAA and Tower shall be notified, and the circuit disconnected. The time and date shall be recorded by Project Engineer/Designer and Engineer's representative, then:

- 1. The switch shall be locked in the open position or opened in a manner which will prevent accidental restoration.
 - 2. The circuit shall be tagged with an acceptable red warning tag. The tag shall state the company name, the electrician's name responsible for disconnection, 24-hour emergency phone number, date, time and project name and number if applicable.
 - 3. The Electrical Contractor's Superintendent or Foreman shall do the above items.

- E. Restoration shall be accomplished and tags removed only by the Electrical Contractor's Superintendent in the presence of the Airport Electrical Superintendent, or his appointed representative.

- F. Any breaker that is required to be turned off to perform work must be tagged out according to OSHA requirements, regardless of system or voltage.

1.4 MISCELLANEOUS SAFETY REGULATIONS

- A. Electrical MDP, branch circuit panels, control panels, etc. may have front covers removed for access to live parts, but must be blanked out by suitable, non-conducting materials, tightly fitted to prevent accidental contact with live parts.

- B. Work performed on or near live parts by qualified persons related to tasks such as testing, troubleshooting, voltage measuring, etc., shall be permitted to be performed without an energized electrical work permit, provided appropriate safe work practices and personal protective equipment are provided and used. Workers must perform a hazard analysis, wear any PPE that is required by the analysis, and implement the safe work practices identified in Chapter 1 of NFPA 70E.
- C. Switchboards, panelboards, industrial control panels, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.
- D. Draw-out type breakers, regardless of operating voltage must be drawn completely out to open position and tagged as in 1.3, D, 2. inclusive.
- E. In hazardous locations, regardless of class, all electrical tools and extension cords shall be of a type approved for use in such areas.
- F. No counterpoise conductors (or any other conductors) may be joined, connected, or affixed to any terminal, grounding electrode, or other point of attachment by any method of welding except cadweld or by approved clamp or connector.
- G. All counterpoise or grounding systems, when severed, shall be properly restored at once.
- H. No high voltage switch shall be engaged or disengaged under load.
- I. Where work operations require the use of construction equipment such as backhoes and cranes, the area shall be properly enclosed or barricaded and signs posted in accordance with safety standards.
- J. No digging, dirt moving or other heavy equipment shall enter physically any approved construction area before all FAA utilities and airport utilities have been located and properly marked out. It is the contractor's responsibility to locate all utilities before digging, sawing, coring, boring, etc. Any damage caused by digging, sawing, boring, coring, or similar activity, is the contractor's responsibility for repair. Any damage must be reported immediately to the Project Engineer. No repair shall be attempted without Project Engineer's approval.
- K. Any damage, interruption or disconnection of vital FAA and tower communications without prior notification and approval may be subject to penalty charges by the FAA. The Contractor at no additional cost to the Owner shall incur all imposed charges.
- L. All high voltage cables shall be disconnected before excavation is attempted.
- M. All ILS cables and cable for other vital airport systems shall be first located by hand excavation and then if appropriate and approved by Project Engineer, completed by mechanical means. Written notice shall be given to the Project Engineer appropriately prior to start of excavation. Remain six inches minimum from such cables. An observer assisting in the ditch will monitor digging.
- N. Begin excavations only after acquiring written permission from Project Engineer.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 6 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 08

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SECTION 26 05 10 - SUBMITTALS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTAL REQUIREMENTS

- A. Technical data is required for all items specified regardless if item furnished is as specified.
- B. See specific sections of the specifications for further requirements.

1.3 PROCESSING SUBMITTALS

- A. Note that the approval of shop drawings or other information submitted in accordance with the requirements specified herein, does not assure that the Designer, or any other Owner's Authorized Representative'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. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Designer's letterhead.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 4 – BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 10

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SECTION 26 05 19 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of Building Wire and Cable for Destin-Fort Walton Beach Airport (VPS).

1.3 DESCRIPTION

- A. 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.

- B. No aluminum conductors shall be permitted.

- C. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM/KCMIL).

1.4 SUBMITTALS

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

1.5 QUALIFICATIONS

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

1.6 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

- B. Conform to the requirements of ANSI/NFPA 70.

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. Record actual routing on red lined as-builts.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: ANSI/NFPA 70, Type THHN/THWN-2 and XHHW-2.
- E. Cable supports shall be O Z/Gedney Type "S" or approved substitution.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install products in accordance with manufacturer's instructions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. 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.).
- D. Conductors #10 AWG or #12 AWG shall be 600-volt type THHN/THWN, stranded unless specifically noted otherwise, rated 90 degrees C. dry.
- E. Use conductor not smaller than 12 AWG for power and lighting circuits.
- F. Use 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet (23 m).
- G. Use 10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 200 feet (61 m).
- H. All conductors shall be installed in raceway.
- I. 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.

- 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-2 insulation, in raceway unless noted otherwise.
- B. Wiring in vicinity of heat producing equipment: Use only XHHW-2 insulation, in raceway.
- C. Conductors installed within fluorescent fixture channels shall be Type THWN-2 or XHHW-2, 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.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 26 05 53 Electrical Identification.
- 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.
- 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 Article 300-19 in NFPA 70. 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 Designer/Project 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 coaxial type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.
- G. Where control or signal circuits with a lower insulation rating enter an enclosure with conductors having a 600 volt or higher insulation rating, a separate wire way will be installed or proper clearance distance will be maintained per NEC.
- H. All conductors shall be pulled in conduits by industry approved cable pulling "tuggers" equipment. The use of construction equipment such as fork lifts, tractors and other vehicles will not be allowed. All conductors will be routed and protected by using the proper pulleys and sheaves.

3.9 CONTROL AND SIGNAL CIRCUITS

- A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW-2 or THHN/THWN-2 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 approved by Code Inspection Authority only. Wire approvals by the Designer/Project Engineer shall not supersede this final approval for conditions of this specific project.
- D. Install circuit conductors in conduit.
- E. Circuit conductors to be stranded.

3.10 COLOR CODING

- A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape in all junction boxes and panels. Tape shall completely cover the full length of conductor insulation within the box or panel.

- B. Unless otherwise approved or required by DESIGNER to match existing, color-code shall be as follows: Neutrals to be white for 120/208V system, natural grey for 277/480V system; ground wire green, bare or green, insulated ground conductor green with yellow tracer. 120/208V, Phase A - black; Phase B - red; Phase C - blue. 480/277V, Phase A brown; Phase B - orange; Phase C - yellow. All switch legs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above.

3.11 TAPS/SPLICES/CONNECTORS/TERMINATIONS

- A. Taps and splices are not acceptable unless specifically noted otherwise on drawings or special written approval is granted by Designer/Project Engineer. (See 3.1K) Submit locations, sizes, etc., where taps will be necessary to coordinate with lug sizes/quantities for review and approval prior to installation.
- B. Clean conductor surfaces before installing lugs and connectors.
- C. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- D. 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 special written approval of PROJECT MANAGER).
- E. 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.
- F. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written approval of Project Engineer
- G. 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 approval of Project Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.
- H. No splices shall be made in circuits of #8 AWG conductors or larger of 1000 feet or less without written approval of the Project Engineer.
- I. 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 providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pullboxes at proper vertical spacings.
- J. A calibrated torque wrench shall be used for all bolt tightening.
- K. Interior Locations:
 - 1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "Screw-on spring type (wire nut)" connectors. All "Push-in" or "Stab-in" type connectors are prohibited. 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.
- L. Exterior Locations:

1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.
2. All taps and splices shall be made with compression type connectors and covered with insulating material equivalent to conductor insulation or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.
3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 19

SECTION 26 05 26 GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of grounding and bonding of the new terminal building of Destin-Fort Walton Beach Airport (VPS).

1.3 DESCRIPTION

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

1.4 SUBMITTALS

- A. Submit catalog cut sheet showing brand and selection for all conductors, test wells, components, etc., as specified herein showing that all materials are UL listed and labeled as applicable and manufactured in the United States.
- B. Product data shall prove compliance with Contract Documents, National Electric Code, Underwriters Laboratories, manufacturer's specifications, manufacturer's written installation data and compliance with all performance criteria.
- C. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

- D. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
- E. Show all dimensions, colors, configurations, covers and applicable labeling/stamping.
- F. Record actual locations of grounding electrodes on red lined as-built documents.
- G. Submit test results of each ground rod.

1.5 REFERENCES AND REGULATORY REQUIREMENTS

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

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 5/8 inch.
- C. Length: 30 feet minimum. Increase lengths as required to achieve specified resistance.

2.2 MECHANICAL CONNECTORS

- A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.
- B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. Specified items of designated manufacturers indicate required criteria and equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:
 - 1. Lugs: substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces equal to Burndy QQA-B Series, two hole, T&B, or approved substitution. Light weight and "competitive" devices shall be rejected.
 - 2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or approved substitution.
 - 3. Piping Clamps: Burndy "GAR-TC series" with two hole compression lug under U-Bolt nut, or T&B, or approved substitution.
 - 4. Grounding Screw and Pigtail: Raco No. 983 or approved substitution.
 - 5. Fastening hardware: Grade 5 silicone bronze with beveled washers. Copperplate is not acceptable
- C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

2.3 WIRE

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

2.4 GROUNDING WELL COMPONENTS

- A. Grass Non-Traffic Areas:
 - 1. Well: Minimum 12-inch-long by 12-inch-wide by 18 inches deep with open.
 - 2. Well Cover: High density plastic, composolite, or cast iron with legend "GROUND" embossed on cover.
 - 3. Material: Structural Plastic, composolite, or concrete.
 - 4. Manufacturer: Brooks Products 70 Series or equal by Quazite or approved substitution.
 - 5. Increase depth, diameter or size as required to provide proper access at installed location.
- B. Paving and Low Traffic Areas:
 - 1. Well: Minimum 12-inch-long by 12-inch-wide by 18 inches deep with open bottom.
 - 2. Well Cover: Traffic rated for use with "GROUND" embossed on cover.
 - 3. Material: Composolite.
 - 4. Manufacturer: Quazite or approved substitution.
 - 5. Increase depth, diameter or size as required to provide proper access at installed location.

2.5 GROUNDING BARS/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BARS AND GROUND BUS BARS)

- A. Ground bars shall be copper of the size and description as shown on the drawings. If not sized on drawings, bus bar shall be minimum 1/4" x 2" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.
- B. Provide bolt tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2 inches on center spacing. Lugs to be manufactured by Burndy, T&B or approved substitution.
- C. Bus bar shall have rows of holes in accordance with NEMA Standards for specified lugs.
- D. Standoff supports to be 2" polyester as manufactured by Glastic #2015-4C or approved substitution.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install products in accordance with manufacturer's instructions.

- B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.
- C. Grounding shall meet (or exceed) all the requirements of the N.E.C., the NFPA, and applicable standards of IEEE.
- D. Where there is a conflict between these specifications and the above applicable codes or standards, or between this section and other specifications 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.
- F. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 GROUNDING ELECTRODES

- A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by brasing or clamping with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on drawings.
- B. Each rod shall be die stamped with identification of manufacturer and rod length.
- C. Install rod electrodes at locations indicated and/or as called for in these specifications.
- D. Ground Resistance:
 - 1. Main Electrical Service (to each building and Site) and Generator Locations:
 - a. Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 25 ohms.
 - 2. Lightning Protection Ground Locations:
 - a. Lightning Protection system ground locations shall not exceed 5 ohms measured at ground electrode.
 - 3. Other Locations:
 - a. Resistance to ground of all non-current carrying metal parts shall not exceed 25 ohms measured at motors, panels, busses, cabinets, equipment racks, light poles, transformers, and other equipment.
 - 4. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two (2) or more ground rod electrodes at each location, then the resistance specified above shall be the maximum resistance with two (2) or more rods connected together but not connected to the grounding electrode conductor.

- E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor).
- F. Provide grounding well with cover at each rod location, with the only exception being a site distribution counterpoise ground rod. Install grounding well top flush with finished grade.
- G. Install ground rods not less than 1 foot below grade level and not less than 2 feet from structure foundation.

3.3 GROUNDING ELECTRODE CONDUCTOR

- A. Conductor shall be sized to meet (or exceed requirements of Contract Documents) the requirements of NEC 250.66.

3.4 EQUIPMENT GROUNDING CONDUCTOR

- A. Grounding conductors shall be provided with every circuit to meet (or exceed requirements of Contract Documents) the requirements of NEC 250.122.
- 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) 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 requirements of Contract Documents) the requirements of NEC 250.122. 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 connected, 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 approved connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

3.5 LIGHTNING PROTECTION SYSTEMS

- A. Ground per NFPA 780, and as specified herein. The most stringent requirements shall govern.
- B. Bond lightning protection system grounds to electrical service system ground, and counterpoise system ground where provided.

3.6 EXTERIOR GRADE (OR FREE STANDING ABOVE GROUND) MOUNTED EQUIPMENT

- A. General:
 - 1. All equipment 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.
- B. Main electrical service rack mounted equipment.
 - 1. Ground per "MAIN ELECTRICAL SERVICE".
 - 2. Bond all metal parts as noted in this section.
- C. Complete installation shall meet or exceed the minimum requirements of NEC 250 and, when applicable, NFPA 780.

3.7 ROOF MOUNTED EQUIPMENT

- A. Bond all roof mounted electrical equipment to lightning protection system (when provided) per NFPA 780.
- B. Where lightning protection system is not provided, ground/bond all roof mounted electrical equipment to building steel and to two (2) or more 30 ft. ground rods at no less than 30 ft. spacing driven vertically to a minimum depth of 30 ft. plus 1 ft. below grade.
 - 1. Bond ground rods together with a - Class I or Class II Materials - 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 meet or exceed the minimum requirements of NFPA 780.

3.8 LIGHTING FIXTURES

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

3.9 MISCELLANEOUS GROUNDING CONNECTIONS

- A. Provide bonding to meet regulatory requirements.
- B. Required connections to building steel shall be with UL approved 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.

- C. Install grounding conductors to permit shortest and most direct path from equipment to ground; install in conduit; bond to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with approved solderless connectors brazed (or bolted) to the equipment ground; 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 electrodes 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. 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 Table 250.122 of NEC for parallel return with respective interior grounding conductor.
 - H. Grounding provisions shall include double locknuts on all heavywall conduits.
 - I. Install grounding bus in all existing panelboards of remodeled areas, for connection of new grounding conductors, connected to an approved ground point.
 - J. Bond together reinforcing steel and metal accessories in pool and fountain structures and bond to electrical system per NEC.
 - K. Where reinforced concrete is utilized for building grounding system, proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten (10) full length rebars which contact the connected rebar. Provide size and length of rod to meet NEC requirements.
- 3.10 GROUNDING BAR/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION
- A. Where indicated on the drawings, provide grounding bar/ground bus (bus bar). Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.
 - B. Mount bolt tapping lugs with hex head bolts to bus bar at 2" o.c. spacing, one for each ground conductor.
 - C. Mount bus bar to wall using 2" polyester molded insulator stand-off.
 - D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by N.E.C. for service ground, etc.) in PVC conduit to approved service ground installation or ground bus/bar in main service equipment enclosure.

- E. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC "Article 800-40(b).

3.11 TESTING AND REPORTS

- A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.
- B. Ground resistance measurements shall be made on each system utilized including:
 - 1. Building structural steel.
 - 2. Driven grounding system.
 - 3. Water pipe grounding system.
 - 4. Other approved systems.
- C. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.
- D. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Designer.

3.12 INTERFACE WITH OTHER PRODUCTS

- A. Interface with site grounding system.
- B. Interface with lightning protection system installed.

3.13 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instruments to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall- of-potential method.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 26

SECTION 260529 SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of supporting devices.

1.3 DESCRIPTION

- A. Furnish and install all supports, anchors, fasteners, hangers and inserts required to mount fixtures, conduit, cables, pullboxes and other equipment furnished under this Division.

1.4 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- B. Conform to the requirements of the following:
 - 1. NECA - National Electrical Contractors Association.
 - 2. ANSI/NFPA 70 - National Electrical Code.

1.5 SUBMITTALS

- A. Submit to Destin-Fort Walton Beach Airport (VPS) and to engineer of record catalog cut sheets showing brand of conduit supporting hardware to be used and (where applicable) showing that conduit supporting hardware is UL listed and labeled, and manufactured in the United States.
- B. Submit catalog cut sheet on all types of conduit support fittings, hardware, straps, and hangers.
- C. Product data shall be submitted for approval to VPS and engineer of record on:
 - 1. Mounting hardware and inserts.
 - 2. Conduit straps, hangers and fittings.
 - 3. Supporting channel.
- D. Product data shall prove compliance with Contract Documents, National Electric Code, National Board of Fire Underwriters, manufacturer's specifications and written installation data.
- E. Submit shop drawings showing routing and location of all conduit racking systems. Provide coordination drawings.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

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

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps and metal banding straps.
- E. Do not fasten supports to sides or bottom of pre-cast structural beams.
- F. Obtain permission from Project Engineer before drilling, or cutting structural members.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations use stainless steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.
- J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- K. All items shall be supported from the structural portion of the building, except standard ceiling-mounted lighting fixtures. Small devices may be supported from ceiling system where permitted by ceiling system manufacturer, 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. Lay out and install work in advance of the laying of floors or walls, and provide all sleeves that may be required for openings through floors, walls, or other assemblies. Where plans call for conduit to be run exposed, provide all inserts and clamps for the supporting of conduit.
- M. All conduits shall be securely fastened in place on maximum of 8 foot intervals. 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 approved 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 1½" x 1½", 12 gauge, pre-galvanized zinc (B-Line or approved substitution), conduit channel trapeze hanger system (racking) consisting of concrete inserts, threaded rods, washers, double nuts for each rod, locknut washers and galvanized "L" angle iron, or Unistrut cross members. Where galvanized "L" angle iron is used, conduits shall be individually fastened to the cross members with malleable iron hangers listed and approved for use on "L" angle iron, bolted with proper size cadmium machine bolts, washers and nuts. Conduits supported to unistrut channel shall be individually fastened with two piece unistrut straps with bolts and nuts listed and approved for such use. Mineralak hangers or one hole type straps fastened to Kindorf racking is not acceptable. Beam clamps shall be malleable iron. All single panelboard, switchboard and motor control center feeder raceway runs shall be supported by means of a trapeze channel hanger support system with provisions for future as specified.
- O. All hangers and mounting hardware clamps shall be made of durable material suitable for the application involved. Where excessive corrosive conditions or exterior and damp conditions are encountered, hanger assemblies shall be malleable iron or protected after fabrication by hot dipped galvanizing and where via written approval is authorized by the PROJECT ENGINEER, special paint or other suitable preservative methods may be used.
- P. On concrete or brick construction, 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 and washers used for supporting conduit or outlets shall be fabricated from rust-resisting metal. Self-tapping power driven fasteners are acceptable on block or brick construction only. Plastic anchors are not acceptable.
- Q. Spring type conduit clip devices are not acceptable for conduit support.
- R. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter. Increase size as required to support assembly. Bending of rod hangers is not permitted.
- S. Concrete anchors, thread rods, or similar fasteners installed on side or bottom of pre-stressed beams are not acceptable.
- T. Group related conduits; support using conduit rack. Construct rack using steel channel in dry locations and galvanized channel or aluminum channel in damp or wet locations (minimum of 24", increase, distance as required for quantity of conduits and spare capacity) provide space on each rack for Building Automation Systems (BAS) raceways and 25 percent additional conduits. Group conduits on channel racking adjacent to each other at one side, allowing all remaining unused space as spare capacity. Spacing between conduits shall not exceed 1" unless written permission is granted by Project Engineer.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 260529

SECTION 26 05 30 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Division 1 Specification sections apply to this section.
- B. General: Refer to Division 1, Project Closeout for requirements related to the preparation and contents of Operation and Maintenance manuals.

1.2 OPERATION AND MAINTENANCE MANUALS

- A. The various specification sections of Division 26 contain specific information to be included in the O&M manuals in addition to the general requirements outlined in Division 1.
- B. Complete Operation and Maintenance Manuals shall be supplied to Destin-Fort Walton Beach Airport (VPS) upon power start-up and commencement of terminal operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 30

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SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of conduit.

1.3 DESCRIPTION

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system using the following:
 - 1. Rigid Metallic Conduit (RMC)
 - 2. Rigid Aluminum Conduit (RAC).
 - 3. Intermediate Metal Conduit (IMC).
 - 4. PVC coated Metal Conduit.
 - 5. Flexible metal conduit (FMC)
 - 6. Liquidtight flexible metal conduit (LFMC)
 - 7. Electrical metallic tubing (EMT)
 - 8. Rigid non-metallic conduit (PVC) (RNC)
 - 9. Flexible metal cables (MC/HFC)
 - 10. Fittings and conduit bodies.
- 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, lighting and electrical systems.
- D. Where the Contract Documents refer to the terms "raceway," or "conduit" the materials shall be as listed above in conjunction with NEC article 100, definition of "raceway". MC and HFC flexible metal cables shall not be considered a substitute for raceway or conduit.
- E. Provide conduit seal offs as noted on plans for Class 1 Division 2 areas.

1.4 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. Submit product data on:
 - 1. Conduits.
 - 2. Conduit straps, hangers and fittings.

3. PVC solvent(s) and bending box.
4. Fitting entering and leaving the ground or pavement.
5. Cables
6. Expansion/deflection fittings.

- D. Submit UL listed fire and smoke stopping assemblies for each applicable application. Provide details from UL Fire Directory and manufacturers' corresponding product data and details.
- E. Product data shall prove compliance with Specifications, National Electrical Code, National Board of Fire Underwriters, manufacturer's specifications and written installation data.

1.5 PROJECT AS-BUILT DOCUMENTS

- A. As-built documents shall accurately record actual routing, type and size of conduits.

1.6 REFERENCE AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- B. Conform to the following:
1. ANSI/NFPA 70 - National Electrical Code.
 2. ANSI C80.1 - Rigid Steel Conduit, Hot-dip galvanized.
 3. ANSI C80.3 - Electrical Metallic Tubing, Hot-dip galvanized.
 4. ANSI C80.5 - Rigid Aluminum Conduit.
 5. ANSI C80.3 - Intermediate Metal Conduit
 6. ANSI/UL 651 - Rigid Non-Metallic Conduit (PVC)
 7. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 8. NECA "Standard of Installation."
 9. ANSI C80.1/NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 10. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
 11. ANSI/Fed. Spec. J-C-30B - Flexible Metal Cables, Galvanized steel jacket.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

- A. Verify routing and termination locations of conduit prior to rough-in.
- B. 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 other nationally recognized testing agency) 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, requirements.

2.2 MINIMUM TRADE SIZE

- A. Power/Lighting Homeruns 3/4"
- B. Power/Lighting Branch Circuits 1/2"
- C. Systems Conduit 1"
- D. Flexible and Seal-tite metallic conduit – 1/2"C (maximum 6 ft. long).

2.3 RIGID METAL CONDUIT

- A. Comply with:
 - 1. ANSI C80.1
 - 2. UL 6
 - 3. NEC
- B. Conduit material:
 - 1. Hot-dipped galvanized steel.
- C. Fittings:
 - 1. Threaded.
 - 2. Hot-dipped galvanized malleable iron or steel manufactured in accord with ANSI C80.4.
- D. Conduit Bodies:
 - 1. Comply with ANSI/NEMA FB 1.
 - 2. Threaded hubs.
 - 3. Hot-dipped galvanized malleable iron.

2.4 INTERMEDIATE METAL CONDUIT

- A. Comply with:
 - 1. U.L Standard 1242.
 - 2. ANSI C80.3
 - 3. NEC
- B. Conduit material: Zinc coated steel.
- C. Fittings:

1. Threaded.
2. Zinc plated malleable iron.
3. Insulated bushings on terminations.

D. Conduit bodies:

1. Comply with ANSI/NEMA FB 1.
2. Threaded hubs.
3. Hot-dipped galvanized malleable iron.

2.5 FLEXIBLE METAL CONDUIT

A. Comply with:

1. NEC
2. ANSI/UL 1

B. Conduit material: Hot-dip galvanized Steel, interlocked.

C. Fittings:

1. ANSI/NEMA FB 1
2. ANSI/UL 514B
3. Malleable iron, zinc plated.
4. Direct flexible conduit bearing set screw type not acceptable.
5. Insulated throat on terminations.
6. Compression EMT to flexible conduit coupling is not acceptable unless special written permission is granted by PROJECT ENGINEER.

2.6 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Comply with:

1. NEC
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. Approved for hazardous locations where so installed.
3. Provide sealing washer in wet/damp locations.
4. Compression type.
5. ANSI/NEMA FB 1.
6. ANSI/UL 5148.
7. Hot-dipped galvanized malleable iron or steel.
8. Insulated throat on terminations.

9. Connections to vibrating equipment and transformers.
 - a. Connectors to have wire mesh conduit grip.

2.7 ELECTRICAL METAL CONDUIT

A. Comply with:

1. U.L 797
2. ANSI C80.3
3. NEC
4. ANSI/UL797

B. Conduit material: Hot-dip Galvanized steel tubing (Electrogalvanized zinc is not acceptable).

C. Fittings:

1. ANSI/NEMA FB 1
2. Compression type.
3. Insulated throat on terminations.
4. Hot-dipped galvanized malleable iron or steel.

2.8 RIGID NON-METALLIC CONDUIT (PVC)

A. Comply with:

1. NEMA TC-2
2. UL 651
3. NEC

B. Conduit material:

1. Shall be high impact P.V.C. - tensile strength 55 PSI, flexural strength 11000 PSI.

C. Fittings:

1. Comply with: NEMA TC-3 and UL 514.

D. General:

1. Shall be UL listed.
2. Fittings and elbows shall be by the same manufacture as conduit.

2.9 EXPANSION FITTINGS

A. Expansion/deflection fittings shall be:

1. Listed, hot dipped galvanized inside and outside providing a 4" expansion chamber and deflection (where applicable) when used with rigid conduit, intermediate metal conduit and electrical metallic conduit, or:
2. U.L. Listed, polyvinyl chloride providing a minimum 6" expansion chamber when used with non-metallic conduit (PVC), and shall meet the requirements of and as specified elsewhere for non-metallic conduit. Provide fittings as specified above for expansion/deflection conditions.

3. Hot dipped galvanized expansion and deflection (where applicable) fitting shall be provided with an external braided grounding and bonding jumper with approved clamps, UL Listed for the application.
4. Expansion fitting, UL Listed for the application and in compliance with the National Electrical Code without the necessity of an external bonding jumper may be considered. Submit fitting with manufacturer's data and UL Listing for approval prior to installation.

PART 3 - EXECUTION

3.1 LOCATION REQUIREMENTS

A. Underground Installations:

1. Use only Schedule 40 thickwall nonmetallic conduit in underground installations unless local authority having jurisdiction or applicable codes/utility requirements, etc. require rigid steel conduit.
2. For concrete encased installations use only Schedule 80 PVC conduit. Encase conduit in a concrete envelope of not less than 3" thickness on all sides and not less than 1-1/2" between conduits (where more than one conduit is installed together) for:
 - a. All conduits installed under roads, taxiways, and runways.
 - b. All conduits installed for primary electric circuits, main feeders, and data/communications systems (i.e. Telephone, data, parking revenue, radio, flight information, air traffic control systems, security, fiber optic).
3. All conduits or elbows entering or leaving any slab or the ground shall be rigid steel conduit coated with asphalt paint.
4. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.
5. All PVC runs over 100 ft. in length shall utilize rigid steel 90° elbows at each horizontal change in direction. All PVC risers shall utilize rigid steel 90° elbows. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC.
6. Underground raceway systems shall conform to all national, state, and local regulations, in general and Article 300, Section 300.5 of the National Electrical Code specifically.
 - a. Depth of conduits shall be not less than 18" with the following exceptions:
 - 1) Conduits installed in concrete floors of buildings to have a minimum concrete cover not less than 2".
7. Verify finished lines in areas where raceways will be installed underground before the grading is complete.

B. In Slab, Above or On Grade:

1. Use coated rigid steel conduit, coated intermediate metal conduit (if approved) or thickwall nonmetallic conduit.
2. In slab conduit is permitted only where written consent is granted by Architect and Structural Engineer, regardless of that shown or noted by drawings. Install as directed by Architect/Structural Engineer.

C. Penetration of Slab:

1. Exposed Location:
 - a. Where penetrating a floor in an exposed location from underground or in slab, a black 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, non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 40" above finished floor.
 - b. Where penetrating a floor from underground or in slab, a coated galvanized rigid steel conduit shall be used.
- D. Outdoor Location:
1. Above Grade:
 - a. Where penetrating the finished grade, a coated galvanized rigid steel conduit shall be used.
 - b. All exterior conduit runs shall be rigid conduit and threaded connectors as specified elsewhere.
 - c. All areas subject to exterior conditions such as overhangs, galvanized rigid steel conduit shall be used.
 2. Roofs:
 - a. Conduit is not to be installed on roofs, without written authorization by Project Engineer for specific conditions.
 - b. When approved by written authorization conduit shall comply with the following:
 - 1) Be PVC coated rigid galvanized metal conduit.
 - 2) All fittings, etc. are to be PVC coated.
 - 3) Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Refer to applicable roofing specifications.
 - 4) Fasten supports to roof per roofing manufacturer's recommendations.
 3. Cooling Towers:
 - a. Conduit installed at cooling towers shall be PVC coated rigid galvanized conduit.
- E. Interior Dry Locations:
1. Concealed:
 - a. Use rigid galvanized steel and electrical metallic tubing. Thickwall non-metallic conduit (PVC) may be used inside block walls up to first outlet to a maximum of 40" A.F.F. except where prohibited by the NEC.
 - b. The use of Metal Clad cables and HFC-90 Armored cables are permitted in very limited applications as specified herein, provided acceptable by the local inspecting authority having jurisdiction and applicable codes and standards. Refer to "ADDITIONAL REQUIREMENTS FOR METAL CLAD/HFC ARMORED CABLES", below

2. Exposed:
 - a. Use rigid galvanized steel and electrical metallic tubing. EMT may only be used where not subject to damage which is interpreted by this specification to be above 96" AFF and exiting the top of panelboards, terminal cabinets, and control panels.
 3. Concealed or exposed flexible conduit:
 - a. Concealed: Flexible steel conduit or seal tight flexible steel conduit shall be in lengths not longer than six (6) feet in length with a ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Direct change over from conduit to flexible conduit is not acceptable unless written permission is granted by Project Engineer or specifically noted on drawings.
 - b. Exposed: Liquid tight flexible steel conduit shall be used for connections to motors, movable equipment, or vibration equipment (transformers, pumps, AHU's, loading bridges, etc.) as specified herein. Lengths shall not exceed two (4) feet in length unless written authorization by Project Engineer for specific conduits is granted. Connections to vibration equipment, motors, etc shall be made with wire mesh grip fittings as specified herein. Flexible steel conduit is not acceptable in exposed locations. All exposed flexible metal conduit shall be liquid tight.
- F. Interior Wet and Damp Locations:
1. Use rigid galvanized steel in interior wet and damp locations. Areas which are subject to direct exterior conditions such as parking garages, open ramp overhangs and the Baggage Claim Areas within 100' of the east/west tug openings, etc., shall be classified "WET/EXTERIOR LOCATION."
- G. Concrete Columns or Poured in-place Concrete Wall Locations:
1. Use thickwall non-metallic conduit. Penetration shall be by approved metal raceway (i.e. metal conduit as required elsewhere in these specifications).
- H. Corrosive Locations:
1. Comply with all codes and standards.
- I. Retail Concession Spaces
1. The use of metal clad cable for the wiring of power, lighting, control and signal circuits in these spaces is permitted except where otherwise specified.
- 3.2 ADDITIONAL REQUIREMENTS FOR RIGID METAL STEEL CONDUIT
- A. Rigid metal conduit shall be cut and threaded with tools approved for the purpose and by qualified personnel.
1. Approved pipe vise.
 2. Roller/bade type cutter or band saw.
 3. Reamer capable of completely removing al ridges or burrs left by the cutter. Reaming with pliers is not acceptable.
- B. Hangers shall be installed 8 ft. apart.

- C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid galvanized metallic conduit.
- D. One hole pipe straps shall be malleable iron. Wet location applications shall include malleable iron back clamp spacers.
- E. Use of two-piece threaded union fittings and rigid set screw fittings are not permitted. Threaded unions may be acceptable where required for special field conditions only when special written permission is granted by PROJECT ENGINEER.

3.3 ADDITIONAL REQUIREMENTS FOR INTERMEDIATE METAL CONDUIT (IMC)

- A. May be installed only by special written permission.
- B. If written approval is received then IMC may be used in locations acceptable by NEC and elsewhere in these specifications, whichever is most stringent.

3.4 ADDITIONAL REQUIREMENTS FOR ELECTRICAL METALLIC TUBING (EMT)

- A. Electric 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 approved reamer.
- C. Cut conduit square using approved hacksaw with 32 tooth per inch blade; de-burr cut ends. Roller/blade type pipe cutter is not acceptable.
- D. One hole pipe straps, where specified herein, shall be heavy duty type.

3.5 ADDITIONAL REQUIREMENTS FOR FLEXIBLE STEEL CONDUIT AND LIQUID-TITE FLEXIBLE METAL CONDUIT

- A. Shall be properly grounded.
- B. Shall be installed with approved fittings.
- C. Shall be used for final connections to vibrating equipment such as motors, pumps, transformers, etc
- D. Liquid-tight conduit termination connectors at vibration equipment (i.e. pumps, AHU's, motors, moveable equipment, etc) shall be provided with wire mesh grips.

3.6 ADDITIONAL REQUIREMENTS FOR NON-METALLIC CONDUIT (PVC)

- A. 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. In elevated slabs, conduit is permitted only where written consent is granted by Structural Engineer, regardless of that shown or noted by drawings. Install as directed by Architect/Structural Engineer.
- B. Join nonmetallic 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 PVC conduit and fittings, except for rigid steel to PVC couplings.

- D. Installation of PVC conduit shall be in accordance with manufacturer's recommendations.
- E. PVC conduit shall not be used to support fixture or equipment.
- F. Field bends or direction changes shall be by manufactured bends only. Heating with flame and hand held dryers are prohibited.
- G. PVC fittings and elbows shall be by same manufacture as conduit.

3.7 ADDITIONAL REQUIREMENTS FOR PVC COATED CONDUIT

- A. All cuts, pinholes and ends shall be sealed using liquid PVC patch. PVC coated conduit shall be thoroughly inspected after installation to assure all voids, cuts, pinholes or other violation of the integrity of the PVC coating are sealed.

3.8 SUPPORTS

- A. Comply with the requirements of Section 26 05 29 Supporting Devices.
- B. Arrange supports to prevent misalignment during wiring installation.

3.9 EXPANSION/DEFLECTION FITTINGS

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

3.10 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 approved 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.

3.11 CONDUITS PENETRATING 2 HOUR FIRE RATING ASSEMBLIES OR GREATER

- A. Conduits with conductors penetrating the wall shall have blow out patches on each side of the wall.
- B. Multiple conduits run through rated walls side by side shall have blow out patches on each side of the wall.
- C. Data or telephone conductors run exposed and penetrating a wall rated 2 hour for fire, smoke or smoke/fire shall be sleeved with steel conduits 30" each side of the wall and conduit ends packed with approved fire sealant.

3.12 FIRE AND SMOKE STOPPING

- A. Contractor is to provide fire stopping and smoke sealing for all penetrations of existing (or new if applicable) fire or smoke assemblies as required to maintain rating of assembly.
- B. All penetrations shall be fire stopped in strict accordance with UL Fire Directory. Submit applicable details for acceptance. Prepare and install as delineated by UL detail(s).
- C. Each penetration shall be identified with the corresponding UL fire assembly number. Labels shall be typed or computer generated minimum 1/2" high black lettering, self-adhesive type.
- D. Comply with UL Fire Directory "F" and "T" ratings respectfully.

3.13 FIRE PROTECTION

- A. Emergency life safety feeder-circuit wiring shall be installed either in spaces fully protected by an approved automatic fire suppression system or shall be a listed electrical circuit protection system with a 2-hour fire rating. Fire circuit protection shall be in accordance with UL Fire Protection Equipment Directory and UL Building Materials Directory (latest edition).

3.14 VERTICAL RACEWAYS

- A. Cables in vertical raceways shall be supported per NEC Article 300.19. Provide supporting devices for cables, including any necessary accessible pull boxes 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 designer prior to installation. This includes empty raceways for future use.

3.15 GENERAL

- A. Install conduit in accordance with NECA "Standard of Installation." Contractor shall layout all work prior to rough-in.
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange conduit to maintain headroom and present neat appearance.
- D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.
- E. Route conduit in and under slab from point-to-point.
- F. Do not cross conduits in slab.

- G. Maintain adequate clearance between conduit and piping.
- H. Maintain 12-inch (300-mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- I. Maintain minimum of 3" inch separation between power and communications raceways. Increase separation if so required to comply with EIA/TIA referenced standards.
- J. Systems raceways shall be installed in accordance with ANSI/EIA/TIA Communications Standards.
 - 1. Maintain proper separation between PDS system cables and all power and unshielded cables, as required to prevent noise or crosstalk interference.
 - 2. Raceway bends shall have minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2-inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.
 - 3. Install raceways so no more than two 90° bends are in any raceway section without a pullbox. Install additional pull boxes as required to maintain maximum of two 90° bends between pull boxes and termination points.
 - 4. Install boxes in straight sections of raceway.
- K. Cut conduit square using saw or pipecutter; de-burr cut ends.
- L. Bring conduit to shoulder of fittings; fasten securely.
- M. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp locations and to cast boxes. Use threaded conduit hubs to fasten conduit to sheet metal boxes, disconnects switches and equipment control panels in wet and exterior locations.
- N. Install no more than equivalent of three 90-degree bends between boxes for power and lighting systems. Use conduit bodies to make sharp changes in direction, as around beams, Use appropriate boxes and conduit bodies for fire alarm, voice/data and sound/paging systems. Use factory elbows for bends in metal conduit larger than 2- inch size.
- O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- P. Provide pull boxes, junction boxes and fire barrier at fire rated walls as required by NEC Article 300, whether shown on drawings or not.
- Q. Use suitable seals to protect installed conduit against entrance of dirt and moisture and insects.
- R. Ground and bond conduit under provisions of Section 26 05 26.
- S. Identify conduit under provisions of Section 26 05 53.
- T. Install all conduit concealed from view unless specifically shown otherwise on drawings
- U. Rigid steel box connections shall be made with double locknuts and bushings.
- V. All wire raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said plumbing fixtures without disturbing wire raceways. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- W. 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.

- X. 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 red lined As-Built drawings as previously specified.
- Y. 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.
- Z. All conduit stubbed above floor shall be strapped to a metal channel supported by conduit driven into ground or tied to steel. Spare conduit stubs shall be capped with a UL listed and approved cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare".
- AA. All connections to motors or other vibrating equipment including transformers or at other locations where required shall be made with not less than 12" nor more than 24" of flexible liquid-tight steel conduit, with nylon insulated throat connectors and wire mesh grip fittings at both terminations of conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.
- BB. Provide a conduit sealing fitting or pliable compound wherever conduit system is exposed to widely temperature changes which may cause condensation within the raceway; as from the inside to the outside of coolers or freezers.
- CC. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified under other Sections of these specifications.
- DD. All raceways shall be run in neat and workmanlike manner and shall be properly in accordance with latest edition of NEC with approved conduit clamps, hanger rods and structural fasteners.
- EE. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.
- FF. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.
- GG. Raceways, boxes, etc shall not be attached to an acoustical grid ceiling system or support wire per NEC Article 300.11. Support all components directly from building structure.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 33

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SECTION 26 05 34 - OUTLET BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of outlet boxes.

1.3 DESCRIPTION

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

1.4 SUBMITTALS

- A. Submit to Destin-Fort Walton Beach Airport (VPS) and engineer of record catalog cut sheet/product data on:
 - 1. Surface cast boxes.
 - 2. All outlet boxes to be used on project.
- B. For pullboxes and junction boxes not covered in Section 26 05 36, submit product data showing dimensions, covers, and construction.

1.5 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- B. Conform to the requirements of the following:
 - 1. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
 - 2. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 3. ANSI/NFPA 70 - National Electrical Code.
 - 4. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

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. 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.
- B. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.
- C. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.
- D. Handy boxes shall not be used.
- E. Outlet boxes to be one-piece.
- F. 4"x 4" boxes and 4 11/16" x 4 11/16" boxes used as junction boxes shall be one piece.

2.2 SHEET METAL OUTLET BOXES:

- A. ANSI/NEMA OS 1, Galvanized Steel.
- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
- C. Concrete Ceiling Boxes: For concrete location installation, providing fire resistance rating as required.
- D. 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 approved substitution.
- E. 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.
- F. 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 approved substitution. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.
- G. For Communication/Systems Telephone, Data, TV, CCTV, Video, and Computer device outlet boxes shall be 4" square x 2 1/8" deep, minimum. Increase outlet box to 4-11/16" with single gang plaster ring as required for special devices respectfully

2.3 CAST BOXES:

- A. NEMA FB 1
- B. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be heavy cast aluminum or iron with external threaded hubs for power devices and

threaded parts for low voltage devices - Appleton, Crouse Hinds or approved substitution. Trim rings shall also be of one piece construction.

- C. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast iron suited to each application and having threaded conduit hubs, cast metal face plate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.
- D. Boxes to be Type FD unless otherwise noted on drawings.
- E. Free standing cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- D. Above ceiling outlet and junction boxes shall be install to permit readily accessible access from ladder or staging from corresponding floor without the need to extend ladder up through ceiling system to facilitate ease of maintenance.
- E. Install boxes to preserve fire resistance rating of partitions and other elements.
- F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- G. Outlets for 120V clocks shall be recessed so that the clock will hang flush with the finished surface of the wall.
- H. Use flush mounting outlet boxes in finished areas.
- I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches (one stud space) separation in acoustic and rated walls.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- L. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- M. Lighting control switches shall be located at the latch side of door. If the drawings indicate otherwise, issue a request for clarification prior to rough-in.
- N. Support all outlet boxes from structure with minimum of one (1) 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two (2) all-thread rod hangers, minimum.

- O. Do not fasten boxes to ceiling support wires.
- P. Support boxes independently of conduit.
- Q. Use gang box where more than one device is mounted together. Do not use sectional box.
- R. Use gang box with plaster ring for single device outlets.
- S. Comply with applicable portions of the National Electrical Contractor's Association's (NECA) "Standard of Installation".
- T. Install outlets in the locations shown on the drawings; however, the Project Engineer shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.
- U. Coordinate each electrical box so that the type is suitable for the wall or ceiling construction anticipated and suitable fireproofing is built into fire rated assemblies.
- V. Relocate electrical boxes as required so that electrical devices, once installed, will be symmetrically located with respect to the room layout.
- W. 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. No surface mounted boxes will be allowed without Project Engineer approval.
- X. For damp and wet locations provide weatherproof boxes and accessories.
- Y. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.
- Z. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
- AA. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
- BB. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
- CC. 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.
- DD. 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 approved 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.
- EE. Outlet boxes mounted in metal stud walls, are to be supported to studs with minimum of two (2) self-tapping screws inside, at the back of outlet box, to a horizontal stud brace between vertical studs or pre-

manufactured heavy duty box bracket equal to Caddy Corporation # SGB/TSGB series, to prevent movement of outlet box after wall is finished.

FF. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

GG. Mount Height.

1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural plans and shop drawings.

- a. Switches: 4'-0" AFF to top
- b. Receptacles: 1'-4" AFF to bottom
- c. Lighting Panels: 6'-6" AFF maximum to centerline of highest breaker/fuse
- d. Phone Outlets: 1'-4" AFF to bottom
- e. ADA Wall Phones: (See part 3.1, Item HH.(4.) below)
- f. Fire Alarm Pull Stations: 4'-0" AFF to top
- g. Fire Alarm Strobe Lights: 80" AFF to bottom of globe or 6" below ceiling to top, whichever is lower

2. Bottoms of outlets and switches above counter tops or base cabinets shall be minimum 4" above counter top or backsplash, whichever is highest. Outlets and switches may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at the same height. Coordinate outlet locations in relation to all casework shown on Architectural plans, prior to rough-in, regardless of height shown on Electrical drawings.

3. Height of wall-mounted fixtures shall be as shown on the drawings. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

HH. 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. Coordinate roughing-in locations. Provide plug for each outlet.

II. Outlets in Rated Assemblies and Smoke Barriers.

1. Metallic and approved non-metallic electrical outlet boxes may be installed in vertical fire resistive assemblies or smoke barriers without affecting the classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 sq. inches.
2. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other approved materials.
3. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under all Sections of these specifications.

B. Coordinate locations and sizes of required access doors with applicable sections in these specifications.

C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

- D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closure in unused box opening.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 34

SECTION 26 05 35 FLOOR BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Division 1 Specifications sections apply to this section.

1.2 SUMMARY

- A. This section includes the requirement for provision and installation of floor boxes.

1.3 DESCRIPTION

- A. Provide and install all equipment, labor, material, accessories and mounting hardware for a complete and operating floor box system, including but not limited to:
 - 1. Floor boxes.
 - 2. Service fittings.

1.4 SUBMITTALS

- A. Submit to Destin-Fort Walton Beach Airport (VPS) and engineer of record under provisions of the General Requirements of the Contract Documents and Section 26 05 10.
- B. Submit catalog cut sheet on each different floor box and all accessories.

1.5 PROJECT AS-BUILT DOCUMENTS

- A. Record actual locations of floor boxes dimensioned from column line or other known fixed point.

1.6 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- B. Floor boxes shall be UL listed for minimum 2-hour fire rating.
- C. Conform to the requirements of the following:
 - 1. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
 - 2. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 3. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
 - 4. ANSI/NFPA 70 - National Electrical Code.
 - 5. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 6. Underwriters Laboratories, Inc. - Fire Resistance Directory - Current Publication Year.

1.7 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.

- B. Coordinate locations of all floor boxes and outlets prior to rough-in.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Each floor box to be complete with plates, trims, and accessories as required for a complete system.
- B. Covers to be brass (unless specifically noted otherwise).

2.2 FLUSH IN FLOOR CAST IN PLACE CAST FLOOR BOXES (SLAB ON GRADE)

- A. UL listed.
- B. Malleable cast iron, threaded hubs.
- C. Fully adjustable.

2.3 FLUSH IN FLOOR CAST IN PLACE CONCRETE TYPE STEEL BOX (ELEVATED SLAB)

- A. UL listed.
- B. Fully adjustable.

2.4 RECESSED FLOOR BOX

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor boxes complete with all devices and accessories as specified and recommended by manufacturer and to meet all applicable codes.
- B. Adjust boxes as required for flush installation.
- C. Use cast floor boxes for installations in slab on grade with thread conduit hubs; formed steel hot dipped galvanized boxes are acceptable for other installations.
- D. Where floor or fill depth is 3" or more, adjustable boxes with maximum vertical and angular adjustment for after concrete pour shall be used. After pour is complete, boxes shall be set and readjusted to provide a smooth surface conforming to the elevation and slope of the surrounding finished floor.
- E. In carpeted areas, Brass carpet flanges shall be installed to protect carpet edges where flush floor boxes are installed.
- F. All assemblies shall be designed and installed to maintain grounding continuity, fireproofing and watertight integrity.
- G. Box trim, service fittings and accessories shall be as specified on the drawings and as required for a complete and operational system.

- H. Flush caps removed to install service fittings shall be turned over to the Owner's Authorized Representative.
- I. Install floor boxes per UL Fire Resistance Directory. Do not exceed spacing and square foot area per unit requirements of specific product, UL fire resistance rating/classification for rating of floor.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 35

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SECTION 26 05 36 - PULL AND JUNCTION BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of pull and junction boxes.

1.3 DESCRIPTION

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating distribution system.
- B. Install pull and junction boxes as shown on drawings or as required by the National Electric Code (NEC).
- C. Install pull and junction boxes wherever required for a complete and operating distribution system whether shown on drawings or not.
- D. Where outlet boxes are used for pull or junction boxes, they shall meet the requirements of the outlet box section of these specifications.

1.4 SUBMITTALS

- A. Submit to Destin-Fort Walton Beach Airport (VPS) and engineer of record product data on all pull boxes showing:
 - 1. Covers.
 - 2. Dimensions - inside and out.
 - 3. Rating of concrete or gauge of metal.
 - 4. Manufacturer.

1.5 PROJECT AS-BUILT DOCUMENTS

- A. Record actual locations and mounting heights of pull and junction boxes and provide to VPS as-built drawings.

1.6 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. and requirements of NEC as suitable for purpose specified and shown.
- B. Conform to requirements of the following:
 - 1. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
 - 2. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 3. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

4. ANSI/NFPA 70 - National Electrical Code.
5. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 GENERAL

- A. Dimensions of pull and junction boxes shall meet dimensions shown on drawings or dimensions required by NEC, whichever is largest.
- B. Standard 25 cubic inch pull boxes shall meet the requirements of these specifications for outlet boxes as a minimum.
- C. All boxes 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. Pull and junction boxes (not in-ground type) used for systems larger than 25 square inches shall be hinged cover type with flush latches operated with screwdriver.
- C. Large Pull Boxes: Boxes larger than 400 cubic inches in volume or 20 inches in any dimension:
 1. Use hinged enclosure under provisions of Section 26 27 16 Cabinets and Enclosures.
- D. Exterior, damp location and wet location pull and junction boxes shall be NEMA 4x stainless steel.

2.3 SURFACE-MOUNTED CAST METAL BOX:

- A. NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
- B. Material: Cast aluminum.
- C. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Provide all hubs as required for conduit connections.

2.4 IN-GROUND PULL BOXES:

- A. Material: Pre-cast concrete.
- B. Bottom: Open with 6" of gravel for drainage.
- C. Cover: Meet Dept. of Transportation requirements for heavy traffic.
- D. Solid sides constructed to facilitate conduit entries.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install per NEC.
- B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- E. Install boxes to preserve fire resistance rating of partitions and other elements.
- F. Align adjacent wall-mounted boxes with each other.
- G. Use flush mounting boxes in finished areas.
- H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated walls.
- I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Pull and junction boxes larger than 25 square inches shall be supported with (2) all-thread rod hangers minimum. Increase quantity and size of all-thread rod hangers as required for application, and to eliminate movement and swaying.
- L. Do not fasten boxes to ceiling support wires.
- M. Support boxes independently of conduit.
- N. Pull boxes shall be installed in straight runs of conduit only. Pull boxes shall not be used in place of a conduit bend.

3.2 IN GROUND PULL BOXES

- A. Provide and install ground rod in each pull box. Connect #2 copper ground wires (counterpoise) to ground rod, run out pullbox 6" over conduits to next pull box; tie to respective building electrical ground rod at each building.
- B. Install pull boxes flush with finished grade. Provide extensions as required.

3.3 INTERFACE WITH OTHER PRODUCTS

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

3.4 ADJUSTING

- A. Install knockout closure in unused box opening.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 36

SECTION 26 05 53 ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of identification for electrical equipment.

1.3 DESCRIPTION

- A. Provide and install all equipment, labor and material for a complete identification system, including but not limited to:
 - 1. Nameplates and labels.

1.4 REFERENCES AND REGULATORY REQUIREMENTS

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

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Nameplates for Normal Branch Power shall be laminated black phenolic plastic with chamfered edges and white engraved lettering.
- B. Letter Size:
 - 1. 1/8 inch for identifying individual equipment and loads.
 - 2. 1/4 inch 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 approval. Nameplates for panelboards and switchboards 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. For example, "Fed From MDP-1:3:5". The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine.

- D. The following items shall be equipped with nameplates: Push-button stations, control panels, time switches, disconnect switches, and panelboards.
- E. All Electrical System panels.
- F. All receptacles shall be clearly labeled with panel/circuit designation.

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. Low voltage circuits (circuits under 120V):

2.3 DEVICE COVER PLATE IDENTIFICATION

- A. Description: Self-adhesive clear printed labels with Black typed letters (pre-printed, dot matrix, or laser).
- B. Locations:
 - 1. Each new receptacle cover plate.
- C. Legend:
 - 1. Receptacle plates shall adequately describe its associated panelboard and circuit reference.

2.4 UNDERGROUND WARNING TAPE

- A. Description: 6-inch-wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines, one strip per 24" of duct.

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 underground conduits using underground warning tape. Install one tape per 24 inches of trench at 3 inches below finished grade.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 05 53

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SECTION 26 08 00 - DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for demonstration of completed electrical system.

1.3 DESCRIPTION

- A. Demonstrate to owner Destin-Fort Walton Beach Airport (VPS) and Engineer of record the essential features of the following electrical systems:

- 1. Electrical Entrance Equipment

- a. Circuit breakers
 - b. Fuses and fuseholders
 - c. Meters (where applicable)

- 2. Miscellaneous Electrical Equipment

- a. Electrical systems controls and equipment
 - b. Electrical power equipment
 - c. Motor control devices
 - d. Relays
 - e. Special transformers
 - f. Starting devices
 - g. Surge suppression equipment

- 3. Distribution Equipment

- a. Lighting and appliance panelboards
 - b. Distribution panels
 - c. Switchboard
 - d. Voltage stabilizers

- 4. Wiring Devices

- a. Low-voltage controls
 - b. Switches: regular, time

- B. After the completion of testing, each system shall be demonstrated to operate successfully as intended.

1.4 TIME

- A. The demonstration shall be held upon completion of construction and installation of all systems at a date to be agreed upon in writing by the ENGINEER OF RECORD.

1.5 ATTENDING PARTIES

- A. Provide the demonstration in the presence of the Owner, Project Engineer and the manufacturer's representative(s).

1.6 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. Certificate of Completed Demonstration
 - 1. Submit to VPS Certificate of Completed Demonstration Memo Form (found under Division 1) signed by the contractor, subcontractor and Project Engineer for "each" type of equipment and system. Complete an individual form for each item, equipment and system. Insert one copy in each O & M manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 08 00

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of panelboards.

1.3 DESCRIPTION

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

1.4 SUBMITTALS

- A. Submit product data to Destin-Fort Walton Beach Airport (VPS) on each basic panelboard construction type, showing manufacturer's standard construction data including:

1. Cabinet construction/dimensions.
2. Bus construction.
3. UL labeling.
4. Each overcurrent device.

- B. Shop drawings shall be submitted for each panel and clearly indicate the following information:

1. Label.
2. Each circuit breaker amperage rating, circuit number and position/location in panel.
3. Electrical characteristics of panel.
4. Mains rating.
5. Main device rating.
6. Mounting.
7. Dimension, width, depth, height.
8. Bus material.
9. Interrupting capacity of minimum rated breaker.
10. Panel type.

1.5 PROJECT AS-BUILT DOCUMENTS

- A. Record actual locations of Panelboards on red lined as-built documents and indicate actual branch circuit arrangement.

1.6 OPERATION AND MAINTENANCE DATA

- A. Provide spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified for minimum ten years.

1.8 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by UL as suitable for purpose specified and indicated.
- B. Conform to the requirements of the following:
1. ANSI/NFPA 70 - National Electrical Code.
 2. NECA (National Electrical Contractors Association) - "Standard of Installation."
 3. NEMA AB 1 - Molded Case Circuit Breakers.
 4. NEMA PB 1 - Panelboards.
 5. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 6. UL 67 - Panelboards
 7. UL 50 - Cabinets and Boxes

1.9 FIELD MEASUREMENTS

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

1.10 MAINTENANCE MATERIALS

- A. Provide two keys per panelboard.

1.11 DELIVERY, STORAGE AND HANDLING

- A. Handle panelboards and enclosures carefully to prevent damage.
- B. Store equipment indoors and protect from weather.
- C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers:
1. Eaton/Cutler Hammer, General Electric, Square D, or Engineer of Record approved substitutions.

2.2 GENERAL

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1, circuit breaker type, dead front, UL 67.
- B. Panelboard Bus: Copper ratings as indicated. Provide copper ground bus in each panelboard. Provide mechanically and electrically isolated from ground full size neutral bus where neutral is applicable.

Provide non-linear load panelboards as specified on drawings. Panelboards feeding Non-linear loads shall have 200 percent rated neutral busbar.

C. Short-Circuit Rating:

1. Minimum short circuit interrupting capacity: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:
 - a. Individual C.B. AIC Rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.
 - b. Circuit breakers shall be based on a fully rated system.
 - c. Circuit breaker types are not specified. Provide breakers to comply with the required AIC specified.
 - d. No series ratings are allowed.
 - e. Short-Circuit Rating Label Panelboards shall be labeled with a UL short-circuit rating.

D. Enclosure:

1. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
2. Enclosures shall be provided with blank ends.
3. Where indicated on the drawings, branch circuit panelboards shall be column width type.
4. Regulatory Requirements:
 - a. NEMA PB 1, Type 1, Interior dry locations.
 - b. NEMA PB 1, Type 3R, Interior damp locations.
 - c. NEMA PB 1, Type 4X stainless steel watertight, Exterior locations including those noted on drawings to be NEMA 3R.
 - d. NEMA PB 1, Type 4X stainless steel watertight, interior wet locations, and wash-down areas, regardless of that noted on drawings.
 - e. UL 50

E. Cabinet box:

1. 6 inches (153 mm) deep; width: 20 inches (508 mm), minimum.
2. Interior dry and damp locations shall be constructed of galvanized code gauge steel, to prevent rust.
3. Exterior, wash-down areas, and Interior wet locations shall be constructed of type 4X stainless steel, watertight.

F. Cabinet Front:

1. Flush or surface with concealed trim clamps, concealed hinge, and flush lock all keyed alike.
2. Shall be door-in-door construction.
3. Finish in manufacturer's standard baked enamel finish for interior dry locations. Interior damp location panels to be painted with rust inhibit primer epoxy paint top coat system.
4. Exterior, wash-down areas, and Interior wet locations shall be constructed of type 4X stainless steel, watertight.

G. Panels and breakers shall be rated for voltage and class of service to which applied.

H. Spaces:

1. Space provisions or spaces for future breakers shall be located at the bottom of the panel and be fully bussed complete with all necessary mounting hardware less the breaker.

2.3 MAINS

A. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.

B. Regardless of what is shown on drawings provide the following minimum requirements.

1. Main circuit breaker on each panel serving building main if required by applicable codes.
2. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).

C. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

D. Main circuit breaker is not to be mounted as branch breaker or subfeed breaker.

2.4 CIRCUIT BREAKERS

A. General

1. Molded Case Circuit Breakers: NEMA AB 1, 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. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
2. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

B. Main Breakers:

1. Main breakers shall be individually mounted separate from branch breakers.
2. Covered by a metal plate, except for operating handle.
3. Connection from the load's side to the panel bus shall be bus bar. Insulated wire not permitted.

C. Branch Breakers:

1. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.
2. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.
3. Multi-pole breakers shall have common internal trip. No handle ties between single pole breakers are acceptable for this Project.
4. Single pole 15 and 20 ampere circuit breakers shall be rated for switching duty and shall be labeled as "SWD".

5. Rating shall be as called for under "2.2 GENERAL".
6. Ground Fault Circuit Interrupters (GFI):
 - a. Provide UL Class (5 milliamp sensitivity) ground fault circuit protection on 120 VAC branch circuits for exterior location receptacles and for interior locations where required by NEC. (These may not be indicated on Panel Schedule.) This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. Provide separate neutral for circuits on GFI breakers whether indicated on drawings or otherwise.
7. Breakers feeding heating and air conditioning equipment shall be rated HACR type breaker.

PART 3 - EXECUTION

3.1 PREPARATION/INSPECTION/EXAMINATION

- A. Verify that surface is suitable for panelboard installation. Do not install NEMA 1 equipment until building has reached the "dried-in" stage.
- B. Examine area to receive panelboard to assure adequate clearance for panelboard installation.
- C. Verify prior to installation that National Electrical Code clearances will be maintained after installation. Rework equipment locations as required to provide electrical code clearances.
- D. Start Work only after unsatisfactory conditions are corrected.
- E. Submit coordination drawings of all electrical rooms, showing all equipment. Comply with Section 26 05 00 Basic Electrical Requirements.

3.2 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practices.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 26 05 29 Supporting Devices.
- C. Panelboards shall be provided with structural framing located within gypsum board partitions. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Attach channels to framing provided within gypsum board partitions.
- D. Enclosures shall be installed so that the top is 6'-6" above finished floor.
 1. Where the size of the enclosure is such that the top cannot be installed at 6'-6", the top of the enclosure shall be kept as low as possible.

- E. Panelboard backboxes/trim covers mounted adjacent to each other (i.e. multi-section panels, etc) installed in finished areas be of same size.
- F. Provide filler plates for unused spaces in panelboards.
- G. Provide typed circuit directory from panelboard manufacturers' original card stock, for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names on inside of door. Room names shall be actual names or numbers used, not necessarily shown on the drawings. Progress Drawings shall show same arrangements as the Directory. Revise directory to reflect circuiting changes required to balance phase loads.
- H. Provide four each 1 inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
- I. Clean the interior of each panelboard before installing conductors. At all times, keep the interior trim and exterior surfaces of the panelboard free of rust and debris. Repaint finishes if necessary.
- J. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be neatly laced and arranged in orderly manner.
- K. Collect all keys upon delivery of panelboard. Store keys on one ring to be kept by project superintendent. Forward key ring with keys to Project Engineer at substantial completion.
- L. Provide a separate neutral conductor for each GFI breaker. These shall not be combined to serve more than 1 circuit, even where on different phases. Increase plan indications of conductors for neutral wires required, as necessary.
- M. Conduit or piping systems that contain water or liquid of any kind shall not be installed over the top of any electrical equipment, transformers, racks, cabinets, or enclosures without prior written approval from the Owner.

3.3 IDENTIFICATION

- A. Refer to Section 26 05 53 Electrical Identification for products and content.
- B. Provide engraved plastic nameplates under the provisions of 26 05 53.
- C. Nameplate shall show panel name, voltage and name of panel that feeds this respective panel, and UL short circuit rating.

3.4 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
- C. All circuits shall be operated to establish a good working order and checked for shorts.

- D. All panel directory circuit numbers shall be checked to verify accuracy of the number.
- E. Equipment Checkout:
 - 1. Where and when requested by Designer/Project Engineer provide (during construction):
 - a. Inspection of equipment by authorized equipment manufacturer technician complete with submittal of statement of findings by technician, and providing any adjustments deemed necessary for a complete and operating system.

3.5 ADJUSTMENT AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Tighten bus connections and mechanical fasteners.
- C. Touch up scratched and marred surfaces to match original finish.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 24 16

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SECTION 26 24 19 - MOTOR CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Division 1 Specifications sections apply to this section.
- B. See section on Motor Control Centers where applicable.

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of motor control and motor control equipment (other than motor control centers), and devices.

1.3 DESCRIPTION

- A. This section covers factory-assembled, metal-enclosed motor control units for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.
- B. Motor control units shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation, and control wiring.
- C. A motor controller is a motor starter (and visa versa).

1.4 FURNISHING OF EQUIPMENT

- A. Unless specifically noted otherwise, automatic motor starters for all equipment requiring them shall be furnished under the section or division where equipment is specified and installed under this Section of the specifications.
- B. Unless specifically noted otherwise manual motor starters shall be furnished and installed under this section of the specifications.
- C. Disconnect switches for 120V fractional HP exhaust fans are specified in Division 23. Other required disconnect switches are part of Div. 26.
- D. Provide lugs on all non-unitary mechanical equipment such as pumps, air handling units and individual motor units/equipment. Coordinate with Division 15.

1.5 CONTROL ITEMS

- A. Provide and install power circuits to all control devices requiring them (i.e. 120V dampers, control panels, control devices, etc.) whether shown on drawings or not. Coordinate requirements for all Work.
- B. Where applicable, raceways are to be routed utilizing overhead conduit racking system.
- C. Coordinate all work with HVAC controls for additional spacing on conduit racks as required.

1.6 SUBMITTALS

A. Product Data:

1. Provide catalog sheets showing:
 - a. Voltage.
 - b. Controller size.
 - c. Ratings and size of switching and overcurrent protective devices.
 - d. Short circuit ratings.
 - e. Dimensions.
 - f. Enclosure details.

B. Shop Drawings:

1. Electrical characteristics including voltage, withstand ratings and trip/ampere ratings.
2. Frame sizes and Interrupting Capacity of starter and/or disconnect unit.
3. Horsepower ratings at rated voltage of starter and/or disconnect unit.
4. Electrical ratings.
5. Single line diagram for power and control connections with numbered terminals and all required accessories.
6. All required accessories.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.7 PROJECT AS-BUILT DOCUMENTS

- A. Submit as-built documents to record actual locations of motor control units; indicate actual circuit numbers.

1.8 OPERATION AND MAINTENANCE DATA

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

1.9 QUALIFICATIONS

- A. Manufacturer: Same manufacturer as that for products specified in Section 26 05 00.

1.10 REFERENCE AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

B. Conform to the requirements of the following:

1. ANSI/NFPA 70 - National Electrical Code.
2. UL 198C- High-Interrupting Capacity Fuses; Current Limiting Type.
3. UL 198E - Class R Fuses.
4. NECA "Standard of Installation," published by National Electrical Contractors Association.

5. NEMA AB 1 - Molded Case Circuit Breakers.
6. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies.
7. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
8. NEMA KS 1 - Enclosed Switches.

1.11 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated, and comply with requirements and instructions of manufacturer.

1.12 EXTRA MATERIALS

- A. Provide three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers:
 1. Westinghouse/Cutler Hammer, General Electric, Square D, or approved substitutions.

2.2 GENERAL

- A. Motor starters shall be manual or automatic type as denoted on the drawings.
- B. Pilot lights shall have long-life lamps rated 7500 hours minimum.
- C. Enclosures shall be NEMA 1 for indoor locations and NEMA 4 (stainless steel) for outdoor or wet locations.
- D. Multi-speed or stop type controllers shall have thermal overload relays in each ungrounded conductor for each speed or step.
- E. Where multi-speed motors are scheduled on the drawings, the motor controls shall be compatible with the type motor and have adjustable time deceleration for transition from high to low speeds.

2.3 MANUAL CONTROLLERS (MANUAL STARTERS/SWITCHES)

- A. Manual Motor controller: NEMA ICS 2, AC general purpose Class A manually operated, full voltage controller with overload element, red pilot light and toggle operator.
- B. Fractional Horsepower Manual Controller: NEMA ICS 2, AC general purpose Class A manually operated, full voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light and toggle operator.
- C. Motor Starting Switch: NEMA ICS 2, AC general purpose Class A manually operated, full voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light and toggle operator.
- D. Provide auxiliary contacts where required for proper operation of system or where noted on drawings.

- E. Unit to be rated in accordance with NEMA Standards, sizes and horsepower rating. Final rating of overloads shall be field set and recorded.
- F. Unit shall be mounted on NEMA 1 enclosures (for interior use), NEMA 4 stainless steel (for exterior use), unless otherwise noted as NEMA ICS 6.
- G. Units shall be flush mounting type where noted on drawings.

2.4 AUTOMATIC CONTROLLERS (STARTERS)

- A. Magnetic Motor Controllers: NEMA ICS 2, AC general purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Reversing Controllers: Include electrical interlock and integral time delay transition between FORWARD and REVERSE rotation.
- C. Two Speed Controllers: Include integral time delay transition between FAST and SLOW speeds.
- D. Motor starter, unless otherwise noted, shall be across-the-line magnetic type rated in accordance with NEMA Standards, sizes, and horsepower ratings. Starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable from front without removing starter from enclosure. Overload relays shall be provided in each phase, and shall be melted alloy or bimetallic type. Thermal units shall be of the one-piece construction and interchangeable.
- E. Starters shall be equipped with minimum of two (normally open) auxiliary contacts in addition to the normally open auxiliary seal-in interlock and shall be suitable for the addition of at least two additional external electrical interlocks, one normally open and one normally closed. All starters shall have red "run" pilot light, "Hand-Off-Auto" selector switch, and nameplate. Control voltage shall be as required. Starters shall contain fused control transformers to provide correct control voltage.
- F. Starter for all motors sized one horsepower or larger shall include three-phase power monitor to provide solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage of (340-480VAC) (160-240VAC) (85-125VAC).
- G. Enclosure: Unit shall be mounted in NEMA 1 enclosure (for interior use), NEMA 4 stainless steel (for exterior use), unless otherwise noted as NEMA ICS 6.
- H. Disconnect: All automatic controllers (starters) are to have integral/ combination disconnect. Combine motor controller (starter) with motor circuit protector (unless fusible switch is required elsewhere in these specifications) disconnect in common enclosure. Provide means for locking disconnect handle, and means for defeating cover interlock.
- I. Motor Circuit Protector: NEMA AB 1, circuit breakers with integral instantaneous magnetic trip in each pole.
- J. Fusible Switch Assemblies: NEMA KC 1, enclosed knife switch with externally operable handle. Provide dual element fuses recommended for use.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine area to receive motor control units to assure adequate clearance for motor control unit installation.
- B. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install motor control units in accordance with manufacturer's written instructions, and NEC.
- B. All starters and their respective enclosures shall be provided with structural framing located within gypsum board partition. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Attach channels to framing provided within gypsum board partitions.
- C. Starters shall be installed with their turning axis of their handles approximately 5'-0" above finished floor. Provide rigid steel (Hot-dipped galvanized or stainless steel for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.
- D. Starters shall be mounted where shown on the drawings. Where the starter also provides the code-required disconnecting means for a load, the starter shall be located within sight of the load and as close as feasible.
- E. Install fusing in all fusible switches.
- F. Provide properly sized heater elements for every starter overload relay. The element shall be sized using the nameplate full load running current of the actual equipment supplied to the job.
- G. Provide a heater element selection chart on the inside of each starter door.
- H. Provide spare pilot light lamps to the Owner's Authorized Representative. Provide 2 of each type and size load.
- I. Provide nameplate for each control units.
- J. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.3 FIELD QUALITY CONTROL

- A. Inspect and test each enclosed controller to NEMA ICS 2.
- B. Test run each motor.

3.4 ADJUSTMENT AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.

- B. Touch-up scratched or marred surfaces to match original finish.
- C. Tighten bus connections and mechanical fasteners.

END OF SECTION 26 24 19

SECTION 26 27 16 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of cabinets and enclosures.

1.3 DESCRIPTION

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
 - 1. Hinged cover enclosures.
 - 2. Cabinets.
- B. Cabinets and enclosures are to include:
 - 1. Terminal blocks,
 - 2. Mounting panel,
 - 3. Ground bus/bar, and
 - 4. All accessories as required for a complete and operating system.

- C. Provide cabinets and enclosures for all systems specified in Division 26.

1.4 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- B. Conform to the requirements of the following:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
 - 3. ANSI/NFPA 70 - National Electrical Code.

1.5 SUBMITTALS

- A. Submit Product Data to Destin-Fort Walton Beach Airport (VPS) and Engineer of Record: Provide manufacturer's standard data for enclosures and cabinets.
- B. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- C. Submit shop drawings on all cabinets and enclosures showing:

1. Covers.
2. Dimensions - inside and out.
3. Gauge of metal.
4. Manufacturer.
5. Terminal mounting plate, construction, etc.
6. Ground bus/bar.

1.6 EXTRA MATERIALS

- A. Provide two keys for each type of lock.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless specifically called for otherwise on contract drawings, provide "CABINETS" as specified herein for terminal cabinets mounted indoor. Similarly, provide "HINGED COVER ENCLOSURES" as specified herein for terminal cabinets mounted outdoors or in locations other than NEMA 1 locations. Also, provide "HINGED COVER ENCLOSURES" for locations where size required is not available in "CABINET" construction, or if specifically specified as "enclosure" on contract documents.
- B. Size.
 1. Dimensions of cabinets and enclosures shall meet the dimensions shown on drawings, dimensions required by NEC, or dimensions sized as required to facilitate all equipment/connections involved installation, whichever is largest.
 2. Coordinate sizes required and assure that equipment cabinets or enclosures will house and facilitate proper installation and access to equipment.
- C. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring or where wiring from separate systems of Normal and Emergency Power are required to be in one enclosure.
- D. Provide accessory feet or mounting brackets for free-standing equipment.

2.2 HINGED COVER ENCLOSURES

- A. Construction:
 1. Interior Dry Locations: NEMA Type 1 (unless otherwise noted), steel.
 2. Exterior and Interior Wet Locations: NEMA Type 4X: Stainless steel.
- B. Covers: Continuous hinge.
- C. Enclosure Finish:
 1. NEMA 1: manufacturer's standard metallic gray enamel over phosphatized surfaces.
 2. NEMA 4X: Stainless steel.
- D. Lock/handle.
 1. Provide key lock handle on all enclosures mounted in areas that are not dedicated electrical or mechanical rooms. Enclosures installed in electrical rooms are not required to be lockable.

- E. Interior mounting plate.
 - 1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
 - 2. Plate/panel is to be metal.
- F. Ground bus/bar.
 - 1. Each enclosure housing surge suppression equipment or other equipment shall have "local" ground bar/bus installed. See Article "Local Ground Bus/Bar".

2.3 CABINETS

- A. Construction: Specified gauge steel with removable enwalls.
- B. Finish:
 - 1. Boxes:
 - a. Surface mounted: Gray baked enamel.
 - b. Flush mounted: Galvanized steel.
 - 2. Fronts: Gray baked enamel.
- C. Fronts:
 - 1. Electrical or mechanical room locations: screw cover with hinged door and flush handle or as noted below.
 - 2. Other locations: mono-flat with concealed trim clamps, concealed hinges, flush lock lockable handle, and custom color finish in interior public areas to match mounting surface.
 - 3. Flush or surface type as shown or called for on contract documents.
- D. Interior mounting plate.
 - 1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
 - 2. Panel/plate shall be metal.
- E. Ground bus/bar.
 - 1. Each cabinet housing surge suppression equipment or other equipment shall have "local" ground bar/bus installed. See specification for "Local Ground Bus/Bar" included within this section.

2.4 TERMINAL BLOCKS

- A. Terminal Blocks: ANSI/NEMA ICS 4.
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.5 LOCAL GROUND BUS/BAR

- A. Size to handle #6 through #14 AWG copper ground wire.
- B. Length as required for circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive Work.

3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install enclosures and cabinets plumb. Anchor securely to wall and structural supports at each corner.
- C. Install cabinet fronts plumb.
- D. Install per N.E.C. and as required for proper clearance. Coordinate with panels.
- E. Provide and install terminal cabinets as shown on drawings or as required by the National Electrical Code (NEC).
- F. Provide terminal cabinets wherever required for a complete and operating distribution system whether shown on drawings or not.
- G. Install local ground bus/bar in each terminal cabinet/enclosure that houses surge suppression equipment or other equipment and bond to cabinet enclosure via mounting screws or #6 AWG copper ground wire.
- H. Ground local ground bus to "SYSTEMS" ground bus/bar with minimum #6 AWG copper ground wire. Increase size if so required on drawings.
- I. Install enclosures.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 27 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of wiring devices.

1.3 DESCRIPTION

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
 - 1. Wall switches.
 - 2. Wall dimmers.
 - 3. Receptacles.
 - 4. Device plates and decorative box covers.
 - 5. Motion Sensors (Interior Wall Switch)

1.4 SUBMITTALS

- A. Submit Product Data to Destin-Fort Walton Beach Airport (VPS) and Engineer of Record: Provide manufacturer's catalog information showing dimensions, colors, and configurations including all types of wiring devices, 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.

1.5 QUALIFICATIONS

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

1.6 REFERENCES AND REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- B. Conform to the requirements of the following:
 - 1. ANSI/NFPA 70 - National Electrical Code
 - 2. NEMA WD 1 - General Purpose Wiring Devices.

3. NEMA WD 5 - Wiring Devices, Special Purpose
4. NEMA WD 6 - Wiring Device Configurations.

1.7 EXTRA MATERIALS

- A. Provide a minimum of two (2) screw drivers of each type of tamper proof screw used on project. Turn over to Project Engineer. Include receipt in O&M 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, wiring devices, special purpose.
- C. All wiring devices shall bear UL labels.
- D. All devices of one type shall be by the same Manufacturer.
 1. "Hazardous Location" and special purpose devices as may not be available from the same manufacturer shall constitute the only exception to this requirement of single source.
- E. Corrosion resistant devices shall be as specified for normal usages, 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.
 1. Provide factory packaged wiring devices having high impact strength molded plastic bodies.
- F. Except where specifically required, the use of interchangeable type or combination switch-receptacle-pilot devices are not acceptable.

2.2 WALL SWITCHES

- A. 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.
 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. Switches connected to emergency power shall have red lighted handles which shall illuminate when the switches are "Off".
7. Voltage and ampere rating of switches shall be marked on switch, and shall conform to voltage of system to which applied.
8. Switches shall have back and side wired screw pressure terminals.

B. Description: NEMA WD 1, heavy-duty, AC only general-use snap switch.

C. Voltage Rating: 120-277 volts, AC.

D. Current Rating: 20 amperes minimum.

E. 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. Color to match plates unless specifically noted otherwise.
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 stainless steel cover plates.
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.
6. Receptacles to be installed in shower rooms, locker rooms, toilet rooms, janitors' closets, exterior, elevator pit and machine rooms, escalator pits, within six (6) feet of a sink, and other areas as required by NEC, and OSHA Standards shall be ground fault circuit interrupting (GFCI) type, whether specified or not.
7. Receptacles installed for water coolers shall be GFCI type, or a single receptacle as permitted by NEC.

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.

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. Receptacle and switch cover plates shall be nylon. Coordinate color with architect/owner.
- C. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed.

2.5 COLOR

- A. Wiring devices connected to normal power shall be gray unless specifically noted otherwise.
- B. All devices and coverplates in paneled walls shall have finish to match paneling.
- C. Modify any given catalog numbers as required to procure devices and plates of the proper color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify floor boxes are adjusted properly.
- D. 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. In general, lighting control switches shall be located at the lock/strike plate side of door(s). If the drawings indicate otherwise, issue a request for clarification prior to rough-in.
- E. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- F. Install receptacles with grounding pole on bottom.

- G. Where 2 or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems or a combined system voltage of 480 volt.
 - 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. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.
 - K. 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.
 - L. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.
 - M. All devices shall be installed so that only one wire is connected to each terminal.
 - N. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.
 - O. Receptacles shown to be floor mounted shall be installed in floor boxes (with coverplates) which are approved for this use.
 - P. Connect wiring devices by back wiring conductor into compression terminal.
 - Q. Install protective rings and split nozzle on active flush cover service fittings.
- 3.4 NEUTRAL CONDUCTOR CONNECTIONS
- A. At each receptacle "in" and "out" phase and neutral conductors shall have an additional conductor "pigtail" 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 to obtain specified mounting heights.
- 3.6 FIELD QUALITY CONTROL
- A. Inspect each wiring device for defects.
 - B. Operate each wall switch with circuit energized and verify proper operation.
 - C. Verify that each receptacle device is energized.
 - D. Test each receptacle device for proper polarity.

- E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 27 26

SECTION 26 28 16 – ENCLOSED DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of enclosed disconnect switches.

1.3 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 15 for disconnect switches for mechanical equipment. Provide all other disconnect switches required for a complete operating system.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver switches in factory wrapped packaging. Handle switches carefully to prevent damage. Store in a clean, dry space protected from dirt, water, and physical damage. Reject damaged switches.

1.5 SUBMITTALS

- A. Submit catalog cut sheet on each type of disconnect switch to be used on this project to Destin-Fort Walton Beach Airport (VPS) and Engineer of Record.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers:
 - 1. General Electric, Eaton/Cutler Hammer, Square D or approved substitution.

2.2 CONSTRUCTION

- A. Switches shall be heavy-duty type with visible, quick-make, quick-break blades.
- B. Provide ground bus and where required, a solid neutral bus.
- C. Switches shall be fusible or non-fusible as noted on the drawings or as required by the equipment served from the switch. Fusible switches shall have rejection type fuse holders.
- D. Terminal lugs shall be rated for 75 degrees Centigrade.

- E. Enclosures, unless otherwise noted, shall be:
 - 1. Interior dry locations shall be NEMA 1.
 - 2. Kitchens, food processing, wash-down areas, interior wet locations or similar shall be NEMA 4X stainless steel watertight, corrosion resistant.
 - 3. Exterior locations shall be NEMA 4X stainless steel watertight, corrosion resistant, including those noted on drawings to be NEMA 3, minimum.
- F. 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.
- G. Finish for NEMA I units shall be standard baked gray enamel finish over a rust inhibiting phosphate primer.

2.3 RATING

- A. The size, number of poles, and fusing for each switch shall be as noted 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.
- C. Switches serving motor loads shall be horsepower rated to match motor and of sufficient size to handle the load regardless if rating noted on drawings is provided in ampere.

2.4 FUSES

- A. General:
 - 1. All fuses shall be of the same manufacture to retain selectability as designed. No fuse shall be installed until equipment is ready to be energized and after tightening of all electrical connections, inspection of all ground and grounding conductors and a megger test of adequate insulation to ground of all circuits.
 - 2. All fuses shall be current limiting with 200,000 amperes interrupting capacity.
 - 3. Fuses rated 601 amperes and larger shall be UL Class L and have a minimum time-delay of 45 seconds at 300% rating and have O-ring gas seals at the end bells.
 - 4. Fuses rated 600 amperes or less, installed ahead of circuit breakers or circuit breaker panels, shall be UL Class K-1.
 - 5. Fuses rated 600 amperes or less for all general power circuits shall be dual-element, UL Class RK-5 time-delay type. They shall be self protecting from extraneous heat.
 - 6. Fuses installed in individual motor circuits shall be dual element time-delay type, UL Class RK-5. Provide fuse reducers when necessary.
 - 7. Fuses called for to be rejection type are to have rejection fuse holders.
 - 8. Fused disconnect switches for elevators and escalators shall have rejection fuse holders.
- B. Fuse Requirements:
 - 1. Dimensions and Performance: NEMA FU 1, Class as indicated.
 - 2. Voltage: Rating suitable for circuit phase-to-phase voltage.
 - 3. Main Service Switches Larger than 600 amperes: Class L (time delay).
 - 4. Motor Load Feeder Switches: Class RK5.

5. Motor Branch Circuits: Class RK5.
- C. Identification Label:
1. Provide a fuse identification label inside each fused switch, showing type and size of each fuse specified or as recommended by the manufacture of the equipment served.
 2. Labeling for rejection type fused switches shall read "Warning-Use Only Current Limiting Fuses Class ___, Type ___, MFR ___".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all switches in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practice.
- B. All switches shall be firmly anchored to walls and supporting structures (where used). 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. 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 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. 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.
- F. Install fuses in accordance with manufacturer's instructions, the NEC, and NEMA Standards.
- G. Install fuse with label oriented such that manufacturer, type, and size are easily read.
- H. Label each fuse.
- I. Conduit or piping systems that contain water or liquid of any kind shall not be installed over the top of any electrical equipment, transformers, racks, cabinets, or enclosures without prior written approval from the Owner.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 28 16

SECTION 26 35 00 - SURGE SUPPRESSION EQUIPMENT (120VAC TO 480VAC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of surge suppression equipment for 120-volt AC to 480 volt AC circuits.

1.3 DESCRIPTION

- A. Provide all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as specified for systems with voltages between 120VAC and 480VAC.
- B. Provide surge suppression equipment for the following equipment:
 - 1. Each existing and new main electrical service switchboard as called for on drawings.
 - 2. Distribution and branch panels as called for on drawings.
 - 3. All electronic communications equipment installed including but not limited to: monitoring/metering equipment.
 - 4. Point of use locations (receptacles, plug-in units) as required.
- C. All surge protection to be connected via a 30A 3 pole circuit breaker (whether shown on Plans/Schedules or not.)

1.4 SUBMITTALS

- A. Submit the following 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. Internal fusing/Thermal Protection
 - 7. Recommended overcurrent protection
 - 8. Size of wire leads
 - 9. Visual failure indicator
 - 10. Warrantee
 - 11. Performance data showing compliance with performance as specified herein
 - 12. Non-Potted construction

1.5 PROJECT AS-BUILT DOCUMENTS

- A. Record locations of surge protection units; indicate actual units used on red lined as-built documents.

1.6 OPERATION AND MAINTENANCE DATA

- A. All approved shop drawings, product data, and cutsheets.
- B. Installation, connection, and maintenance information on each type of surge suppression.
- C. Procedure and time table for recommended periodic inspection of devices to determine usefulness and life expectancy.

1.7 QUALITY ASSURANCE

- A. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.
- B. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor. Factory representatives are to approve installation prior to Substantial Completion.

1.8 REFERENCES AND REGULATORY REQUIREMENTS

- A. Equipment Certification: Surge suppression equipment shall be UL listed and labeled for intended use.
- B. Surge suppression devices shall be selected, installed and located in accordance with requirements of the following:
 - 1. ANSI/NFPA 780 - Lightning Protection Code, latest edition.
 - 2. ANSI/NFPA 70 - National Electrical Code, current adopted year.
 - 3. U.L. 1449 – 3rd Edition, Standard for Safety for Surge Protective Devices.
 - 4. 1363-1986 - Standard for Temporary Power Taps.
 - 5. ANSI/IEEE C62.41-1991 (IEEE 587) - Guide for Surge Voltages in Low-Voltage AC Power Circuits.
 - 6. ANSI/IEEE C62.33-1982 - Standard Test Specifications for Varistor Surge Protection Devices.
 - 7. ANSI/IEEE C62.45-1987 - IEEE Guide for Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

1.9 COORDINATION/PROJECT CONDITIONS

- A. Verify proper grounding is in place.
- B. Verify if space and proper clearance for the surge suppressor installation is available.
- C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge suppression device.

1.10 WARRANTY

- A. All surge suppression devices shall be warranted to be free from defects in materials and workmanship for a period of five (5) years.
- B. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced at no cost to the owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Suppressors shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (L-N-G) mode protection.
- B. Suppressors shall be of a hybrid design, and include circuitry with tight, wave-tracking clamping characteristics.
- C. Suppressors shall be designed to withstand a maximum continuous operating voltage of not less than 115% of nominal RMS line voltage.
- D. Suppressors shall contain internal safety fusing to disconnect the suppressor from the electrical source if the suppressor fails, in order to prevent catastrophic failure modes.
- E. Suppressors shall be fail safe, shall allow no follow-thru current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.
- F. Suppressors shall be UL 1449 listed and shall be approved for the location in which they are installed.

2.2 SUPPRESSOR CRITERIA

- A. Main Electrical Service Entrance Suppressors (First Level of Protection) shall meet or exceed the following:
 - 1. General:
 - a. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltage using Cat. C3 test criteria.
 - b. Suppressors shall be sequential surge tested as per IEEE C62.45-1987, and shall withstand 1000 test cycles at 120kA, Cat. C3 test criteria.
 - c. Internal fusing for each phase connected.
 - d. Fail-safe with no hold over current.
 - e. Enclosure:
 - 1) Listed.
 - 2) Fire retardant.
 - 3) NEMA 1 as required for each location.

- B. Branch Distribution and/or SubPanels (Second Level of Protection), suppressors shall meet or exceed the following:
1. General.
 - a. Suppressors shall be tested as per IEEE C62.41-1991 to determine clamping voltage using Cat. B3 test criteria.
 - b. Suppressors shall be sequential surge tested as per IEEE C62.45-1987, and shall withstand 1000 test cycles at 120kA, Cat. B3 test criteria.
 - c. Internal fusing for each phase connected.
 - d. Fail-safe with no hold over current.
 - e. Enclosure:
 - 1) Listed.
 - 2) Fire retardant.
 - 3) NEMA 1.
- C. Point of Use Location (120 Volt), Hardwire.
1. 1449 Listed.
 2. 20 Amp, 120V rated. All components must be 20 Amp rated.
 3. Suppressors shall be tested per IEEE, C62.41-1991 for categories A and B.
 4. Internal fusing.
 5. Indicators for normal operation and failure indication.
 6. Enclosure: Fire retardant high impact, phenolic or plastic housing or metal enclosure.
 7. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3kA, 8 x 20 μ s): 350V @ 120V.
 8. Maximum Surge Capacity: 20,000 Amps.
 9. Maximum continuous operating voltage: 115% of line voltage.
 10. Provide hardwire connection or add 20-amp receptacle device to hardwired devices to match equipment being protected and maintain UL Listing.
- D. Point of Use Location (120 Volt) Plug Strip
1. 20 amp, 120V rated.
 2. Suppressors shall be tested per IEEE, C62.41-1991 for categories A and B.
 3. Normal Mode (L - N), and common mode (L+N-G) protection.
 4. Internal fusing.
 5. 6 ft. line cord.
 6. Protected outlets.
 7. Indicators for normal operation and failure indication.
 8. Re-settable circuit breaker.
 9. On/off switch.
 10. Extruded aluminum enclosure.
 11. Clamping voltage UL 1449, line to neutral, Category B impulse at (3kA, 8 x 20 μ s): 310V @ 120V.
 12. Maximum Surge Capacity: 20,000 Amps.
 13. Maximum continuous operating voltage: 135V.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide suppressor at first piece of electrical equipment (switchboard) that the electrical service encounters as it enters the facility.
- B. Provide suppressor at each branch panel as noted on drawings.
- C. Provide surge suppression at location where data, metering, or monitoring equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect TVSS equipment to equipment being protected and maintain UL listing.

3.2 INSTALLATION OF SUPPRESSORS

- A. Suppressors shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.
- B. Suppressors shall be close nipped to the device being protected in a position near the neutral bus which will minimize lead length between suppressor and the buses or control breaker to which the suppressor connects. Suppressor leads shall not extend beyond the suppressor manufacturer's recommended maximum lead length without specific approval of the Designer.
- C. Location shown on drawings is diagrammatic only.
- D. Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.
- E. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and approved connections unless otherwise noted. Referenced to a common earth ground.
- F. Suppressors shall be installed in a manner that allows simple replacement within short periods of downtime.
- G. Suppressors other than point of use type shall be installed with a means of disconnecting the suppressor at the panel. At the main service entrance location, provide a dedicated 30 amp, 3P-CB, 100,000 A.I.C. for the TVSS device. At the distribution secondary and subpanel locations, provide dedicated 20 amp or 30 amp, 3P-CB's, for the TVSS device. Label disconnect or CB "Surge Protector". Fused disconnects may be substituted for the CB, with the approval of the Designer. Change rating of CB's noted above as required to properly provide system as recommended by manufacturer.
- H. Suppressors at main switchgear are to be mounted integral to switchgear. Comply with all codes and UL labeling. Provide UL label for complete system. All status indicators are to be mounted to switchgear door, visible from exterior of switchgear without requiring operation of door, lid, etc.
- I. Suppressors at distribution panels to be mounted external to panel cabinet in NEMA 1 enclosure.

PART 4 - METHOD OF MEASUREMENT

- 4.1 Separate payment shall not be made for items in this section. Items in this section shall be considered incidental to the project pay items.

PART 5 - BASIS OF PAYMENT

- 5.1 No direct payment shall be made for the work described in this section. The work described in this section is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

END OF SECTION 26 35 00

SECTION 26 41 00 - LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General Conditions, Special Conditions, and other sections apply to this section.

1.2 SUMMARY

- A. This section includes the requirements for provision and installation of a complete lightning protection system.

1.3 DESCRIPTION

- A. The lightning protection design shown in the plans shall be considered the minimum acceptable design criteria. The lightning protection systems provided under this specification shall equal or exceed the minimum requirements shown in the plans and shall comply with this specification.
- B. A Lightning Protection System shall be provided and installed on the airfield lighting vault by experienced LPI Certified or UL Listed Installers in compliance with provisions of National Fire Protection Association (NFPA) 780, Standard for the Installation of Lightning Protection Systems and Underwriters' Laboratories (UL) UL 96 and UL 96A. 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 the Lightning Protection Institute (LPI).
- C. Materials shall comply in weight, size and composition with the requirements of Underwriters' Laboratories UL 96 and NFPA 780 relating to this type of installation, and shall be UL Labeled.
- D. All materials, where available by any one manufacturer, shall be cast.
- E. System shall be inspected by an independent third party organization. As a result of the inspection the third party shall provide the following endorsement/accreditation.
 - 1. New Installation:
 - a) UL Master Label Service.
 - b) LPI Master Label Certificate.
 - 2. Reconditioned Installation:
 - a) UL Master Label Service.
 - b) LPI Reconditioned Master Label Certificate.
 - 3. Modified or partial installation:
 - a) UL Letter of Finding.

b) LPI Limited Scope Inspection.

4. All prerequisite work and coordination necessary to obtain the independent third party inspection (including required coordination/work/shop drawings, etc. prior to the actual lightning protection system installation) is the responsibility of the Contractor.

1.4 REFERENCES

- A. NFPA 780 - Standard for the Installation of Lightning Protection Systems.
- B. UL 96 – Standard for Safety - Lightning Protection Components.
- C. UL 96A – Standard for Safety - Installation Requirements for Lightning Protection Systems.
- D. LPI 175 – Standard for the Design – Installation – Inspection of Lightning Protection Systems.
- E. LPI 177 – Inspection Guide for Certified Systems.

1.5 SUBMITTALS

- A. Submit shop drawings showing layout of air terminals, strike termination devices, grounding electrodes, conductors, bonding connections to structure and other metal objects. Include air terminal, electrode, and conductor sizes, and connection and termination details. Shop drawings shall include complete dimensioned layout of all components, conductors, electrodes, and bonding points, and connections. Shop drawings/submittal shall be prepared by a LPI Certified or UL Listed Installer.
- B. Submit product data showing dimensions and materials of each component, and include verification of listing in accordance with UL 96.
- C. Submit manufacturer's installation instructions.

1.6 PROJECT AS-BUILT DOCUMENTS

- A. Record actual locations of strike termination devices, grounding electrodes, bonding connections, and routing of system conductors on red lined as-built documents.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specialized in lightning protection equipment with minimum five (5) years documented experience.
- B. Installer: Authorized installer of manufacturer with minimum five (5) years documented experience and LPI Certified or UL Listed Installer.

1.8 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference one (1) week prior to commencing lightning protection work. All submittals shall be complete and accepted prior to scheduling conference.

1.9 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. Harger Lightning & Grounding, Inc.: Premium Line.
- B. Thompson Lightning Protection, Inc.: Premium Line.
- C. Heary Bros. Lightning Protection: Premium Lines.

2.2 MATERIALS

- A. Components: In accordance with UL 96 and LPI.
- B. Air Terminals:
 - 1. Air Terminals shall be solid (aluminum) as required to match roof conductors, and shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface.
 - 2. Terminal length: Comply with NFPA 780.
- C. Conductors:
 - 1. Roof conductors shall consist of aluminum complying with the weight and construction requirements of the standard. Roof conductor material shall match and 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. Use approved bi-metal connector for transition.
- D. Fastener: Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor.
- E. Connectors and Splicers: Bronze or aluminum as required to be compatible with conductor being connected.
- F. Ground Rods: Comply with all requirements of Item L-108 and Item 26 05 26.
- G. Comply with additional minimum requirements shown in Contract Documents.

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, NFPA 780, and LPI 175.
- C. Install ground rods in accordance with Item L-108 and Item 26 05 26. Where conflict exists between the requirements of Item L-108, Item 26 05 26 and this Section, the most stringent shall govern.
- D. Installation shall be made in an inconspicuous manner with conductors routed to conceal as much as possible. Down conductors shall be concealed within structure, and shall be run in 1" PVC conduit. See Paragraph 'F' below and NFPA 780 4.18.
- E. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- F. Conductors concealed in steel reinforced concrete shall be installed and bonded per NFPA 780 4.18. Specific attention is brought to the requirements of 4.9.13 requiring down conductors to be connected to reinforced steel at its upper and lower ends.
- G. Lightning protection system shall be bonded to metal bodies as required by NFPA 780 4.16.
- H. Provide proper connections of lightning protection system to all grounded media in and around the protected structure per NFPA 780 4.15 "Potential Equalization".
- I. Provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14 including electric service, telephone and antenna system grounds as well as underground metallic piping systems, underground metal conduits, etc.
- J. Ground loop: Bond to ground loop system. See Item 26 05 26. Items required to be bonded/connected in 'H' and 'I' above shall be bonded/connected via ground loop system where available and applicable.
- K. All exposed conductors located 6 ft. or less above finished floor or finished grade are to be suitably protected/shielded as well as other exposed locations where conductor is subject to mechanical damage.
- L. Coordinate and receive approval of all penetrations of roofing system and mounting to roofing system with Architect and Roofing Contractor prior to submittal of shop drawings.
- M. Coordinate and receive approval of all connections to structural steel, rebar, and other structural elements with Structural Engineer prior to submittal of shop drawings.
- N. Ground connections shall be made in accordance with requirements of all applicable codes and Item L-108, Item L-111 and Item 26 05 26 (including but not limited to requirements for testing, ground rods, materials, wells, etc.).

3.4 FIELD QUALITY CONTROL

- A. Test lightning protection system components in accordance with Item L-111.

- B. Obtain the service of UL or LPI to provide third party inspection and certification of the lightning protection system to NFPA 780. Submit certification and submit in O & M Manual.
- C. Submit test results on each grounding electrode, include location including final length of each ground rod and final distance between each installed ground rod in O & M Manual.

PART 4 - METHOD OF MEASUREMENT

4.1 METHOD OF MEASUREMENT

- A. The items described in Item 26 41 00 are incidental to other pay items and shall not be measured for payment.

PART 5 - BASIS OF PAYMENT

5.1 BASIS OF PAYMENT

- A. No direct payment shall be made for the work described in Item 26 41 00. The work described in Item 26 41 00 is incidental to other items and shall be paid for in the respective bid item of which it is a component part.

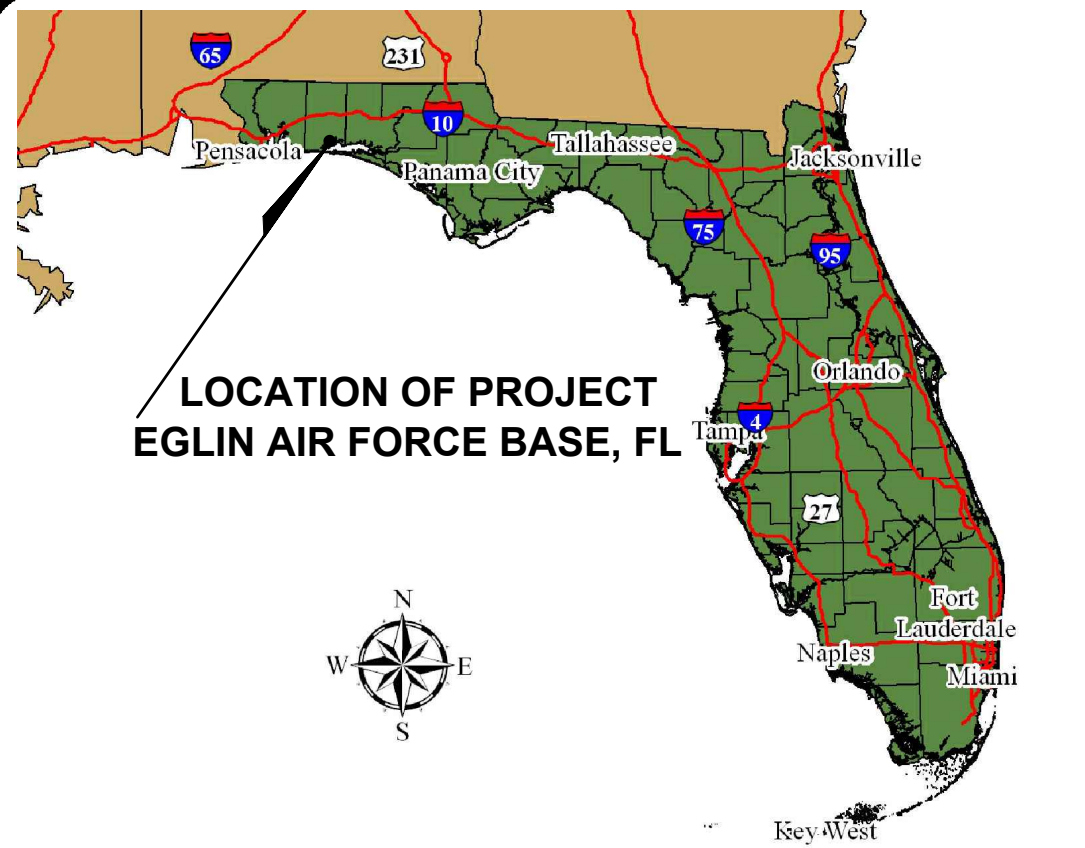
END OF SECTION 26 41 00

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DESIGN DRAWINGS FOR:

VPS CHILLER REPLACEMENT


DESTIN-FORT WALTON BEACH AIRPORT (VPS)
EGLIN AIR FORCE BASE, FLORIDA



LOCATION OF PROJECT
EGLIN AIR FORCE BASE, FL

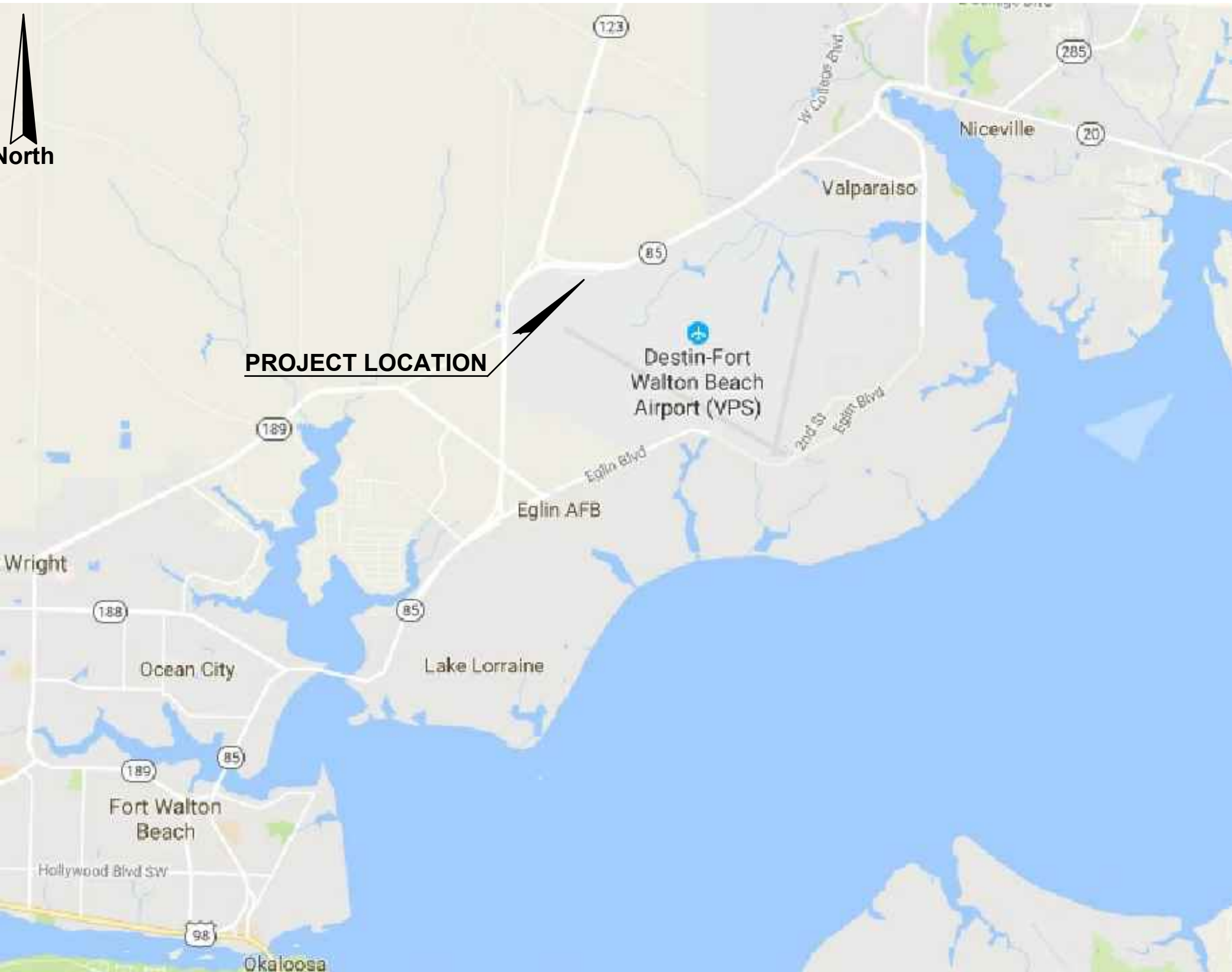


DESTIN-FORT WALTON BEACH AIRPORT



SITE LOCATION

PROJECT LOCATION
VICINITY MAPS
N.T.S.



PROJECT LOCATION

Destin-Fort
Walton Beach
Airport (VPS)

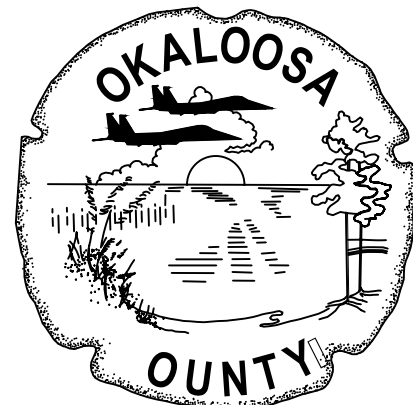
Eglin AFB

LOCATION MAP
N.T.S.

DRAWN BY:
CHECKED BY:
APPROVED BY:
DATE:
PROJECT NO.

NO.	DATE		

OWNER



Okaloosa County Airports
1701 State Road 85 North
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Phone: (850) 651-7160
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Airports Director: TRACY STAGE, A.A.E.
Projects & GA Manager: CHAD ROGERS, P.E.

COMMISSIONERS

- DISTRICT 2: GRAHAM FOUNTAIN, CHAIR
- DISTRICT 1: KELLY WINDES, VICE CHAIR
- DISTRICT 3: CAROLYN KETCHEL
- DISTRICT 4: NATHAN BOYLES
- DISTRICT 5: TREY GOODWIN



320 BAYSHORE DRIVE, SUITE A - NICEVILLE, FL
CORPORATE CERTIFICATE OF AUTHORIZATION NUMBER: 5057
Project Manager: John Collins, P.E.

RELEASE FOR BID

N:\NICEVILLE-PROJECTS\050-OKALOOSA COUNTY AIRPORTS\2017.050.11-VPS CHILLER REPLACEMENT\00 CAD January 9, 2018

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GENERAL	
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G-002	INDEX OF DRAWINGS & SUMMARY OF QUANTITIES
G-003	GENERAL NOTES
G-004	CONSTRUCTION SAFETY AND PHASING PLAN
MECHANICAL	
M-001	MECHANICAL LEGEND AND NOTES
M-101	MECHANICAL OVERALL FIRST FLOOR PLAN
M-102	MECHANICAL OVERALL SECOND FLOOR PLAN
M-103	MECHANICAL PHASING PLANS
M-111	MECHANICAL FIRST FLOOR ENLARGED PLANS
M-112	MECHANICAL SECOND FLOOR ENLARGED PLANS
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M-115	MECHANICAL CHILLER DEMOLITION ROOF PLAN
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M-301	MECHANICAL FLOW DIAGRAM
M-501	MECHANICAL DETAILS
M-502	MECHANICAL DETAILS
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E-601	ELECTRICAL PANEL SCHEDULES
E-602	ELECTRICAL PANEL SCHEDULES
STRUCTURAL	
S-001	STRUCTURAL GENERAL NOTES
S-100	STRUCTURAL DETAILS



AVCON, INC.
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 CORPORATE CERTIFICATE OF AUTHORIZATION NUMBER: 5057
 www.avconinc.com

**DESTIN-FORT WALTON
 BEACH AIRPORT**

**VPS CHILLER
 REPLACEMENT**

**INDEX OF DRAWINGS
 & SUMMARY OF
 QUANTITIES**

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REVISIONS:

NO.	DATE	BY	DESCRIPTION

RELEASE FOR BID

DESIGNED BY: J.R.C.
 DRAWN BY: S.M.M
 CHECKED BY: J.R.C.
 APPROVED BY: V.C.L.
 DATE: DECEMBER 2017

AVCON PROJECT NO. 2017.050.11

SHEET NUMBER

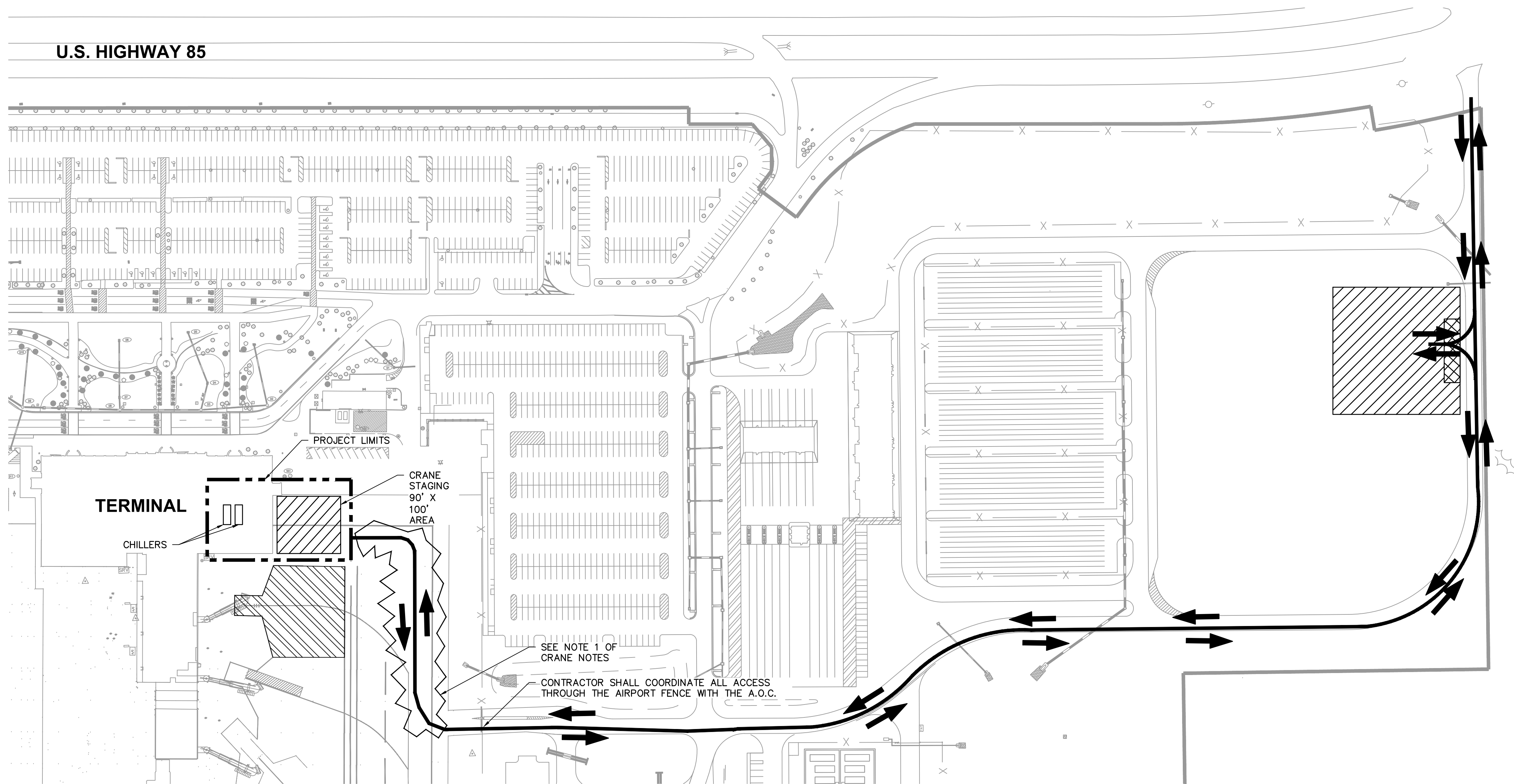
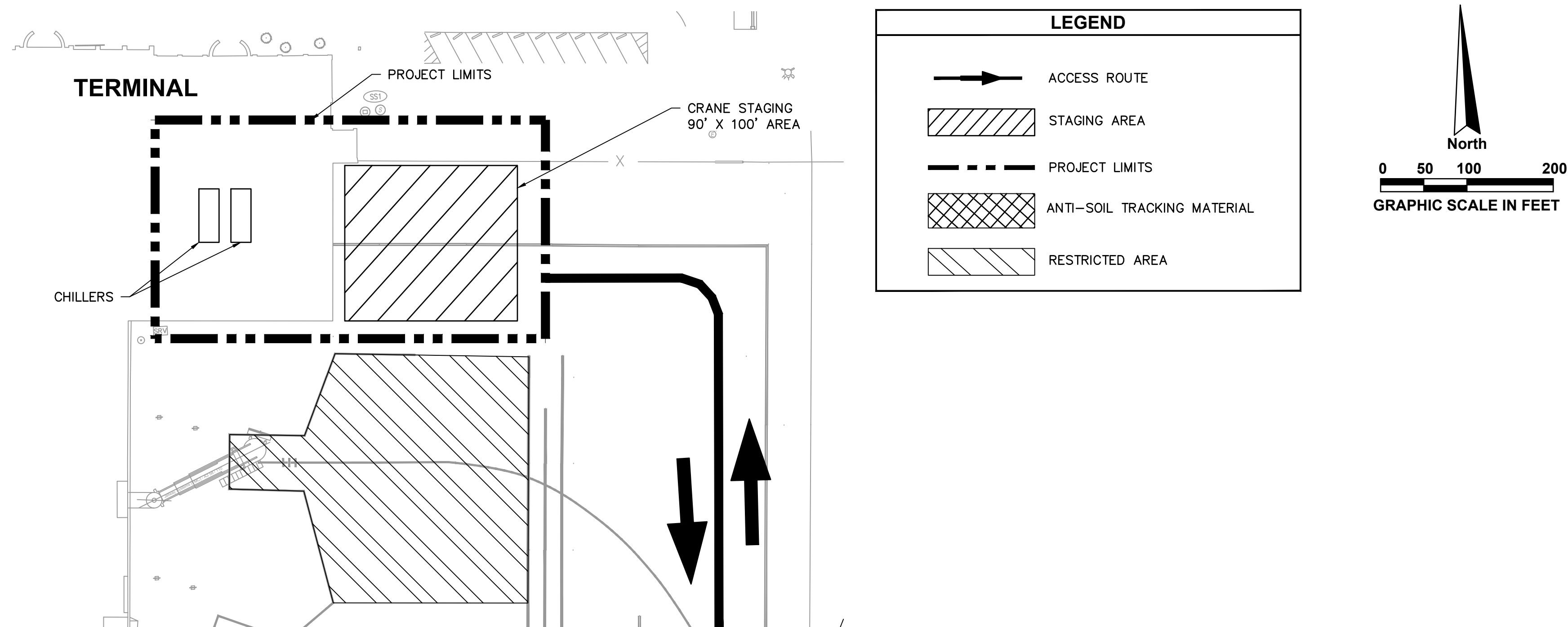
G-002

STAGING NOTES:

1. IN THE EVENT TEMPORARY HAUL ROUTES ARE REQUIRED, THE CONTRACTOR SHALL CONSTRUCT HAUL ROUTES CAPABLE OF ADEQUATELY SUPPORTING HAULING UNITS. WHEN A HAULING ROUTE IS NO LONGER NEEDED, THE AREA (INCLUDING ALL NEW PAVEMENT DAMAGED FROM HAUL ROUTE CROSSINGS) SHALL BE RESTORED TO ITS ORIGINAL OR PROPOSED CONDITION. NO SEPARATE PAYMENT WILL BE MADE FOR THIS WORK. FENCING, DRAINAGE, GRADING, AND OTHER MISCELLANEOUS CONSTRUCTION REQUIRED TO CONSTRUCT TEMPORARY HAUL ROUTES OR ACCESS POINTS WILL BE THE CONTRACTOR'S TOTAL RESPONSIBILITY AND SHALL BE APPROVED BY THE AIRPORT PRIOR TO WORK.
2. CONTRACTOR SHALL COORDINATE STAGING AREA WITH OWNER'S REPRESENTATIVE ON SITE.
3. CONTRACTOR SHALL RESTORE CONTRACTOR STAGING AREA TO ITS ORIGINAL OR BETTER CONDITION AT HIS/HER OWN EXPENSE.
4. SILT FENCE SHALL BE INSTALLED COMPLETELY AROUND STAGING AREA.
5. CONTRACTOR IS SOLELY RESPONSIBLE FOR SECURING MATERIALS IN STAGING AREA. OKALOOSA COUNTY IS NOT RESPONSIBLE FOR ANY LOST OR DAMAGED MATERIALS OR EQUIPMENT.

CRANE NOTES:

1. CONTRACTOR SHALL ALWAYS YIELD TO AIRCRAFT TRAFFIC AND BE ESCORTED BY AIRPORT REPRESENTATIVES TO AND FROM CRANE STAGING AREA.
2. CONTRACTOR AND EQUIPMENT SHALL STAY INSIDE CRANE STAGING AREA AT ALL TIMES.



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

CONSTRUCTION SAFETY AND PHASING PLAN

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REVISIONS:

NO.	DATE	BY	DESCRIPTION

RELEASE FOR BID

DESIGNED BY: J.R.C.
DRAWN BY: S.M.M.
CHECKED BY: J.R.C.
APPROVED BY: V.C.L.
DATE: DECEMBER 2017

AVCON PROJECT NO. 2017.050.11

SHEET NUMBER
G-004

V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\M-M-001 MECHANICAL LEGEND AND NOTES.DWG 1/12/2018 12:16 PM

SYMBOLS	DESCRIPTION	SYMBOLS	DESCRIPTION
	SMOKE DAMPER		GATE VALVE
	COMBINATION FIRE/SMOKE DAMPER		CHECK VALVE
	FIRE DAMPER		GLOBE VALVE
	FIRESTAT		PLUG VALVE
	HUMIDISTAT		BUTTERFLY VALVE
	TEMPERATURE SENSOR		STRAINER
	ADJUSTABLE VOLUME DAMPER		3/4" GATE VALVE WITH HOSE CONNECTION
	MOTORIZED DAMPER		3-WAY CONTROL VALVE
	BAROMETRIC DAMPER		STRAIGHT THROUGH CONTROL VALVE
	BACKDRAFT DAMPER		BALL VALVE
	CARBON DIOXIDE SENSOR		TEST PLUG
	FREEZESTAT		GAUGE STATION WITH COCK
	SMOKE DETECTOR (BY DIVISION 16)		THERMOMETER
	AIR FLOW MONITORING STATION		PRESSURE RELIEF VALVE
07/M-3	INDICATES REFERENCE TO DETAIL 07, SHEET M-3. ALSO INDICATED BY: REF. 07/M-3		PRESSURE REDUCING VALVE
	FILTER SECTION		AIR VENT
	FLEXIBLE CONNECTION		FLOW METER
	MECHANICAL EQUIPMENT		FLOW SWITCH
	CEILING SUPPLY DIFFUSER		UNION OR FLANGE
	CEILING RETURN OR EXHAUST GRILLE		PIPE FLEXIBLE CONNECTION
	INDICATES REFERENCE TO SEC. 01, SHEET M-3		TEMP. SENSOR INSIDE PIPE WELL
	DUCTWORK		DIFF. PRESSURE SENSOR/TRANSMITTER
	STATIC PRESSURE SENSOR		P/T PORT (PETE'S PLUG)
	LIMITS OF DEMOLITION		AUTOMATIC (PI) FLOW BALANCING/LIMITING VALVE W/ MEASURING PORTS
	POINT OF CONNECTION		CALIBRATED MANUAL BALANCING VALVE WITH MEASURING PORTS
	VOLUME DAMPER		CHILLED WATER SUPPLY
	CAP SECTION		CHILLED WATER RETURN
			HOT WATER SUPPLY
			HOT WATER RETURN
			CONDENSATE DRAIN
			CONDENSER WATER
			REFRIGERANT SUCTION
			REFRIGERANT LIQUID
			GAS MAIN
			WATER LINE
			UNKNOWN
			BURIED FIBER OPTIC
			AIR HANDLING UNIT
			EXHAUST FAN
			HEAVY WEIGHT DASH LINE INDICATES ITEM TO BE REMOVED/ DEMOLISHED

NOTE: NOT ALL SYMBOLS TABULATED ABOVE ARE NECESSARILY USED ON THE DRAWINGS.

MECHANICAL SYMBOLS

HVAC DRAWING INDEX

SHEET	DESCRIPTION	ISSUED
M-001	MECHANICAL LEGENDS AND NOTES	Yes
M-101	MECHANICAL OVERALL FIRST FLOOR PLANS	Yes
M-102	MECHANICAL OVERALL SECOND FLOOR PLANS	Yes
M-111	MECHANICAL FIRST FLOOR ENLARGED PLANS	Yes
M-112	MECHANICAL SECOND FLOOR ENLARGED PLANS	Yes
M-113	MECHANICAL SECOND FLOOR ENLARGED PLANS	Yes
M-114	MECHANICAL PUMP ROOM ENLARGED PLANS	Yes
M-115	MECHANICAL CHILLER DEMOLITION ROOF PLAN	Yes
M-116	MECHANICAL NEW CHILLER ROOF PLAN	Yes
M-301	MECHANICAL CHW FLOW DIAGRAM	Yes
M-501	MECHANICAL DETAILS	Yes
M-502	MECHANICAL DETAILS	Yes
M-601	MECHANICAL SCHEDULES	Yes
M-701	CONTROL DIAGRAMS AND SEQUENCES OF OPERATION	Yes
M-702	CONTROL DIAGRAMS AND SEQUENCES OF OPERATION	Yes

GENERAL NOTES

- THE CONTRACTOR AND SUBCONTRACTOR SHALL VISIT THE FACILITY AND THOROUGHLY FAMILIARIZE THEMSELVES WITH THE EXISTING CONDITIONS. NO CLAIMS FOR ADDITIONAL WORK DUE TO OBSERVABLE CONDITIONS WILL BE CONSIDERED.
- THE MECHANICAL CONTRACTOR TO VERIFY MECHANICAL EQUIPMENT LOCATIONS AND BE RESPONSIBLE FOR ALL RELATED CLEARANCES IN THE FIELD. PROVIDE ADEQUATE MAINTENANCE CLEARANCE AROUND EACH PIECE OF EQUIPMENT. PROVIDE EQUIPMENT CLEARANCES IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND IN ACCORDANCE WITH ALL APPLICABLE CODES. PROVIDE CLEARANCE IN FRONT OF ELECTRICAL PANELS AND OTHER ELECTRICAL EQUIPMENT PER THE NATIONAL ELECTRICAL CODE REQUIREMENTS.
- THE PLANS HAVE BEEN PREPARED BASED ON A RECENT SURVEY AND CONSTRUCTION DOCUMENTS FROM PREVIOUS PROJECTS AND ARE THE BEST SOURCES OR INFORMATION TO DATE. ALL PIPING, EQUIPMENT, UTILITIES, ETC. SHALL BE FIELD VERIFIED. PLANS SHALL NOT BE SCALED.
- REPORT ANY ALTERATION TO AND/OR DEVIATIONS FROM THE DRAWING AS REQUIRED BY THE REGULATORY AUTHORITIES TO THE ARCHITECT/ENGINEER AND SECURE HIS APPROVAL BEFORE STARTING ALTERATIONS.
- ALL WORK AND EQUIPMENT SHALL MEET THE REQUIREMENTS OF THE MOST RECENTLY REVISED VERSION OF ALL APPLICABLE LAWS, RULES, REGULATION AND ORDINANCES OF FEDERAL, STATE, AND LOCAL AUTHORITIES, WHETHER INDICATED ON THE DRAWINGS OR NOT.

WORK SHALL COMPLY WITH THE FOLLOWING AGENCIES:
-2017 FLORIDA BUILDING CODE
-2017 FLORIDA MECHANICAL CODE
-2017 FLORIDA PLUMBING CODE
-2017 FLORIDA FUEL GAS CODE
-NATIONAL FIRE PROTECTION AGENCY (NFPA)
-AMERICAN SOCIETY OF HEATING AND REFRIGERATION ENGINEERS (ASHRAE)
- PATCH ALL WALL/FLOOR PENETRATIONS WATER TIGHT WHERE PIPING OR EQUIPMENT IS REMOVED AND WHERE OPENING IS NOT BEING REUSED. WALL/FLOOR SHALL BE SEALED TO PRE-CONSTRUCTION CONDITION AND MEET EXISTING WALL RATING.
- PROVIDE FIRE STOPPING AT PENETRATIONS OR RATED ASSEMBLIES (SLAB AND RATED WALLS). PIPING PENETRATIONS OF FIRE RATED WALLS, CEILINGS, FLOORS ETC. TO BE UL LISTED FIRESTOPS AND SHALL BE INSTALLED AS PER MANUFACTURER'S RECOMMENDATION.
- THE PIPING SHOWN ON THESE DRAWINGS ARE DIAGRAMMATIC. CONTRACTOR SHALL ARRANGE WORK IN A NEAT AND ORDERLY MANNER. THE CONTRACTOR SHALL MAKE ANY OFFSETS, TRANSITIONS, AND OTHER MINOR ADJUSTMENTS AS REQUIRED FOR A COMPLETE AND WORKING SYSTEM INSTALLATION.
- DRAWINGS SHOW GENERAL SIZE AND APPROXIMATE LOCATIONS. THE DRAWINGS ARE INTENDED TO SHOW THE GENERAL ARRANGEMENT OF THE UTILITY SYSTEM. THE CONTRACTOR SHALL FIELD VERIFY ALL UTILITY CONNECTIONS SIZE, LOCATION, DEPTH. THE CONTRACTOR SHALL INSTALL ALL SYSTEMS ACCORDING TO THE ACTUAL FIELD CONDITIONS FOUND. ANY MECHANICAL SYSTEM COMPONENT INSTALLED INCORRECTLY DUE TO FIELD CONDITIONS SHALL BE REMOVED AND INSTALLED CORRECTLY AT THE EXPENSE OF THE CONTRACTOR. THE CONTRACTOR SHALL NOT CUT ANY STRUCTURAL MEMBERS OF BUILDING WITHOUT PRIOR CONSENT OF THE STRUCTURAL ENGINEER.
- ENGAGE A FACTORY AUTHORIZED SERVICE REPRESENTATIVE TO PERFORM START-UP SERVICES AND TO TRAIN OWNER'S MAINTENANCE PERSONNEL TO ADJUST, OPERATE AND MAINTAIN EQUIPMENT.
- PROVIDE OPERATION AND MAINTENANCE MANUALS TO OWNER FOR ALL INSTALLED EQUIPMENT.
- ALL PIPING ELEVATIONS INDICATED ON THIS DRAWING SET ARE APPROXIMATE AND ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY. THE CONTRACTOR SHALL FIELD VERIFY ALL PIPING ELEVATIONS IN THE FIELD PRIOR TO SUBMITTING A BID.
- THE CONTRACTOR SHALL NOT CUT ANY STRUCTURAL MEMBERS OF BUILDING WITHOUT PRIOR CONSENT OF ARCHITECT AND/OR STRUCTURAL ENGINEER.
- CONTRACTOR SHALL PROVIDE GENERAL WARRANTY FOR WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL COMPLETION. REFER TO SPECIFICATIONS FOR EQUIPMENT WARRANTY REQUIREMENTS.
- PROVIDE ALL NEW CONTROL VALVES, FLOW AND TEMPERATURE SENSORS WITH 2 1/2"x4" ENGRAVED, LAMINATED PLASTIC EQUIPMENT MARKER FOR IDENTIFICATION PURPOSES.
- CONTRACTOR SHALL PROVIDE SUBMITTAL DRAWINGS FOR INTER-TRADE COORDINATION PURPOSES. SUBMITTALS SHALL INCLUDE PRODUCT DATA (INCLUDING PHYSICAL AND ELECTRICAL CHARACTERISTICS) AND SHOP DRAWINGS AS REQUIRED TO COORDINATE EQUIPMENT AND SYSTEM INSTALLATION(S).
- CONTRACTOR SHALL PROVIDE ALL CONNECTIONS, FITTINGS, APPURTENANCES, ETC. AS NECESSARY FOR INSTALLATION AND OPERATION OF OWNER FURNISHED EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS.
- COMPLY WITH MSS SP-58 (PIPE HANGERS AND SUPPORTS-MATERIALS, DESIGN, AND MANUFACTURE), MSS SP-69 (PIPE HANGERS AND SUPPORTS-SELECTION AND APPLICATION), MSS SP-89 (PIPE HANGERS AND SUPPORTS-FABRICATION AND INSTALLATION) FOR PIPE HANGER SELECTIONS AND APPLICATIONS.

CONTRACTOR SHALL PROVIDE BID ALTERNATES FOR SCOPE OF WORK DESCRIBED BELOW AND AS SHOWN IN THE PLANS AND SPECIFICATIONS.

BID ALTERNATE 1: SHALL INCLUDE FURNISH AND INSTALL OF CHILLED WATER PUMP CHWP-3 AND RESPECTIVE VARIABLE SPEED DRIVE. SHALL INCLUDE BAS UPGRADE TO CURRENT SOFTWARE LICENSE, NEW WORKSTATION, ADDITIONAL SENSORS, DEVICES AND PROGRAMING FOR CHILLED WATER PUMP CHWP-3, NEW CONTROL VALVES FOR CHILLERS AND VARIABLE PRIMARY PUMPING SYSTEM, ALL REQUIREMENTS OF SEQUENCES OF OPERATION AS SHOWN ON M-701, M-702 AND IN SPECIFICATION SECTION 23 09 13.

BID ALTERNATE 2: SHALL INCLUDE COMMISSIONING OF HVAC SYSTEM AS DESCRIBED IN SPECIFICATION SECTIONS 01 91 13 AND 23 09 01. SHALL INCLUDE COMPLETE AIRSIDE TEST & BALANCE IN ACCORDANCE WITH SPECIFICATION 23 05 93 (NOTE THAT WATER SIDE TEST & BALANCE SHALL BE INCLUDED IN BASE BID).



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ENGINEER OF RECORD:
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FL LICENSE NO.: 41147

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MECHANICAL LEGEND AND NOTES

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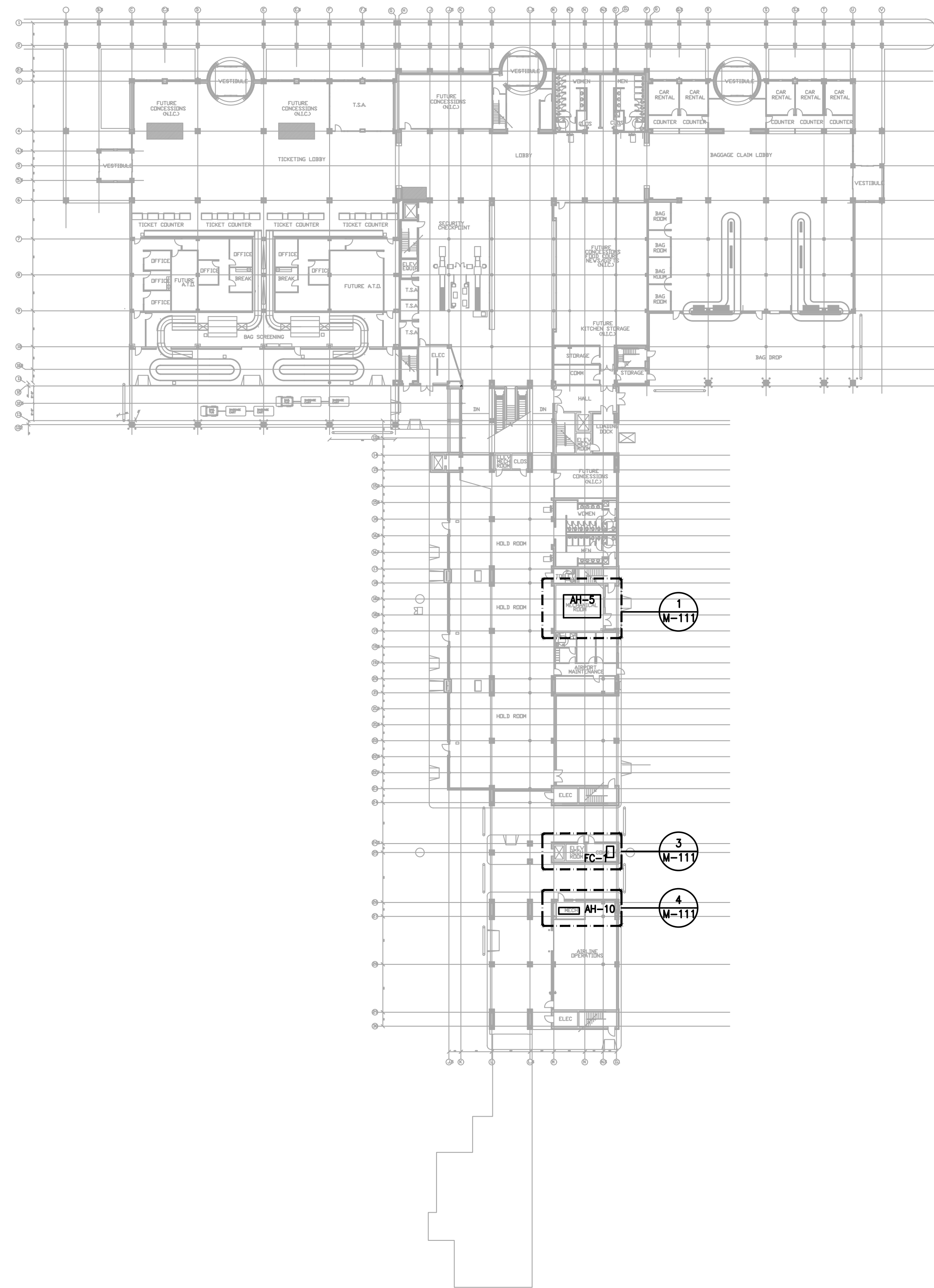
RELEASE FOR BID

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APPROVED BY: ZP
DATE: DEC 2017

AVCON PROJECT NO. 2017.050.11

SHEET NUMBER M-001

V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\M-M-101 MECHANICAL OVERALL FIRST FLOOR PLAN.DWG 1/12/2018 12:16 PM



1 OVERALL MECHANICAL FIRST FLOOR PLAN
1" = 40'-0"



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MECHANICAL OVERALL FIRST FLOOR PLAN

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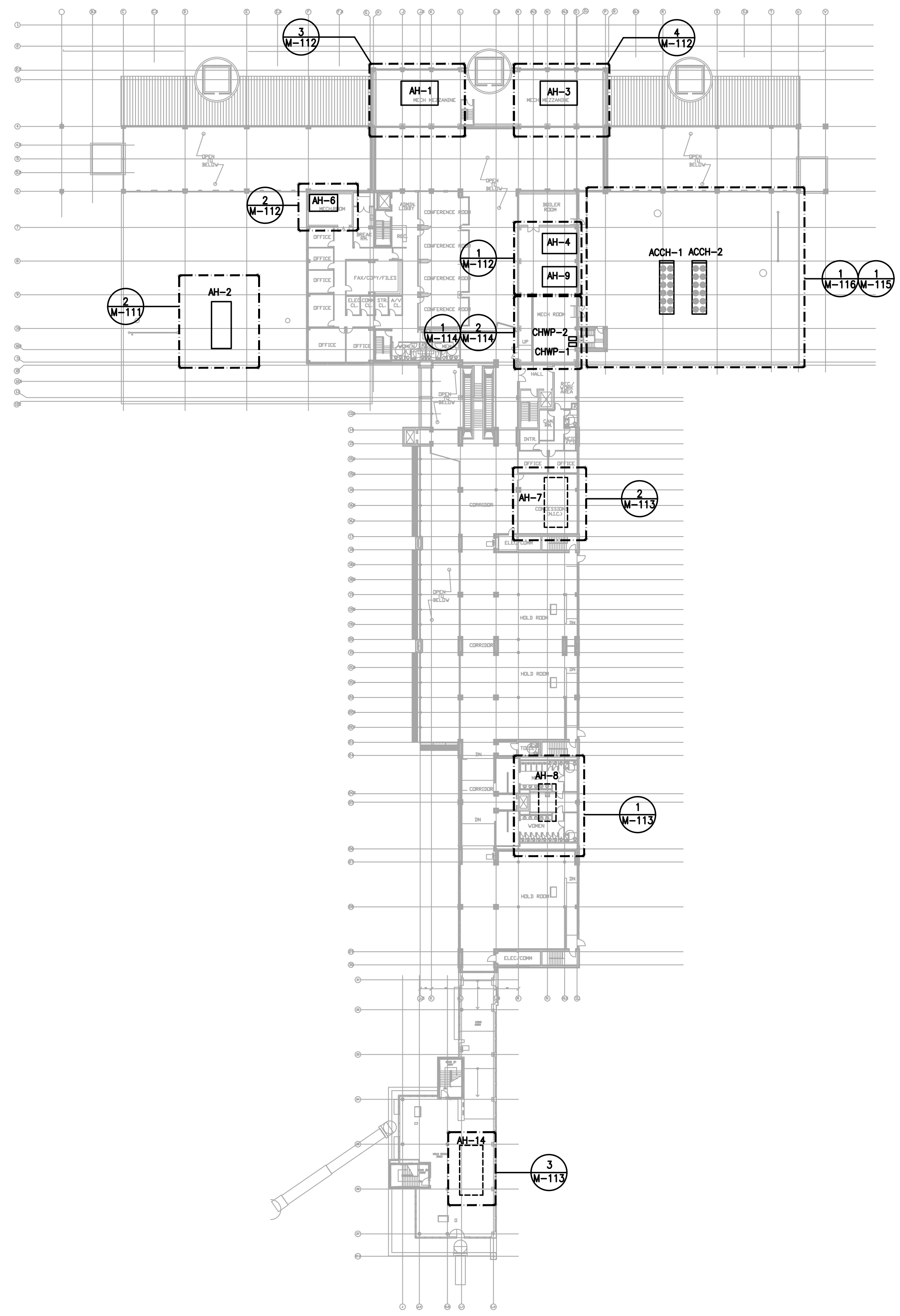
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1 OVERALL MECHANICAL SECOND FLOOR PLAN
 1" = 40'-0"

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MECHANICAL OVERALL SECOND FLOOR PLAN

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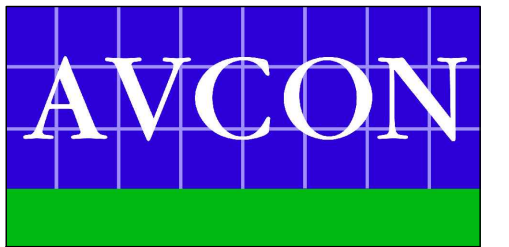
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MECHANICAL PHASING PLANS

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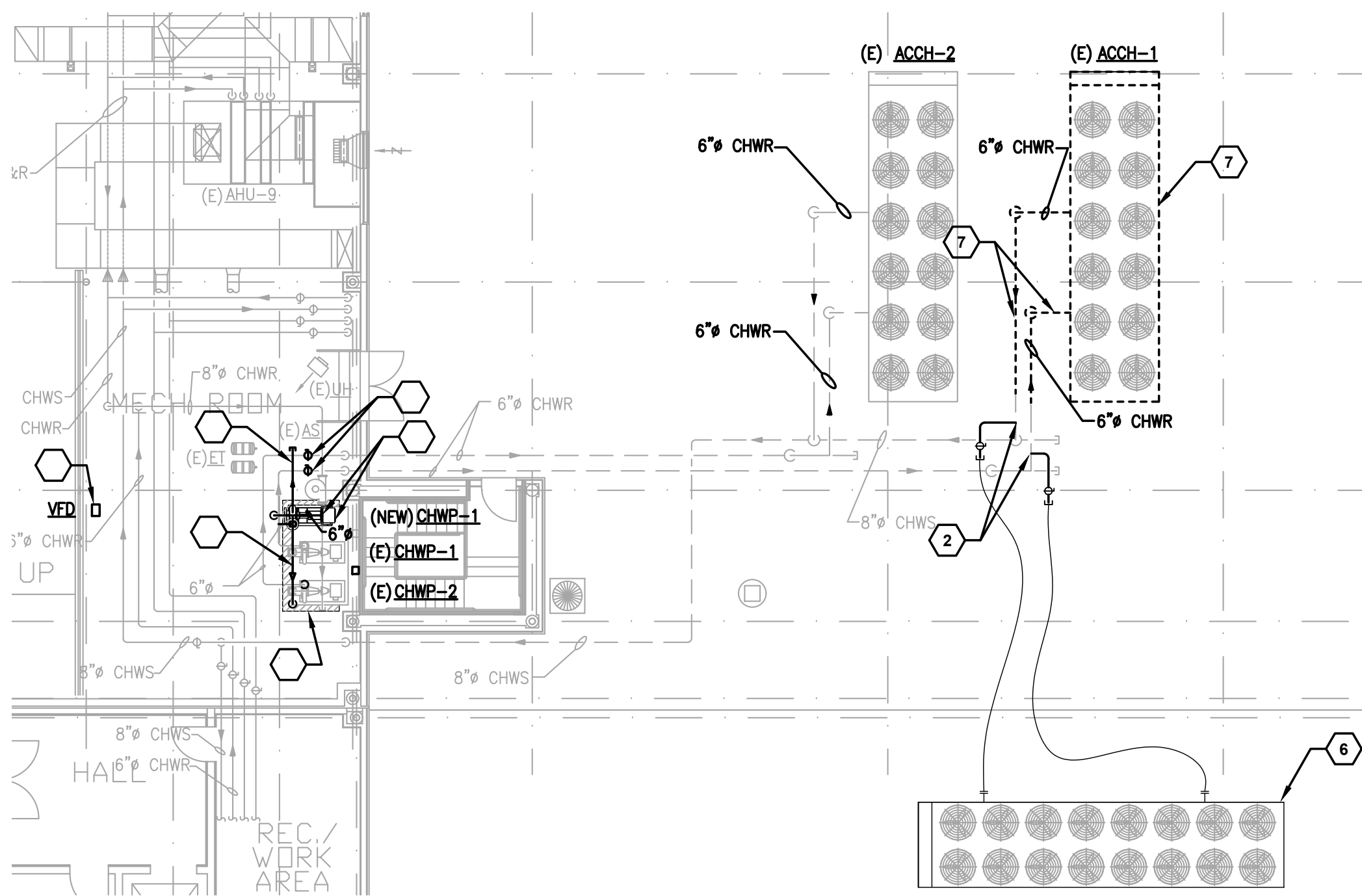
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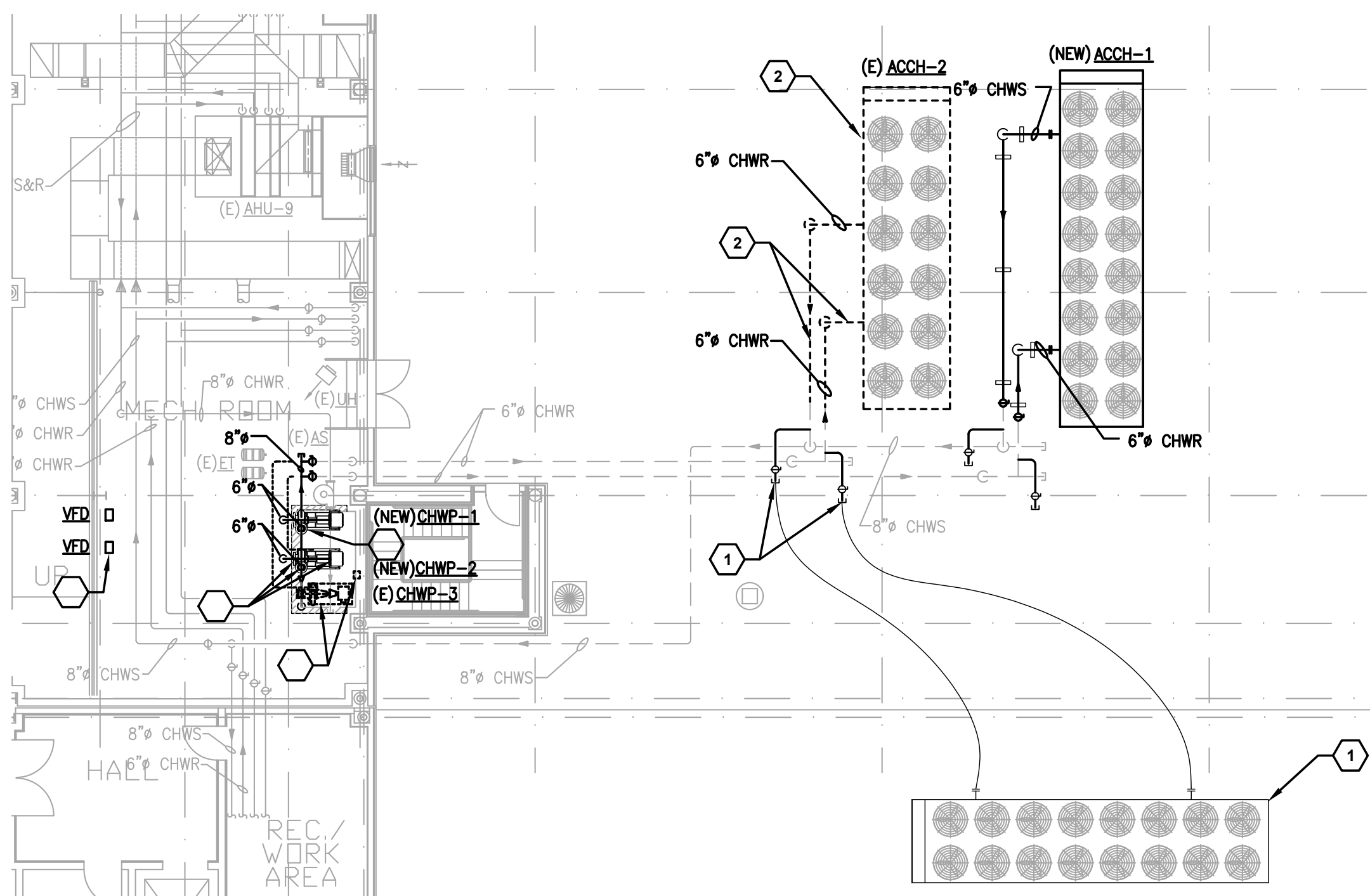


MECHANICAL PHASING KEY NOTES

1. LINE-STOP OR FREEZE EXISTING 6" CHWR LINES AND INSTALL NEW SHUT-OFF VALVES.
2. WET-TAP OUTDOOR CHWS&R PIPES TO ACCH-1 TO INSTALL NEW 6" EMERGENCY CONNECTIONS AND ISOLATION VALVES.
3. ROUGH-IN/INSTALL NEW 8" PUMP DISCHARGE HEADER AND MAKE CONNECTION-READY. (I.E. INSTALL ALL NECESSARY TAPS/TEES AND ISOLATION VALVES)
4. INCREASE/MODIFY CONCRETE PAD TO ACCOMMODATE NEW PUMPS.
5. SET NEW CHWP-1 IN PLACE AND SECURE TO THE PAD. CONNECT PUMP SUCTION LINE TO A NEW 6" TAP ON EXISTING 8" PUMP SUCTION HEADER. TEMPORARILY CONNECT DISCHARGE SIDE OF THE PUMP TO EXISTING ACCH-1 6" DISCHARGE CHWR LINE. INSTALL ASSOCIATED VFD AND WIRE.
6. PROVIDE TEMPORARY 250 TON AIR-COOLED CHILLER, SUFFICIENT FLEXIBLE PIPING FOR CONNECTION AT NEW ROOF EMERGENCY CONNECTIONS AND ELECTRICAL CONNECTION.
7. TRANSFER CHILLED WATER SERVICE AND POWER TO TEMPORARY CHILLER AND COMMENCE REMOVAL OF EXISTING ACCH-1, CONNECTING CHWS&R LINES AND ANCILLARY VALVES AND SENSORS.

MECHANICAL PHASING PLAN

3/32" = 1'-0"

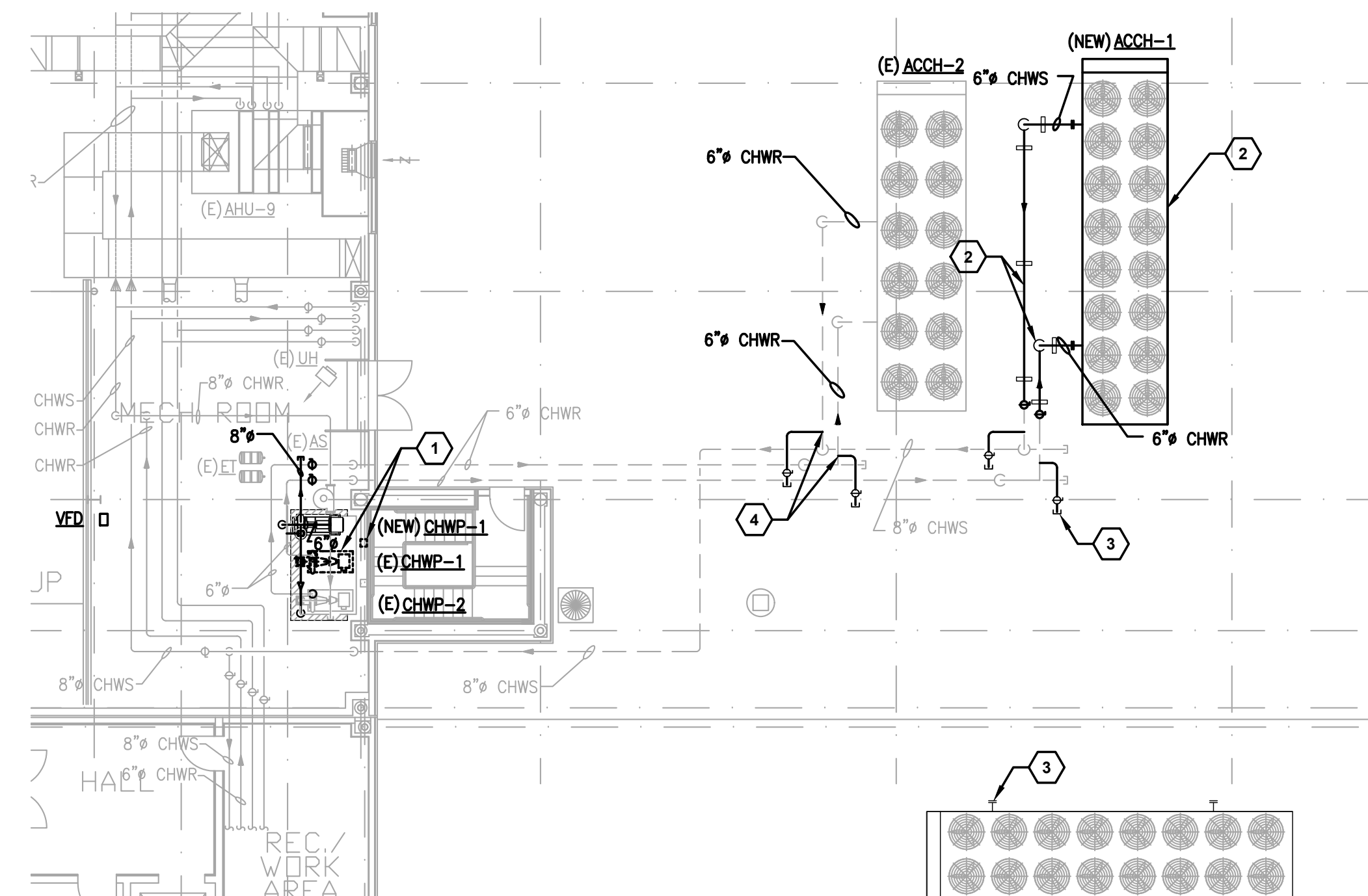


MECHANICAL PHASING KEY NOTES

1. CONNECT TEMPORARY CHILLER TO NEW EMERGENCY CONNECTION TO EXISTING ACCH-2.
2. TRANSFER CHILLED WATER SERVICE AND POWER TO TEMPORARY CHILLER AND COMMENCE REMOVAL OF EXISTING ACCH-2, CONNECTING CHWS&R LINES AND ANCILLARY VALVES AND SENSORS.
3. CONNECT NEW CHWP-1 6" DISCHARGE LINE TO NEW 8" PUMP DISCHARGE HEADER.
4. SET NEW CHWP-2 IN PLACE AND SECURE TO THE PAD. CONNECT PUMP SUCTION LINE TO A NEW 6" TAP ON EXISTING 8" PUMP SUCTION HEADER. CONNECT NEW PUMP DISCHARGE LINE TO NEW 8" PUMP DISCHARGE HEADER. INSTALL ASSOCIATED VFD AND WIRE.
5. REMOVE EXISTING CHWP-2, ASSOCIATED VALVES, STRAINER AND MOTOR STARTER.

MECHANICAL PHASING PLAN

3/32" = 1'-0"

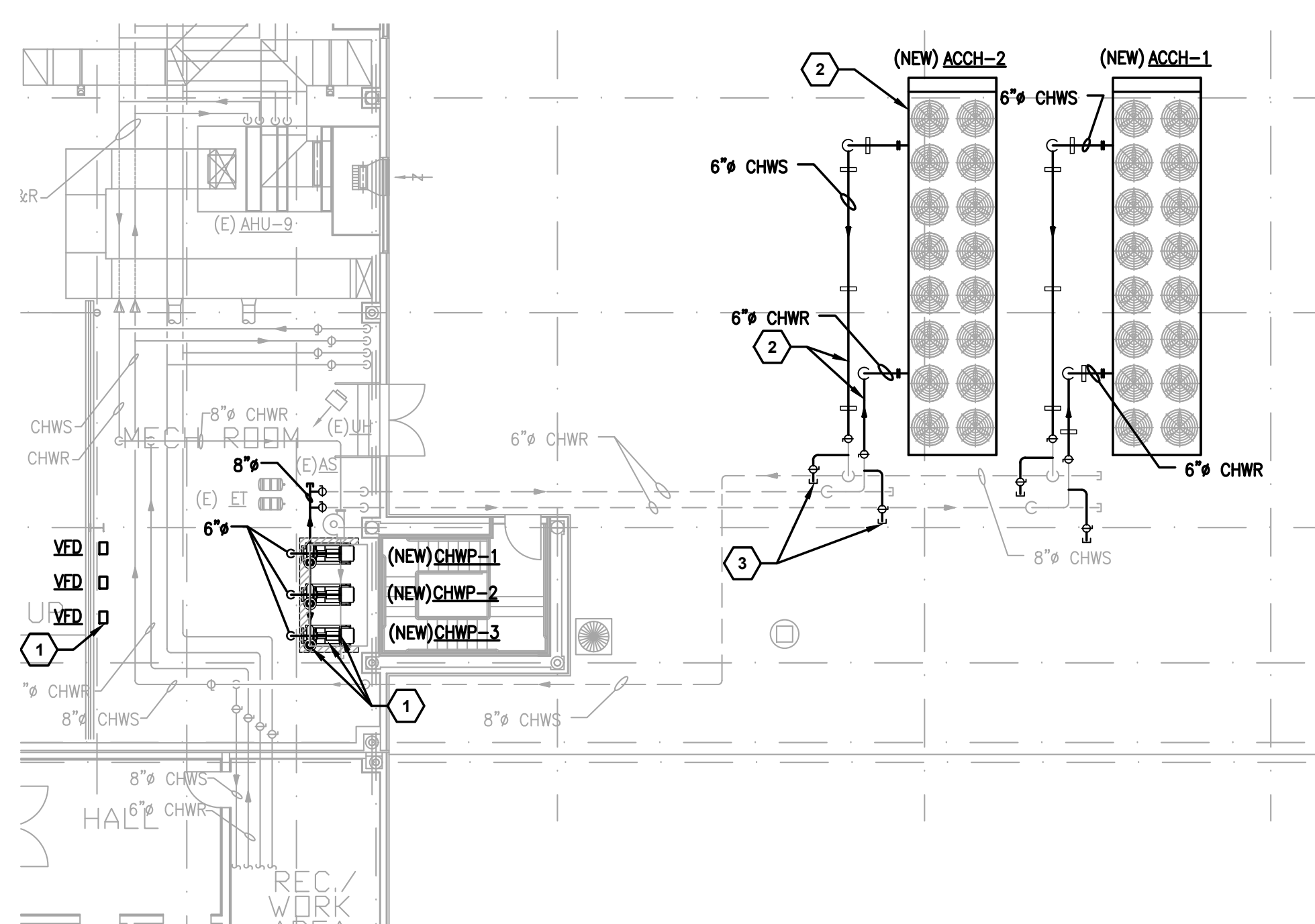


MECHANICAL PHASING KEY NOTES

1. REMOVE EXISTING CHWP-1, ASSOCIATED VALVES, STRAINER AND MOTOR STARTER.
2. INSTALL NEW AIR-COOLED CHILLER ACCH-1 AND ASSOCIATED NEW PIPE CONNECTIONS, PIPE SUPPORTS, FITTINGS, VALVES, SENSORS, ETC.
3. ONCE NEW ACCH-1 IS OPERATIONAL (AFTER AIR PURGING, INITIAL START-UP AND PERFORMANCE VERIFICATION, ONLINE CONTROLS), DISCONNECT TEMPORARY CHILLER FROM EMERGENCY CONNECTIONS.
4. WET-TAP OUTDOOR CHWS&R PIPES TO ACCH-2 TO INSTALL NEW 6" EMERGENCY CONNECTIONS AND ISOLATION VALVES.

2 MECHANICAL PHASING PLAN

3/32" = 1'-0"



MECHANICAL PHASING KEY NOTES

1. SET NEW CHWP-3 IN PLACE AND SECURE TO THE PAD. CONNECT PUMP SUCTION LINE TO A NEW 6" TAP ON EXISTING 8" PUMP SUCTION HEADER. CONNECT NEW PUMP DISCHARGE LINE TO NEW 8" PUMP DISCHARGE HEADER. INSTALL ASSOCIATED VFD AND WIRE.
2. INSTALL NEW AIR-COOLED CHILLER ACCH-1 AND ASSOCIATED NEW PIPE CONNECTIONS, PIPE SUPPORTS, FITTINGS, VALVES, SENSORS, ETC.
3. ONCE NEW ACCH-1 IS OPERATIONAL (AFTER AIR PURGING, INITIAL START-UP AND PERFORMANCE VERIFICATION, ONLINE CONTROLS), DISCONNECT TEMPORARY CHILLER FROM EMERGENCY CONNECTIONS AND REMOVE TEMPORARY CHILLER FROM THE SITE.

4 MECHANICAL PHASING PLAN

3/32" = 1'-0"

V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\M-M-103 MECHANICAL PHASING PLANS.DWG 1/12/2018 12:16 PM



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MECHANICAL FIRST FLOOR ENLARGED PLANS

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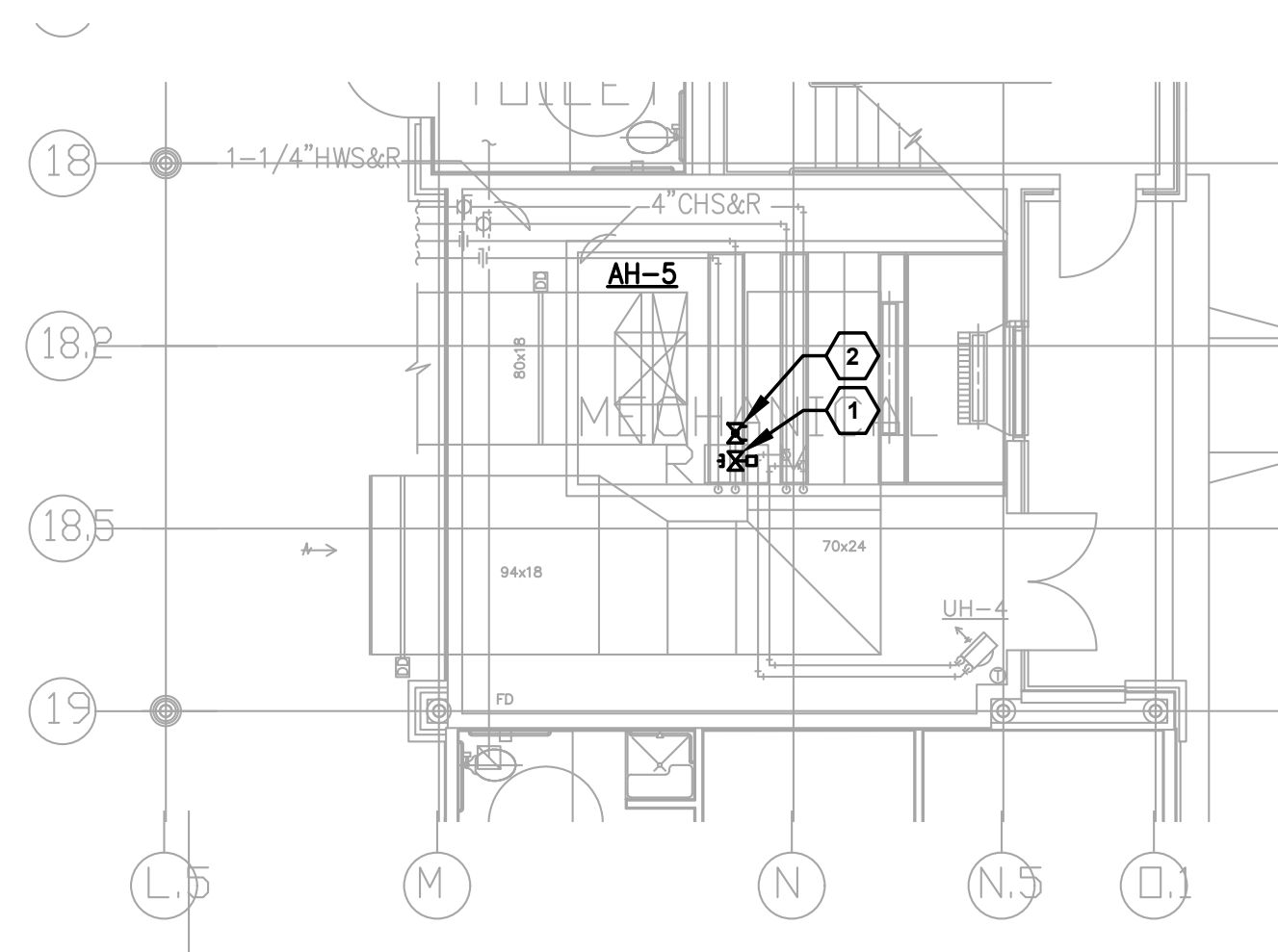
**SHEET NUMBER
M-111**

GENERAL NOTES

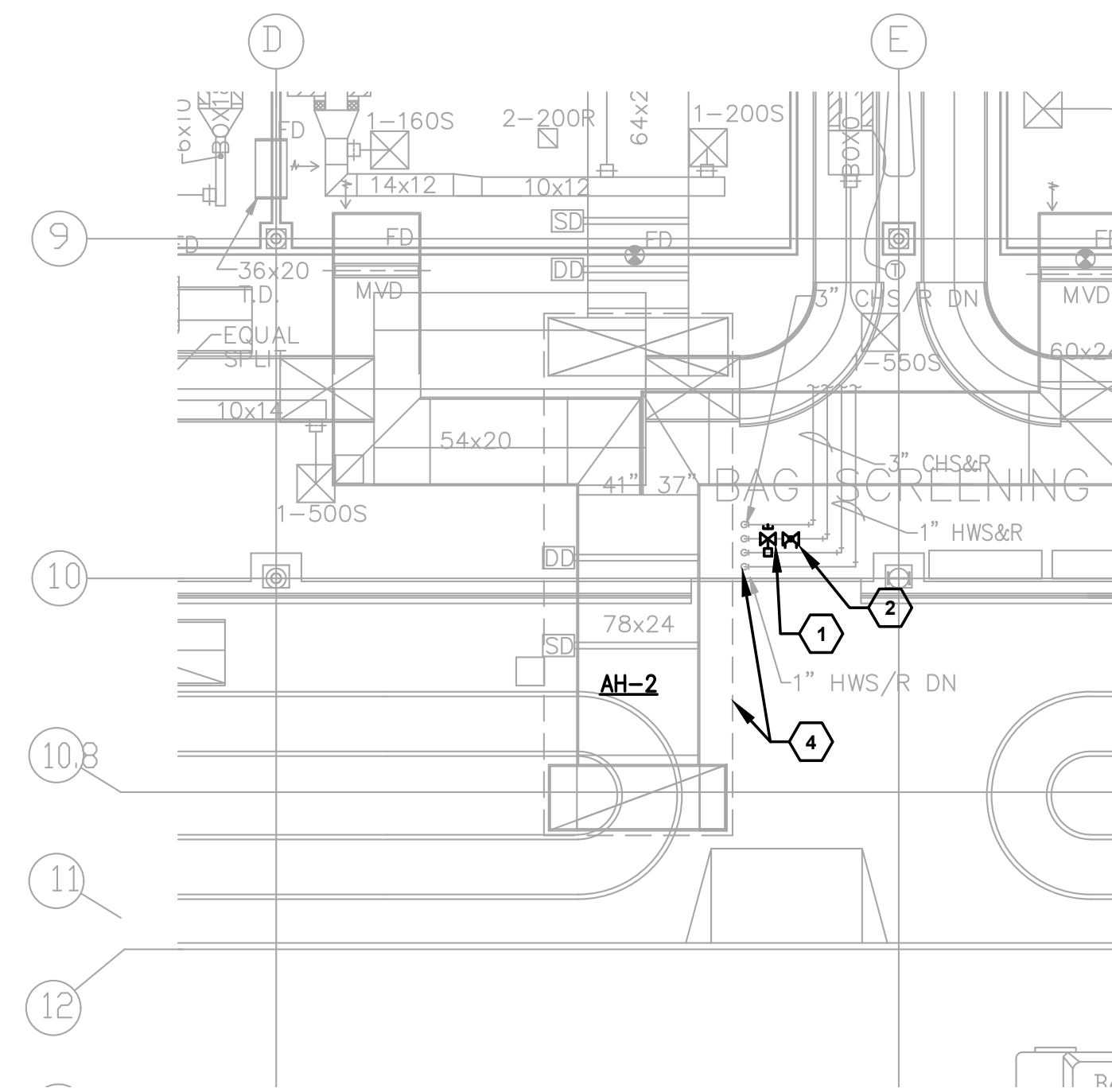
- A. DEMOLITION WORK – CARRY OUT DEMOLITION WORK TO CAUSE AS LITTLE INCONVENIENCE TO OCCUPIED BUILDING AREAS AS POSSIBLE. DEMOLISH IN AN ORDERLY AND CAREFUL MANNER AS REQUIRED TO ACCOMMODATE THE NEW WORK. PERFORM DEMOLITION IN ACCORDANCE WITH APPLICABLE AUTHORITIES HAVING JURISDICTION. TAKE CARE TO PREVENT DAMAGE AND EXCESSIVE NOISE OR VIBRATION SO AS NOT TO DISTURBANCE ADJACENT OCCUPIED AREAS. ANY OPERATION THAT MAY CAUSE DISTURBANCE TO THE AIRPORT SHALL BE COORDINATED WITH THE AIRPORT A MINIMUM OF TWO (2) WEEKS IN ADVANCE. SOME WORK MAY REQUIRE PERFORMANCE DURING "OFF HOURS" TO ALLOW AIRPORT FULL USE OF THE OCCUPIED AREAS.
- B. PROTECTION – EXERCISE CARE DURING THE WORK TO PROTECT INTERIOR AND EXTERIOR EXISTING CONSTRUCTION TO REMAIN. REPAIR TO EXISTING CONSTRUCTION DUE TO DAMAGE SHALL BE DONE AT NO COST TO AIRPORT.
- C. ALL DEMOLITION WORK SHALL BE IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL CODES.
- D. PATCH ALL WALL PENETRATIONS WHERE PIPING REMOVED AND WHERE OPENING IS NOT BEING REUSED. WALL SHALL BE SEALED TO PRE-CONSTRUCTION CONDITION AND MEET EXISTING WALL RATING.
- E. REMOVE ALL HANGERS, CONDUCTORS, CONDUIT, HARDWARE AND ANY OTHER APPURTENANCES THAT ARE NOT TO BE REUSED THROUGHOUT THE MECHANICAL DEMOLITION.

MECHANICAL KEY NOTES

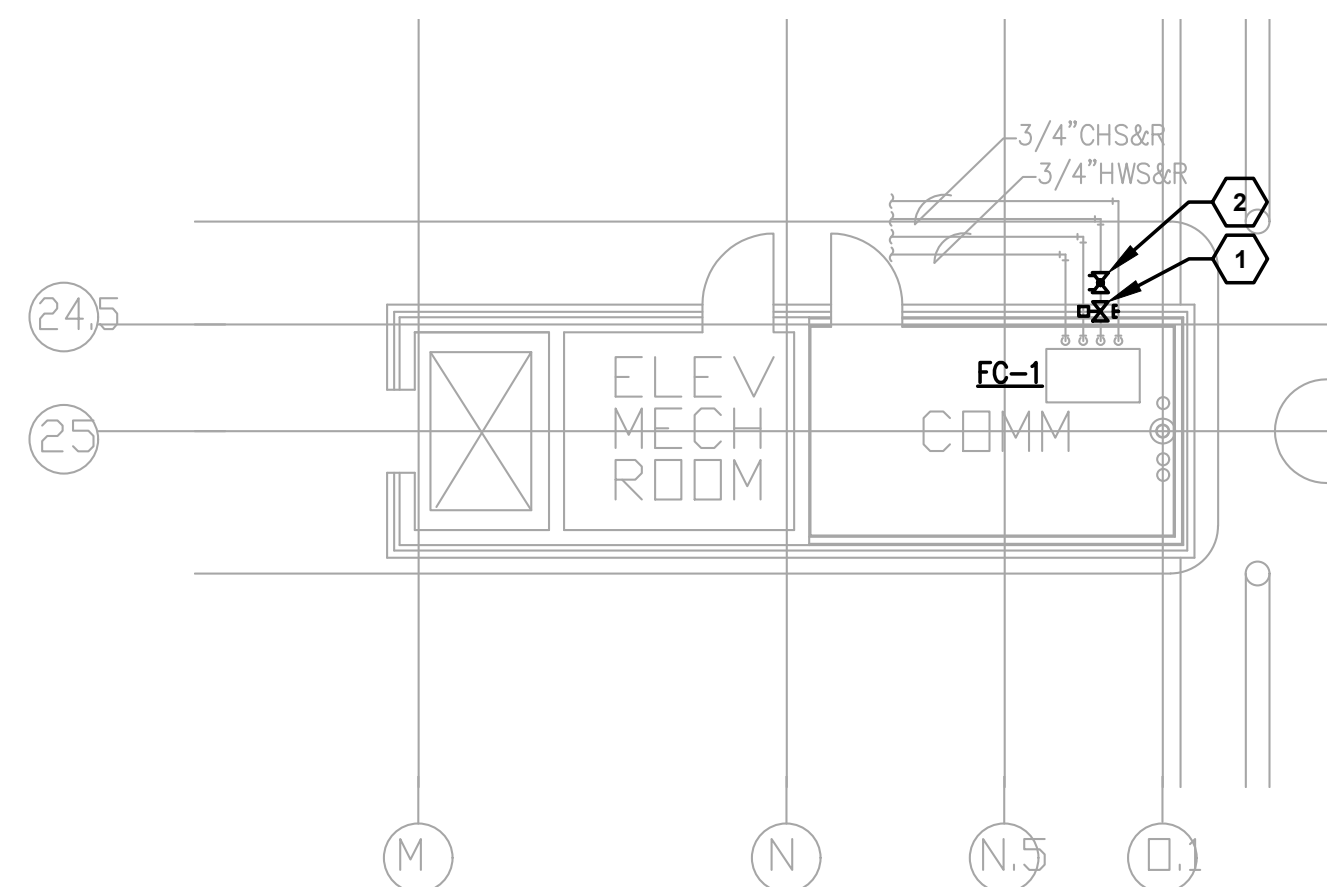
- 1 REMOVE CHILLED WATER COIL'S 3-WAY CONTROL VALVE. CAP 3-WAY VALVE BYPASS LEG AND INSULATE EXPOSED PIPING PER SPECIFICATIONS. PROVIDE NEW MODULATING 2-WAY CHILLED WATER CONTROL VALVE AT CHILLED WATER COIL.
- 2 REMOVE CHILLED WATER COIL BALANCING VALVE. PROVIDE NEW AUTOMATIC FLOW LIMITING/BALANCING VALVES AT CHILLED WATER COIL RETURN SIDE PIPING. REFERENCE COIL PIPING DETAIL 03/M-501.
- 3 AH-10 3-WAY CONTROL VALVE TO REMAIN.
- 4 NOTE AH-2 IS A ROOF MOUNTED AIR HANDLER AND CONTROL VALVE IS LOCATED IN 1ST FLOOR CEILING PLENUM.



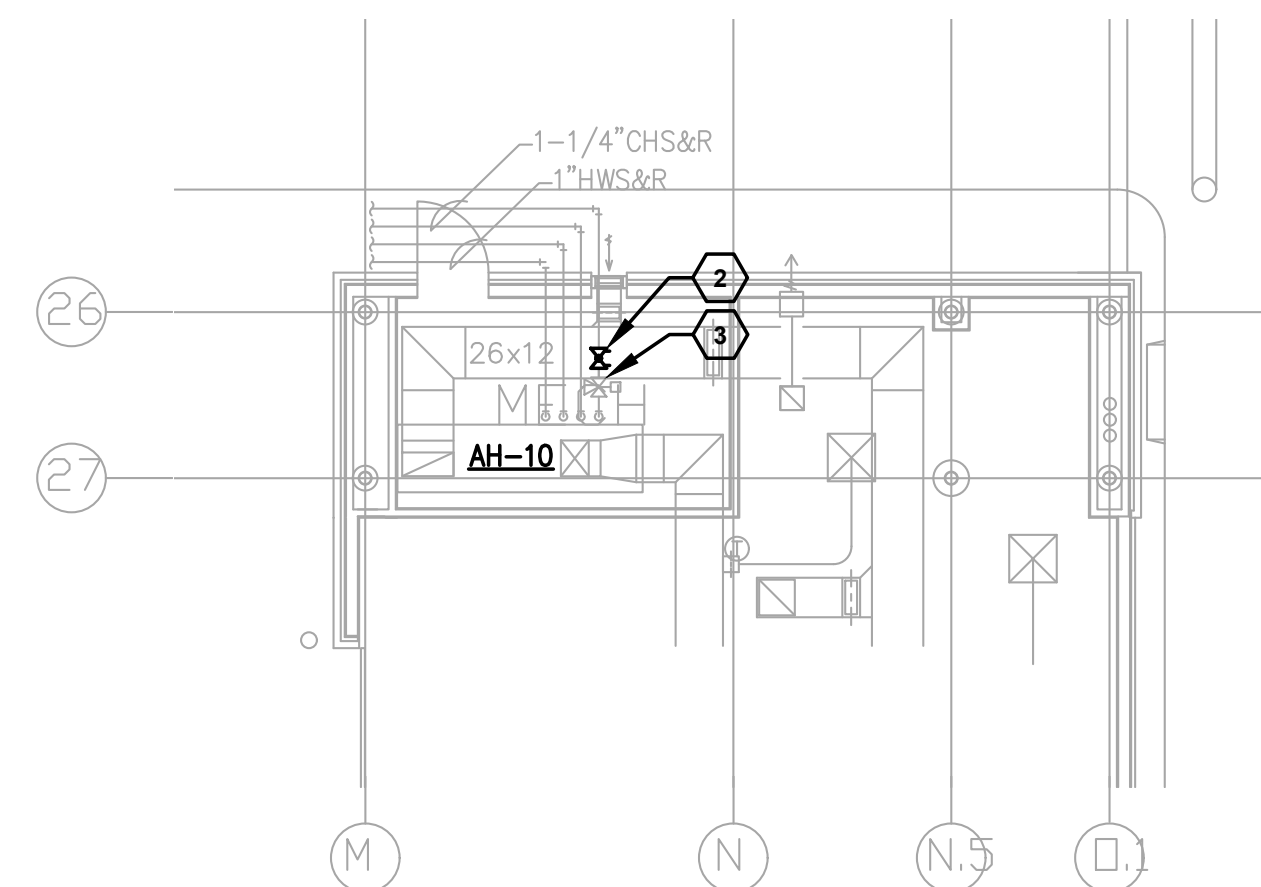
FIRST FLOOR PLAN AREA C MECH ROOM



2 FIRST FLOOR PLAN AREA A
1/8" = 1'-0"

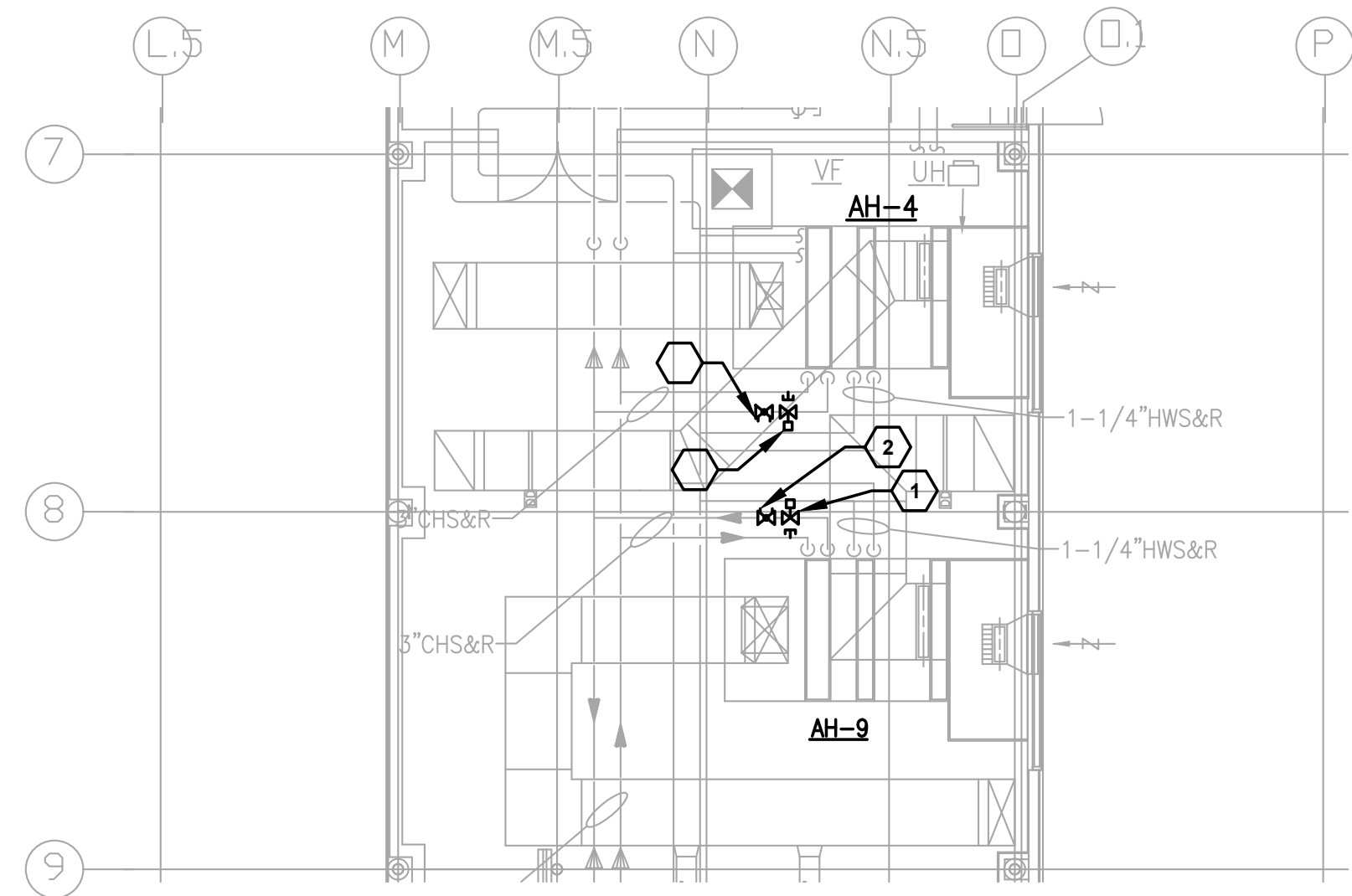


FIRST FLOOR AREA D COMM ROOM

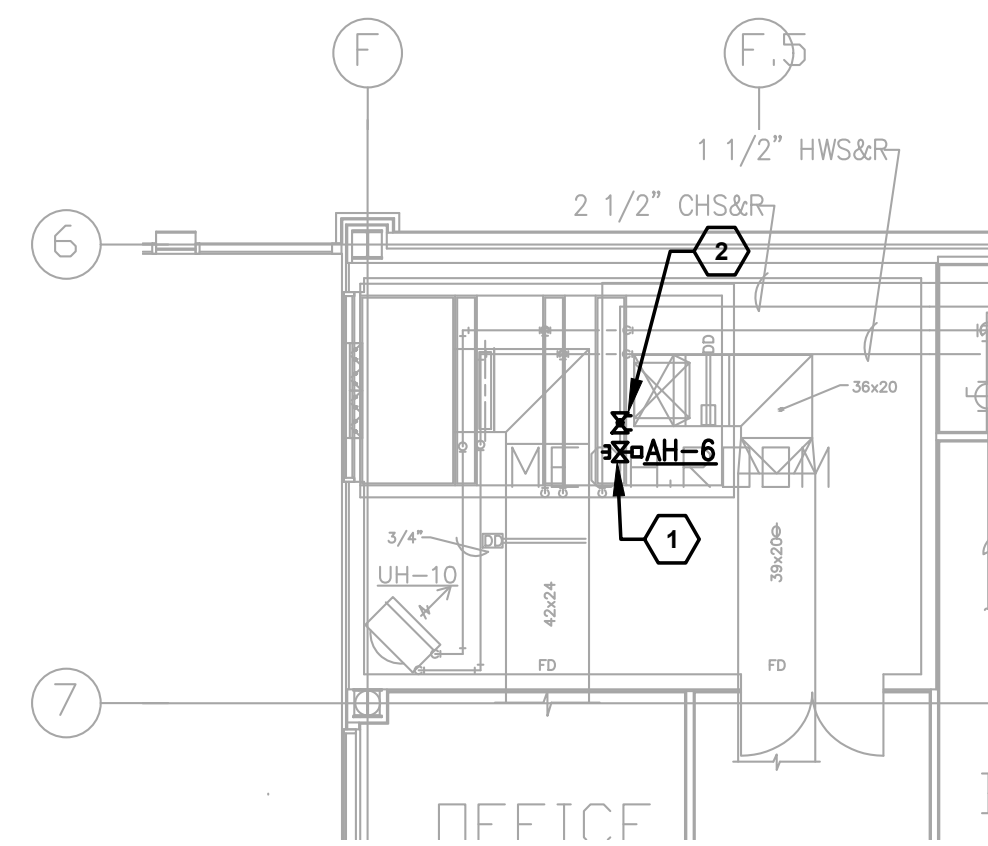


4 FIRST FLOOR AREA D MECH ROOM
1/8" = 1'-0"

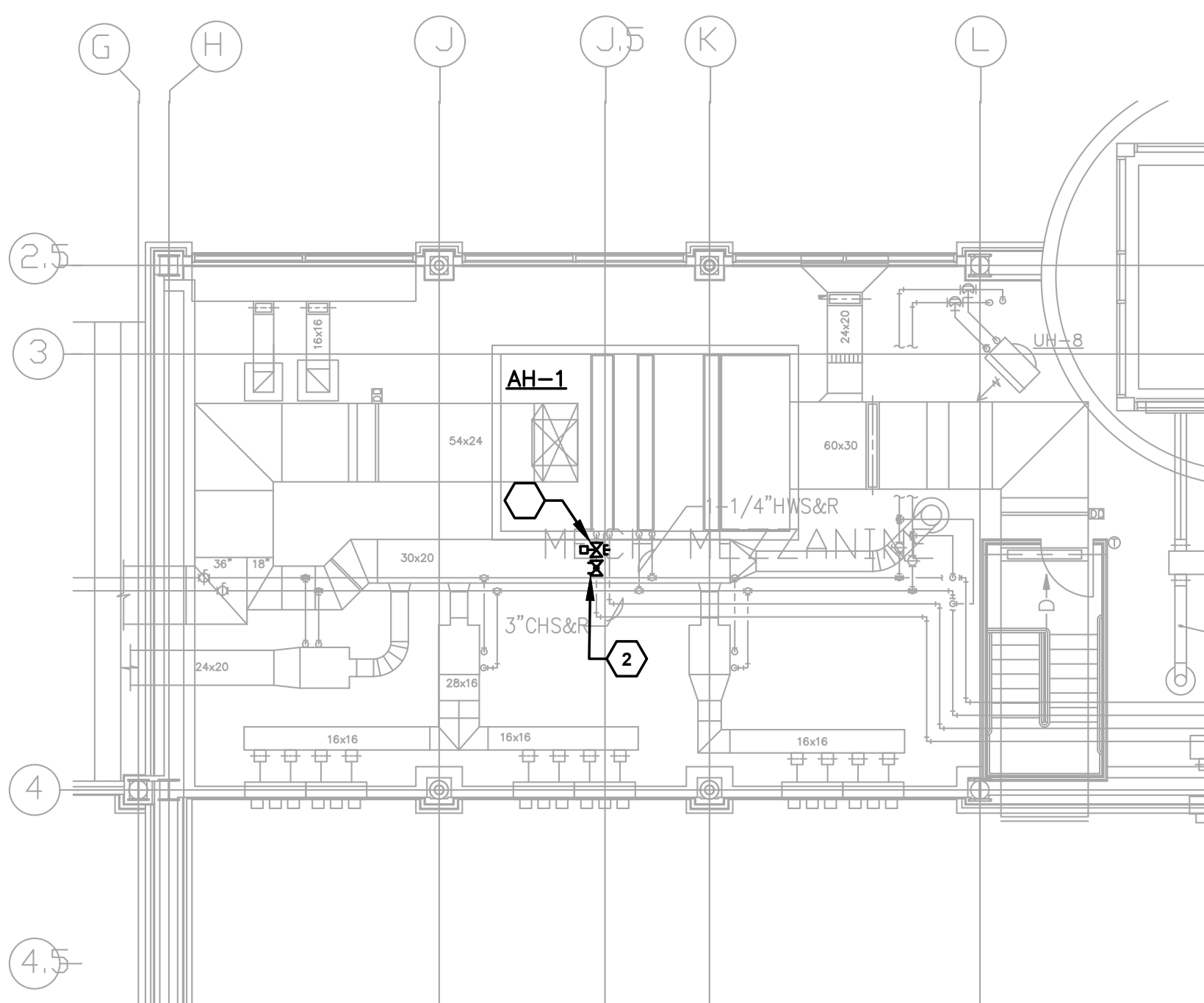
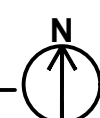
NOTE THAT ALL WORK SHOWN ON THIS SHEET SHALL BE BID AS A PART OF THE ALTERNATE 1 SCOPE OF WORK.



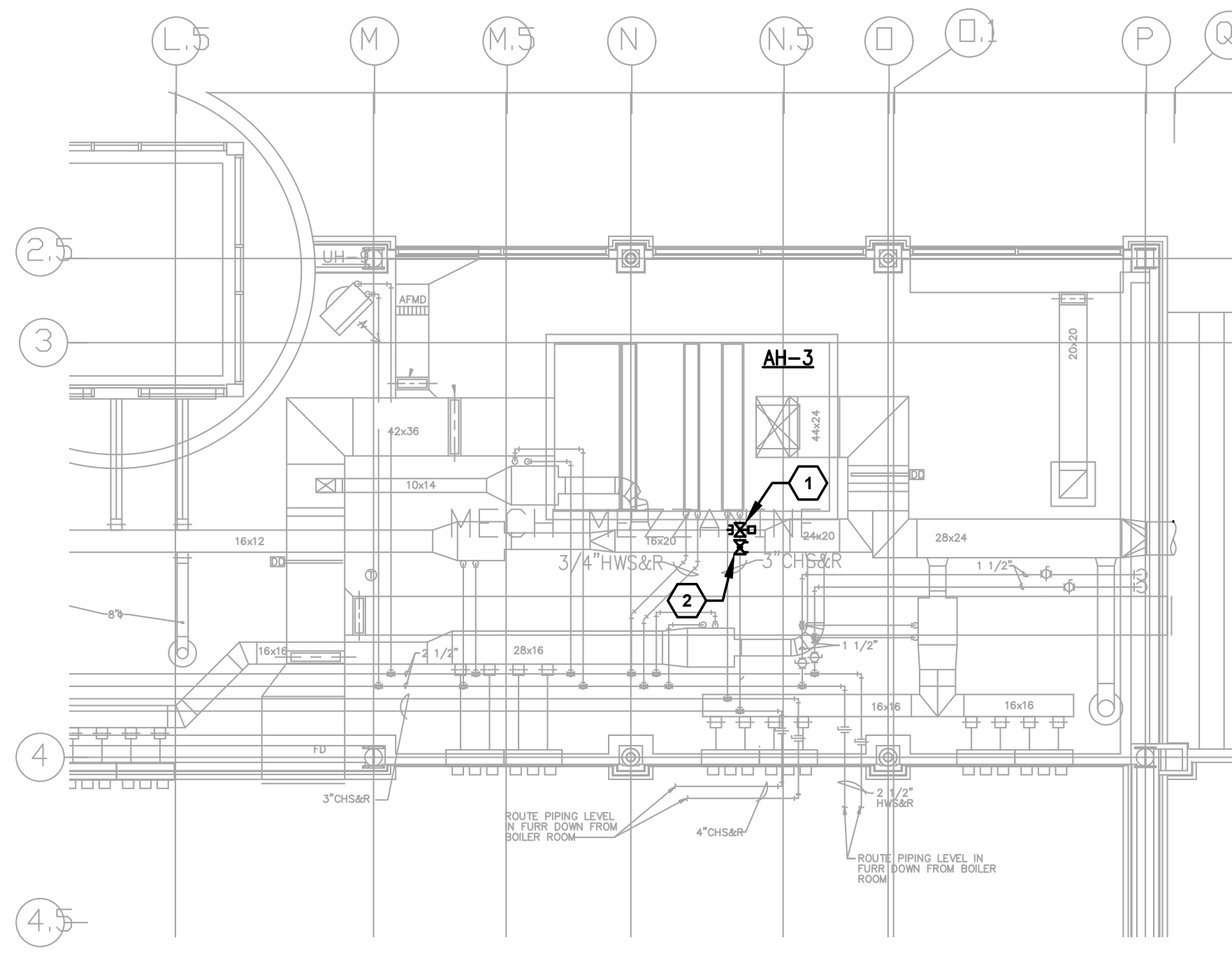
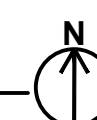
MECHANICAL SECOND FLOOR PLAN



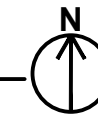
2 MECHANICAL SECOND FLOOR PLAN
1/8" = 1'-0"



MECHANICAL MEZZANINE FLOOR PLAN



4 MECHANICAL MEZZANINE FLOOR PLAN
1/8" = 1'-0"



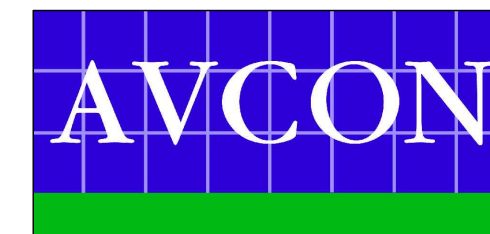
GENERAL NOTES

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- B. PROTECTION – EXERCISE CARE DURING THE WORK TO PROTECT INTERIOR AND EXTERIOR EXISTING CONSTRUCTION TO REMAIN. REPAIR TO EXISTING CONSTRUCTION DUE TO DAMAGE SHALL BE DONE AT NO COST TO AIRPORT.
- C. ALL DEMOLITION WORK SHALL BE IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL CODES.
- D. PATCH ALL WALL PENETRATIONS WHERE PIPING REMOVED AND WHERE OPENING IS NOT BEING REUSED. WALL SHALL BE SEALED TO PRE-CONSTRUCTION CONDITION AND MEET EXISTING WALL RATING.
- E. REMOVE ALL HANGERS, CONDUCTORS, CONDUIT, HARDWARE AND ANY OTHER APPURTENANCES THAT ARE NOT TO BE REUSED THROUGHOUT THE MECHANICAL DEMOLITION.

MECHANICAL KEY NOTES

- 1 REMOVE CHILLED WATER COIL'S 3-WAY CONTROL VALVE. CAP 3-WAY VALVE BYPASS LEG AND INSULATE EXPOSED PIPING PER SPECIFICATIONS. PROVIDE NEW MODULATING 2-WAY CHILLED WATER CONTROL VALVE AT CHILLED WATER COIL.
- 2 REMOVE CHILLED WATER COIL BALANCING VALVE. PROVIDE NEW AUTOMATIC FLOW LIMITING/BALANCING VALVES AT CHILLED WATER COIL RETURN SIDE PIPING. REFERENCE COIL PIPING DETAIL 03/M-501.

NOTE THAT ALL WORK SHOWN ON THIS SHEET SHALL BE BID AS A PART OF THE ALTERNATE 1 SCOPE OF WORK.



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

MECHANICAL SECOND FLOOR ENLARGED PLANS

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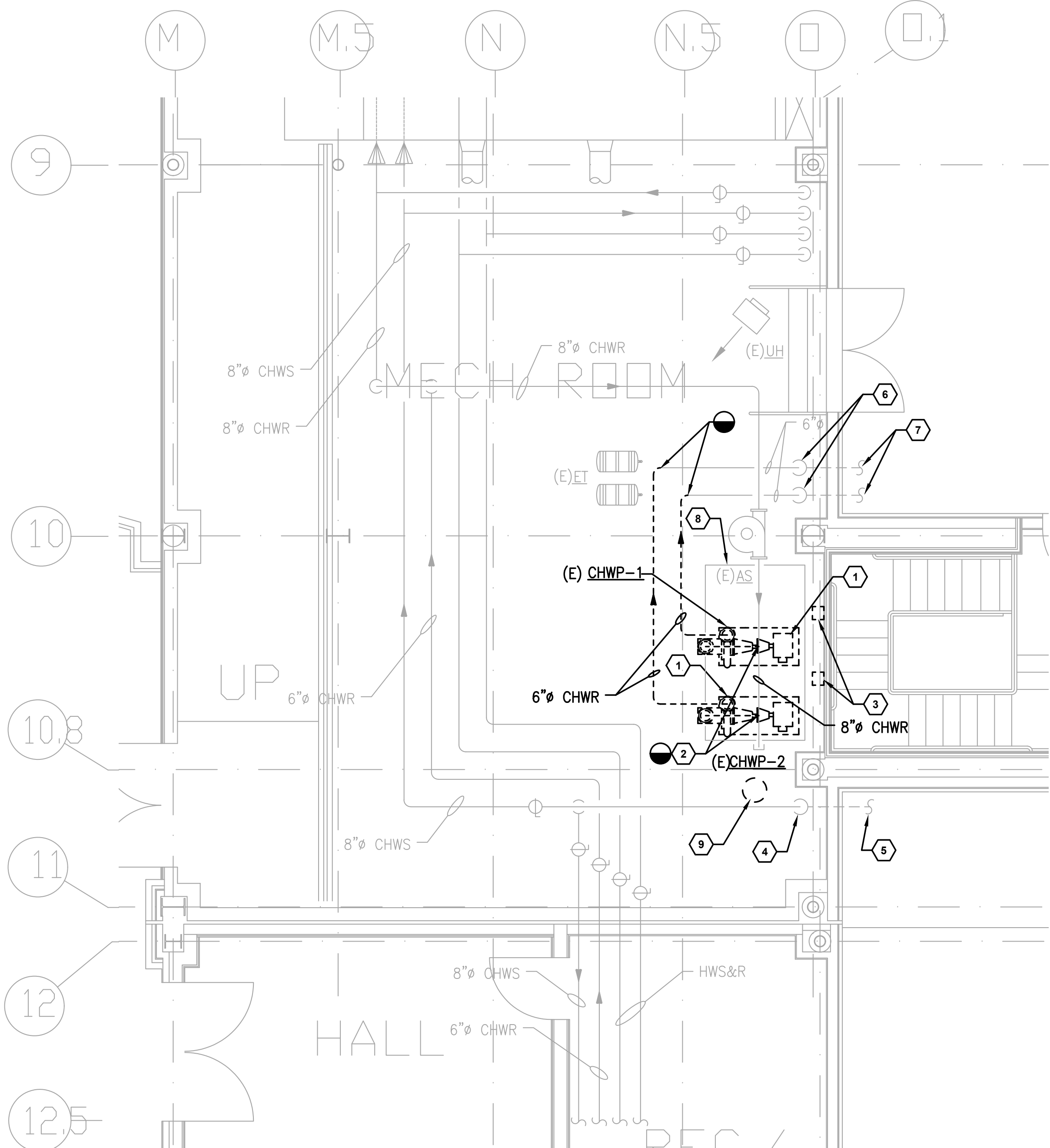
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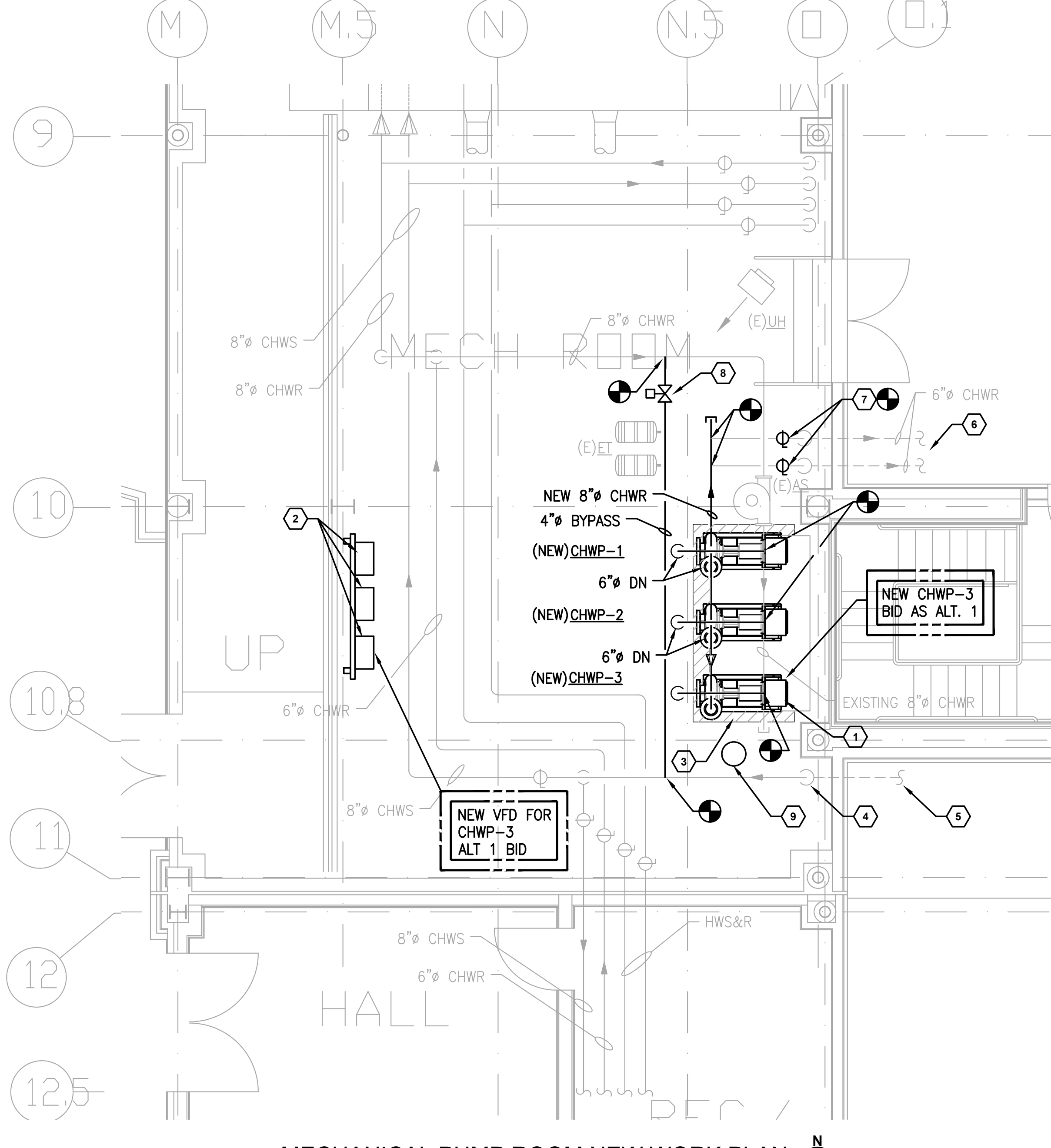
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MECHANICAL PUMP ROOM DEMOLITION FLOOR PLAN

DEMOLITION KEY NOTES

- A. DEMOLITION WORK - CARRY OUT DEMOLITION WORK TO CAUSE AS LITTLE INCONVENIENCE TO OCCUPIED BUILDING AREAS AS POSSIBLE. DEMOLISH IN AN ORDERLY AND CAREFUL MANNER AS REQUIRED TO ACCOMMODATE THE NEW WORK. PERFORM DEMOLITION IN ACCORDANCE WITH APPLICABLE AUTHORITIES HAVING JURISDICTION. TAKE CARE TO PREVENT DAMAGE AND EXCESSIVE NOISE OR VIBRATION SO AS NOT TO DISTURBANCE ADJACENT OCCUPIED AREAS. ANY OPERATION THAT MAY CAUSE DISTURBANCE TO THE AIRPORT SHALL BE COORDINATED WITH THE AIRPORT A MINIMUM OF TWO (2) WEEKS IN ADVANCE. SOME WORK MAY REQUIRE PERFORMANCE DURING "OFF HOURS" TO ALLOW AIRPORT FULL USE OF THE OCCUPIED AREAS.
 - B. PROTECTION - EXERCISE CARE DURING THE WORK TO PROTECT INTERIOR AND EXTERIOR EXISTING CONSTRUCTION TO REMAIN. REPAIR TO EXISTING CONSTRUCTION DUE TO DAMAGE SHALL BE DONE AT NO COST TO AIRPORT.
 - C. ALL DEMOLITION WORK SHALL BE IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL CODES.
 - D. PATCH ALL WALL AND FLOOR PENETRATIONS WHERE PIPING REMOVED AND WHERE OPENING IS NOT BEING REUSED. WALL AND FLOOR SHALL BE SEALED TO PRE-CONSTRUCTION CONDITION AND MEET EXISTING WALL RATING.
 - E. REMOVE ALL HANGERS, CONDUCTORS, CONDUIT, HARDWARE AND ANY OTHER APPURTENANCES THAT ARE NOT TO BE REUSED THROUGHOUT THE MECHANICAL DEMOLITION.
- 1 REMOVE EXISTING CHILLED WATER PUMPS CHWP-1 & 2 AND ASSOCIATED ANCILLARY VALVES, STRAINER AND FLEX CONNECTIONS.
 - 2 REMOVE CHW PUMP SUCTION AND DISCHARGE 6" LINES TO LIMITS SHOWN.
 - 3 REMOVE EXISTING WALL-MOUNTED CHWP-1 & 2 STARTERS AND ELECTRICAL FEEDERS ALL THE WAY BACK TO SOURCE PANEL. REFER TO ELECTRICAL DRAWINGS.
 - 4 EXISTING 8" CHWS LINE UP FROM 1ST FLOOR CEILING SPACE TO REMAIN.
 - 5 EXISTING 8" CHWS LINE FROM ROOF-MOUNTED CHILLERS TO REMAIN. CHW LINE IS ROUTED INSIDE CEILING SPACE BELOW 1ST FLOOR ROOF. REFER TO SHEET M115 FOR CONTINUATION.
 - 6 EXISTING 6" CHWR LINES DN TO 1ST FLOOR CEILING SPACE TO REMAIN.
 - 7 EXISTING 6" CHWR LINES TO ROOF-MOUNTED CHILLERS TO REMAIN. CHW LINES ARE ROUTED INSIDE CEILING SPACE BELOW 1ST FLOOR ROOF. REFER TO SHEET M115 FOR CONTINUATION.
 - 8 EXISTING PUMP CONCRETE PAD TO REMAIN.
 - 9 REMOVE EXISTING CHEMICAL SHOT FEEDER. CONTRACTOR SHALL FIELD VERIFY LOCATION.



2 MECHANICAL PUMP ROOM NEW WORK PLAN
1/4" = 1'-0"

MECHANICAL KEY NOTES

- 1 NEW BASE-MOUNT END-SUCTION CENTRIFUGAL CHW PUMPS (TYP. OF 3). REFER TO PUMP SCHEDULE ON SHEET M-601 AND PUMP DETAIL 04 ON SHEET M-501.
- 2 NEW VARIABLE FREQUENCY DRIVES FOR CHWP-1, 2 & 3. REFER TO SPECIFICATION SECTION 23 05 17 AND CHILLED WATER SYSTEM CONTROL SEQUENCE OF OPERATION AND SCHEMATIC ON SHEETS M-701 & M-702.
- 3 EXISTING CONCRETE PAD SHALL BE EXTENDED TO ACCOMMODATE NEW PUMPS AND PROVIDE CLEARANCE SHOWN. REFER TO REINFORCED CONCRETE PAD DETAIL 04/M-502.
- 4 EXISTING 8" CHWS LINE UP FROM 1ST FLOOR CEILING SPACE TO REMAIN.
- 5 EXISTING 8" CHWS LINE FROM ROOF-MOUNTED CHILLERS TO REMAIN. CHW LINE IS ROUTED INSIDE CEILING SPACE BELOW 1ST FLOOR ROOF. REFER TO SHEET M-115 FOR CONTINUATION.
- 6 EXISTING 6" CHWR LINES TO ROOF-MOUNTED CHILLERS TO REMAIN. CHW LINES ARE ROUTED INSIDE CEILING SPACE BELOW 1ST FLOOR ROOF. REFER TO SHEET M-115 FOR CONTINUATION.
- 7 PROVIDE NEW 6" CHWR MANUAL ISOLATION VALVES.
- 8 4" MINIMUM FLOW CHW BYPASS AND MODULATING CONTROL VALVE.
- 9 NEW CHEMICAL SHOT FEEDER LOCATION SHALL MATCH EXISTING. REFER TO DETAIL 02/M-501.



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MECHANICAL PUMP ROOM ENLARGED PLAN

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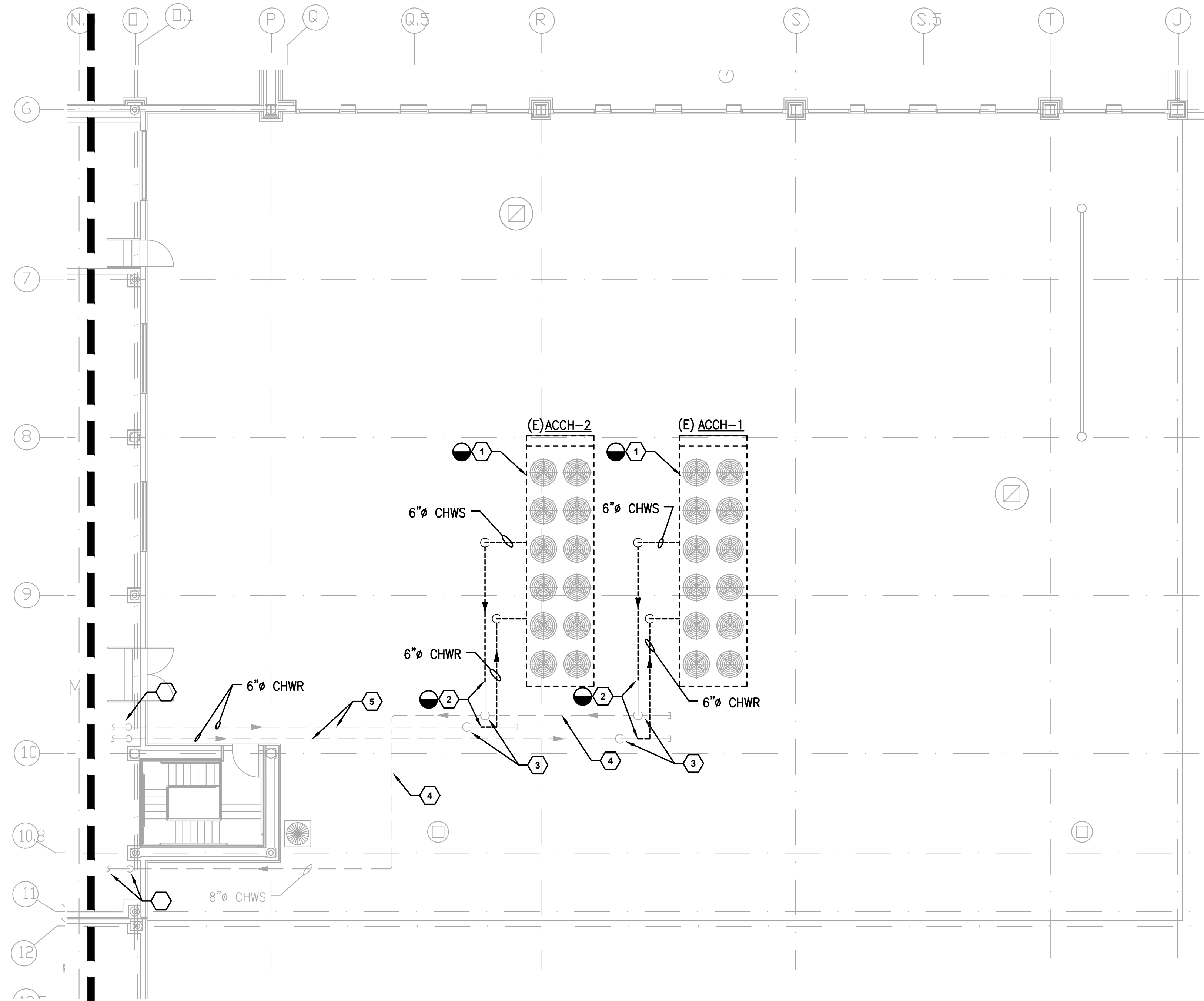
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SHEET NUMBER M-114

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SHEET M-114
MATCH LINE

1 MECHANICAL DEMOLITION FIRST FLOOR ROOF PLAN
1/8" = 1'-0"

GENERAL NOTES

- A. DEMOLITION WORK – CARRY OUT DEMOLITION WORK TO CAUSE AS LITTLE INCONVENIENCE TO OCCUPIED BUILDING AREAS AS POSSIBLE. DEMOLISH IN AN ORDERLY AND CAREFUL MANNER AS REQUIRED TO ACCOMMODATE THE NEW WORK. PERFORM DEMOLITION IN ACCORDANCE WITH APPLICABLE AUTHORITIES HAVING JURISDICTION. TAKE CARE TO PREVENT DAMAGE AND EXCESSIVE NOISE OR VIBRATION SO AS NOT TO DISTURBANCE ADJACENT OCCUPIED AREAS. ANY OPERATION THAT MAY CAUSE DISTURBANCE TO THE AIRPORT SHALL BE COORDINATED WITH THE AIRPORT A MINIMUM OF TWO (2) WEEKS IN ADVANCE. SOME WORK MAY REQUIRE PERFORMANCE DURING "OFF HOURS" TO ALLOW AIRPORT FULL USE OF THE OCCUPIED AREAS.
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- D. PATCH ALL WALL AND FLOOR PENETRATIONS WHERE PIPING REMOVED AND WHERE OPENING IS NOT BEING REUSED. FLOOR AND WALL SHALL BE SEALED TO PRE-CONSTRUCTION CONDITION AND MEET EXISTING WALL RATING.
- E. REMOVE ALL HANGERS, CONDUCTORS, CONDUIT, HARDWARE AND ANY OTHER APPURTENANCES THAT ARE NOT TO BE REUSED THROUGHOUT THE MECHANICAL DEMOLITION.
- F. THE EXISTING ROOF WARRANTY SHALL BE MAINTAINED FOR ALL ROOF WORK ASSOCIATED WITH THE CHILLER AND PIPING REPLACEMENT.

MECHANICAL KEY NOTES

- 1 REMOVE EXISTING AIR-COOLED CHILLERS ACCH-1 & 2 INCLUDING ALL ANCILLARY VALVES, FITTINGS AND SENSORS IN 6" CHWS&R PIPE CONNECTIONS.
- 2 REMOVE EXISTING 6" CHWS&R LINES LOCATED ABOVE THE ROOF FROM CHILLER CONNECTIONS TO LIMITS SHOWN INCLUDING EXISTING ISOLATION VALVE. HEAVY WEIGHT DASHED LINES DENOTE CHWS&R PIPING SECTIONS TO BE REMOVED.
- 3 EXISTING 6" CHWS&R PIPING DN THRU ROOF TO REMAIN.
- 4 EXISTING 8" CHWS PIPING, LOCATED INSIDE 1ST FLOOR CEILING SPACE TO REMAIN.
- 5 EXISTING 6" CHWR PIPING, LOCATED INSIDE 1ST FLOOR CEILING SPACE TO REMAIN.
- 6 EXISTING 8" CHWS PIPING INSIDE UP TO PUMP ROOM TO REMAIN. REFER TO SHEET M-114 FOR CONTINUATION.
- 7 EXISTING 6" CHWR PIPING INSIDE DN FROM PUMP ROOM TO REMAIN. REFER TO SHEET M-114 FOR CONTINUATION.



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

MECHANICAL CHILLER DEMOLITION ROOF PLAN

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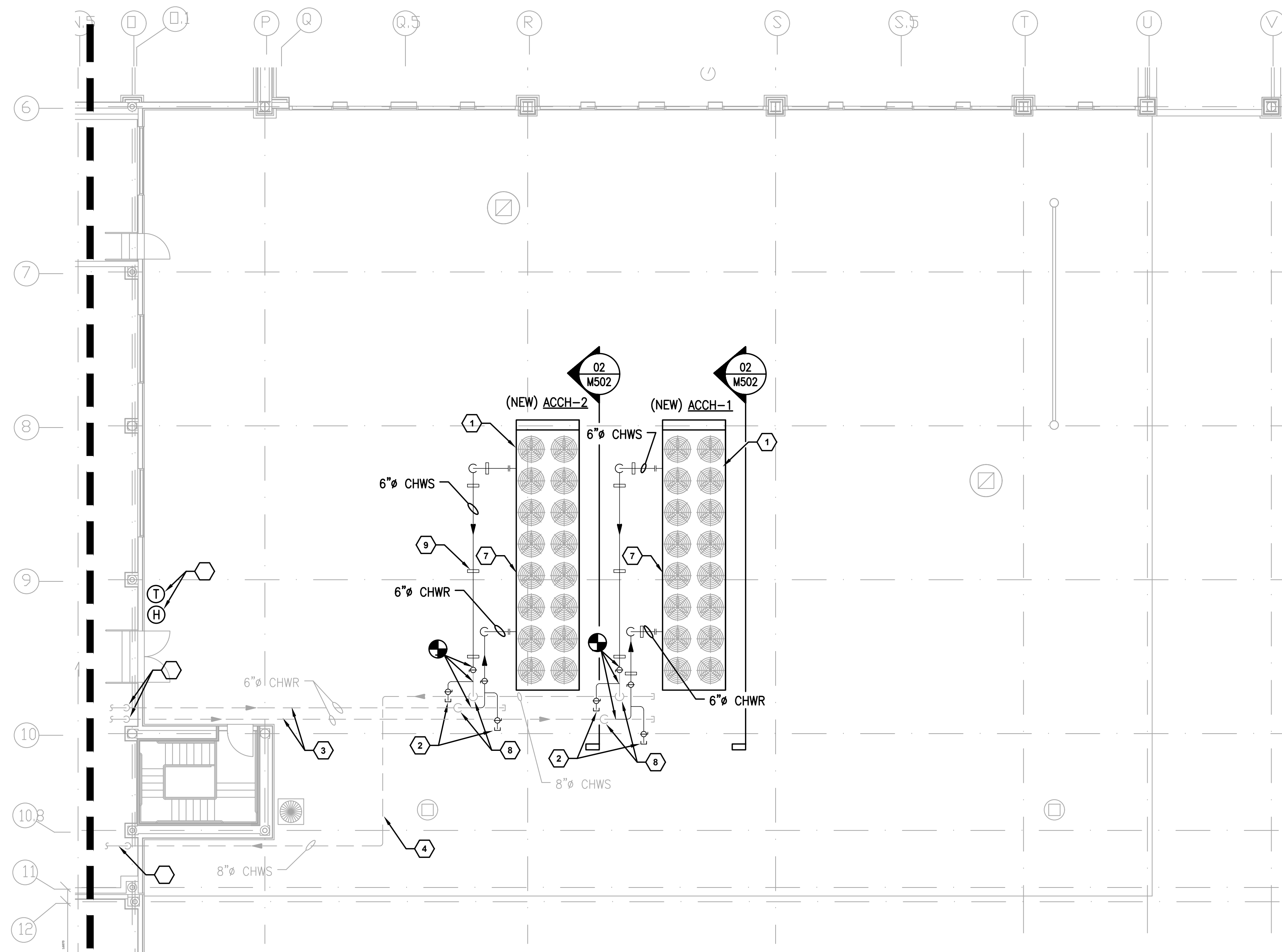
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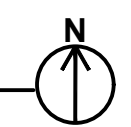
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SHEET NUMBER M-115

V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\M-M-116 MECHANICAL_SECOND FLOOR PLANS.DWG 1/12/2018 12:17 PM



1 MECHANICAL NEW WORK FIRST FLOOR ROOF PLAN
1/8" = 1'-0"



GENERAL NOTES

- A. DEMOLITION WORK – CARRY OUT DEMOLITION WORK TO CAUSE AS LITTLE INCONVENIENCE TO OCCUPIED BUILDING AREAS AS POSSIBLE. DEMOLISH IN AN ORDERLY AND CAREFUL MANNER AS REQUIRED TO ACCOMMODATE THE NEW WORK. PERFORM DEMOLITION IN ACCORDANCE WITH APPLICABLE AUTHORITIES HAVING JURISDICTION. TAKE CARE TO PREVENT DAMAGE AND EXCESSIVE NOISE OR VIBRATION SO AS NOT TO DISTURBANCE ADJACENT OCCUPIED AREAS. ANY OPERATION THAT MAY CAUSE DISTURBANCE TO THE AIRPORT SHALL BE COORDINATED WITH THE AIRPORT A MINIMUM OF TWO (2) WEEKS IN ADVANCE. SOME WORK MAY REQUIRE PERFORMANCE DURING "OFF HOURS" TO ALLOW AIRPORT FULL USE OF THE OCCUPIED AREAS.
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- E. REMOVE ALL HANGERS, CONDUCTORS, CONDUIT, HARDWARE AND ANY OTHER APPURTENANCES THAT ARE NOT TO BE REUSED THROUGHOUT THE MECHANICAL DEMOLITION.
- F. THE EXISTING ROOF WARRANTY SHALL BE MAINTAINED FOR ALL ROOF WORK ASSOCIATED WITH THE CHILLER AND PIPING REPLACEMENT.

MECHANICAL KEY NOTES

- 1 NEW AIR-COOLED CHILLERS. REFERENCE DETAIL 01/M-501 AND CHILLER SCHEDULE ON SHEET M-601.
- 2 NEW 6" CHWS&R EMERGENCY CONNECTIONS. VALVE, CAP AND INSULATE PER SPECIFICATIONS.
- 3 EXISTING 6" CHWR PIPING IS ROUTED HORIZONTALLY THROUGH 1ST FLOOR CEILING SPACE.
- 4 EXISTING 8" CHWS PIPING IS ROUTED HORIZONTALLY THROUGH 1ST FLOOR CEILING SPACE.
- 5 REFER TO SHEET M-114 FOR CONTINUATION OF EXISTING 6" CHWR LINES IN MECHANICAL ROOM.
- 6 REFER TO SHEET M-114 FOR CONTINUATION OF EXISTING 8" CHWS LINE IN MECHANICAL ROOM.
- 7 EXISTING CHILLER SUPPORT FRAMES SHALL BE MODIFIED TO ACCOMMODATE NEW CHILLERS' DIMENSIONS AND WEIGHT. NEW SPRING VIBRATION ISOLATION SHALL BE PROVIDED PER SPECIFICATIONS. REFER TO STRUCTURAL SHEETS S-001 AND S-100 FOR DETAILED DESIGN MODIFICATIONS.
- 8 EXISTING 6" CHWS&R DN THRU ROOF TO REMAIN.
- 9 CHILLED WATER PIPING ROOF SUPPORTS, REFER TO DETAIL 05/M-502.
- 10 OUTDOOR HUMIDITY AND TEMPERATURE SENSOR/TRANSMITTER. REFER TO DETAIL 03/M-701.



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MECHANICAL NEW CHILLER ROOF PLAN

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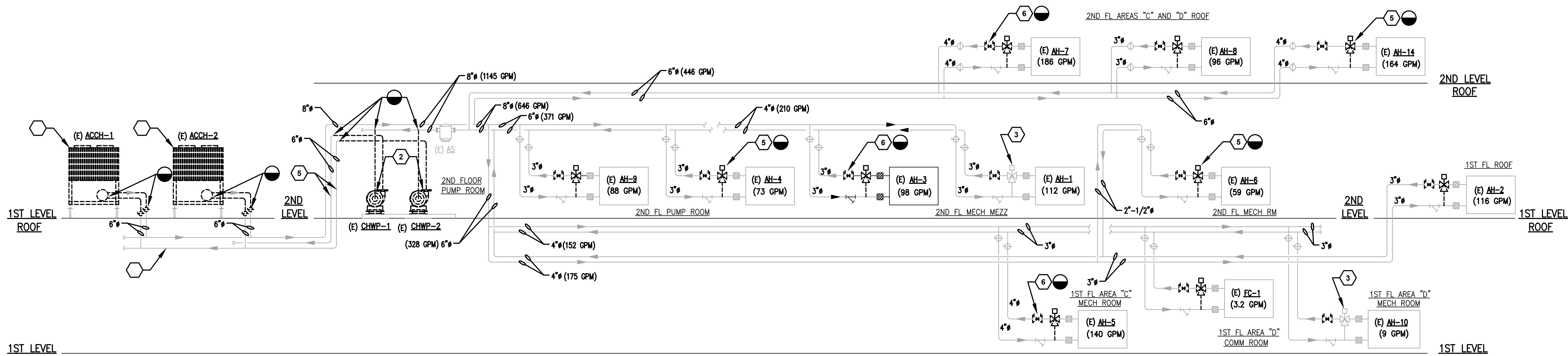
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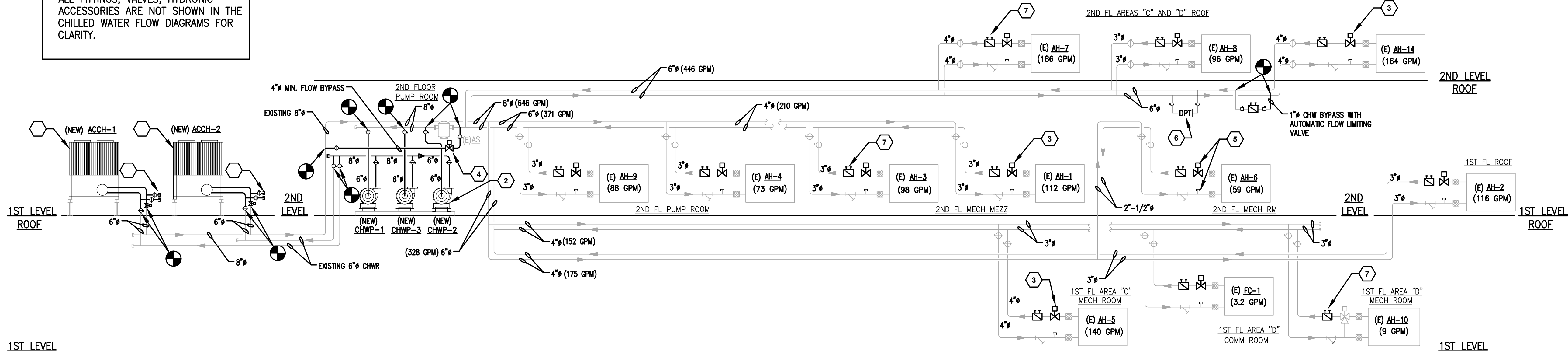
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V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\M-M-301 MECHANICAL FLOW DIAGRAMS.DWG-1/12/2018 12:17 PM



NOTE:
ALL FITTINGS, VALVES, HYDRONIC ACCESSORIES ARE NOT SHOWN IN THE CHILLED WATER FLOW DIAGRAMS FOR CLARITY.

01 CHW FLOW DIAGRAM - DEMOLITION PLAN
NOT TO SCALE



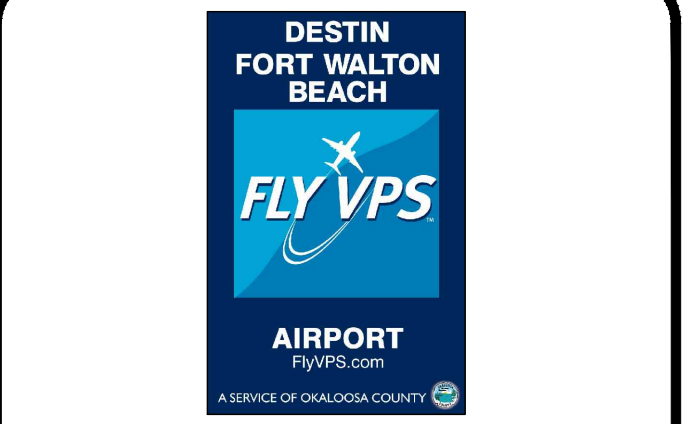
02 CHW FLOW DIAGRAM - NEW WORK PLAN
NOT TO SCALE

DEMOLITION KEY NOTES

- ⬡ EXISTING AIR-COOLED CHILLERS TO BE REMOVED (TYP. OF 2) (BASE BID & ALT. 1)
- ⬡ EXISTING CHILLED WATER PUMPS TO BE REMOVED (TYP. OF 2)
- ⬡ AH-10 3-WAY CONTROL VALVE TO REMAIN.
- ⬡ UNLESS NOTED OTHERWISE, REMOVE ALL CHILLED WATER COILS 3-WAY CONTROL VALVES. CAP 3-WAY VALVE BYPASS LEG AND INSULATE PER SPECIFICATION 23 07 00. (ALT. 1)
- ⬡ CHILLED WATER PIPING TO BE REMOVED SHOWN BY HEAVY WEIGHT DASHED LINES. (REFER TO PLANS) (BASE BID & ALT. 1)
- ⬡ REMOVE ALL CHILLED WATER COIL BALANCING VALVES. (ALT. 1)

MECHANICAL KEY NOTES

- ① NEW AIR-COOLED CHILLERS (TYP. OF 2).
- ② NEW BASE-MOUNT END-SUCTION CHW PUMPS (TYP. OF 3) (BASE BID & ALT. 1)
- ③ NEW MODULATING CHW CONTROL VALVES AT EACH CHW COIL (TYPICAL UNLESS NOTED OTHERWISE). (ALT. 1)
- ④ NEW 4" MINIMUM FLOW BYPASS AND CONTROL VALVE. REFER TO SHEET M-114 FOR APPROXIMATE BUILDING LOCATION.
- ⑤ 6" EMERGENCY CHW CONNECTIONS. VALVE, CAP AND INSULATE PER SPECIFICATIONS.
- ⑥ NEW DIFFERENTIAL PRESSURE TRANSMITTER. REFER TO SHEET M-113 FOR APPROXIMATE BUILDING LOCATION.
- ⑦ NEW AUTOMATIC FLOW LIMITING/BALANCING VALVES. (TYPICAL AT EACH CHILLED WATER COIL RETURN.) (ALT. 1)



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

MECHANICAL FLOW DIAGRAMS

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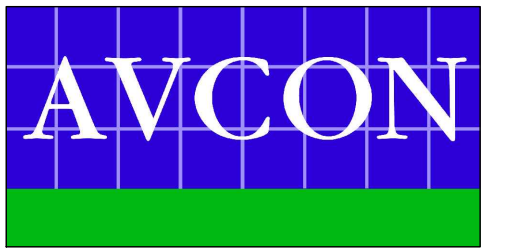
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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

MECHANICAL DETAILS

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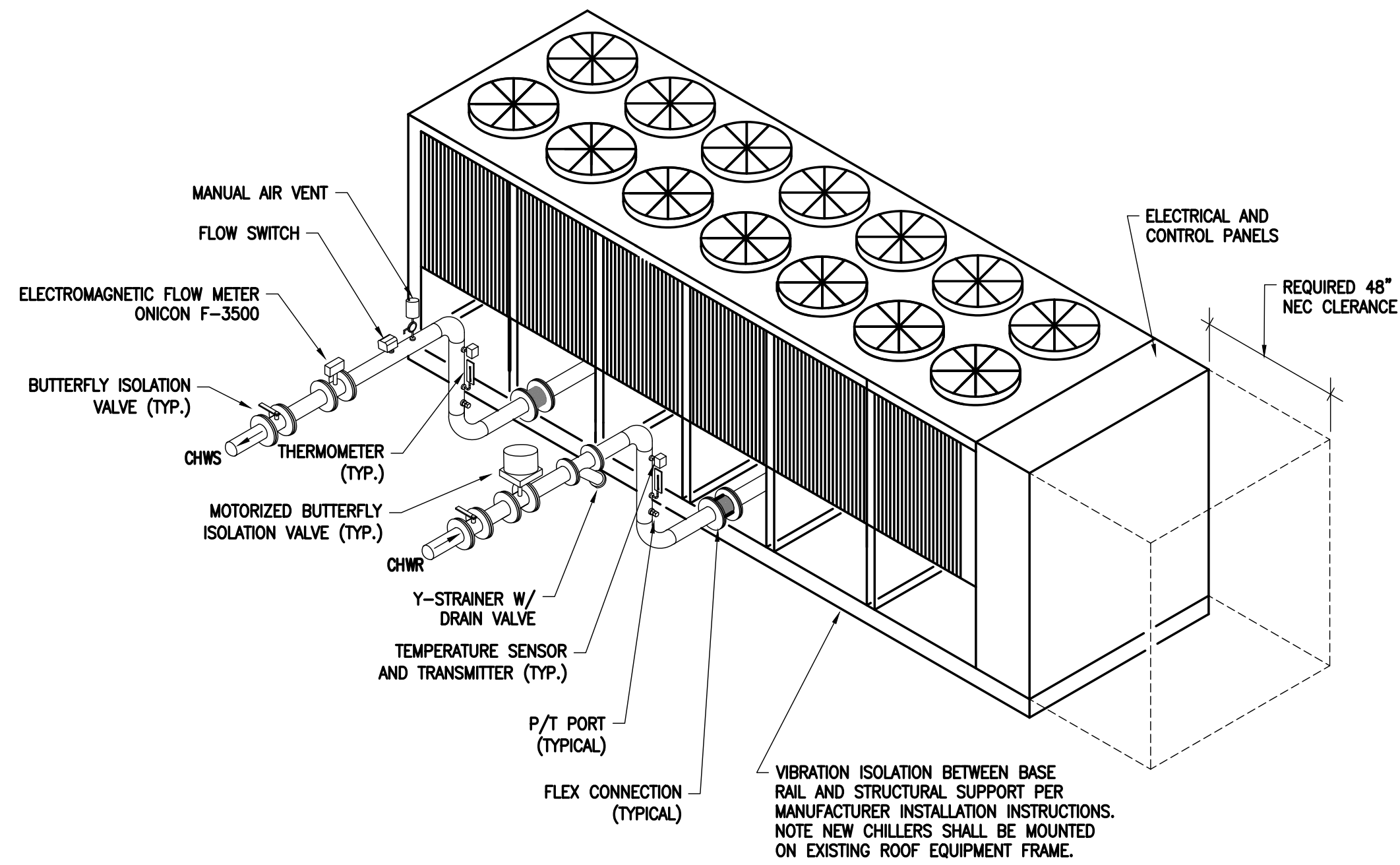
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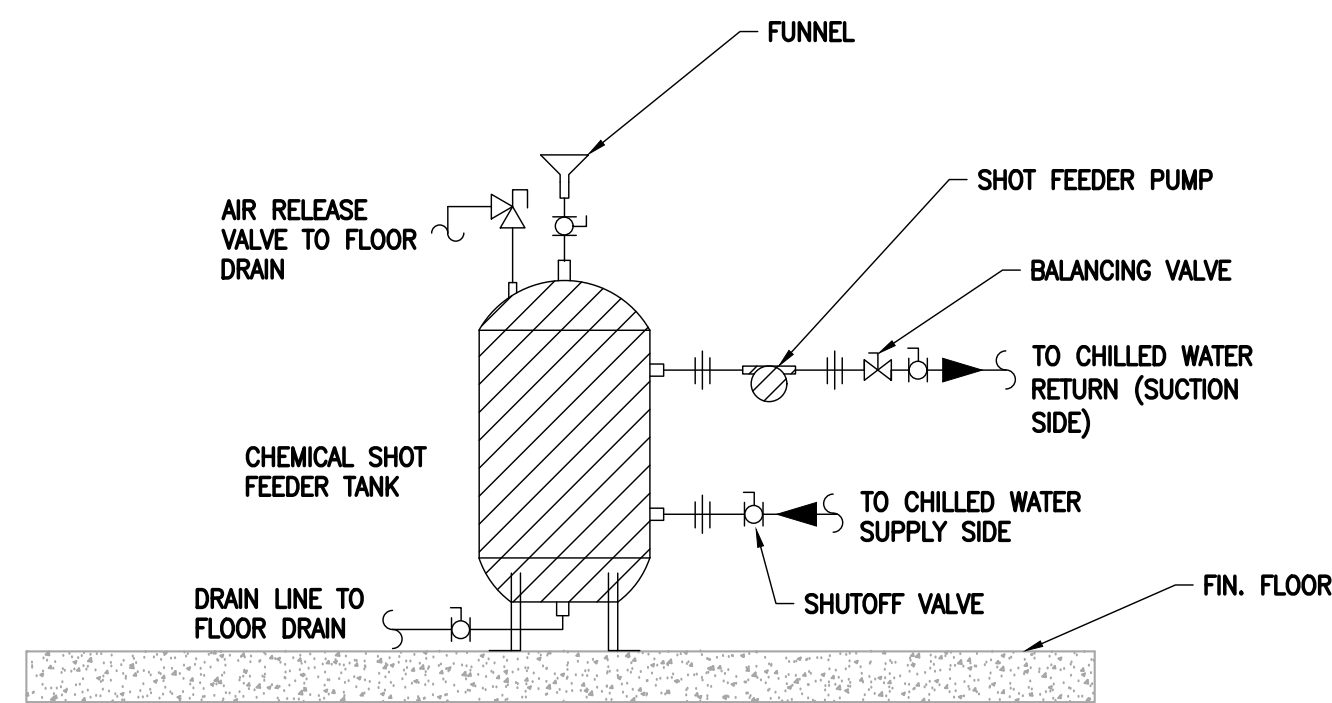
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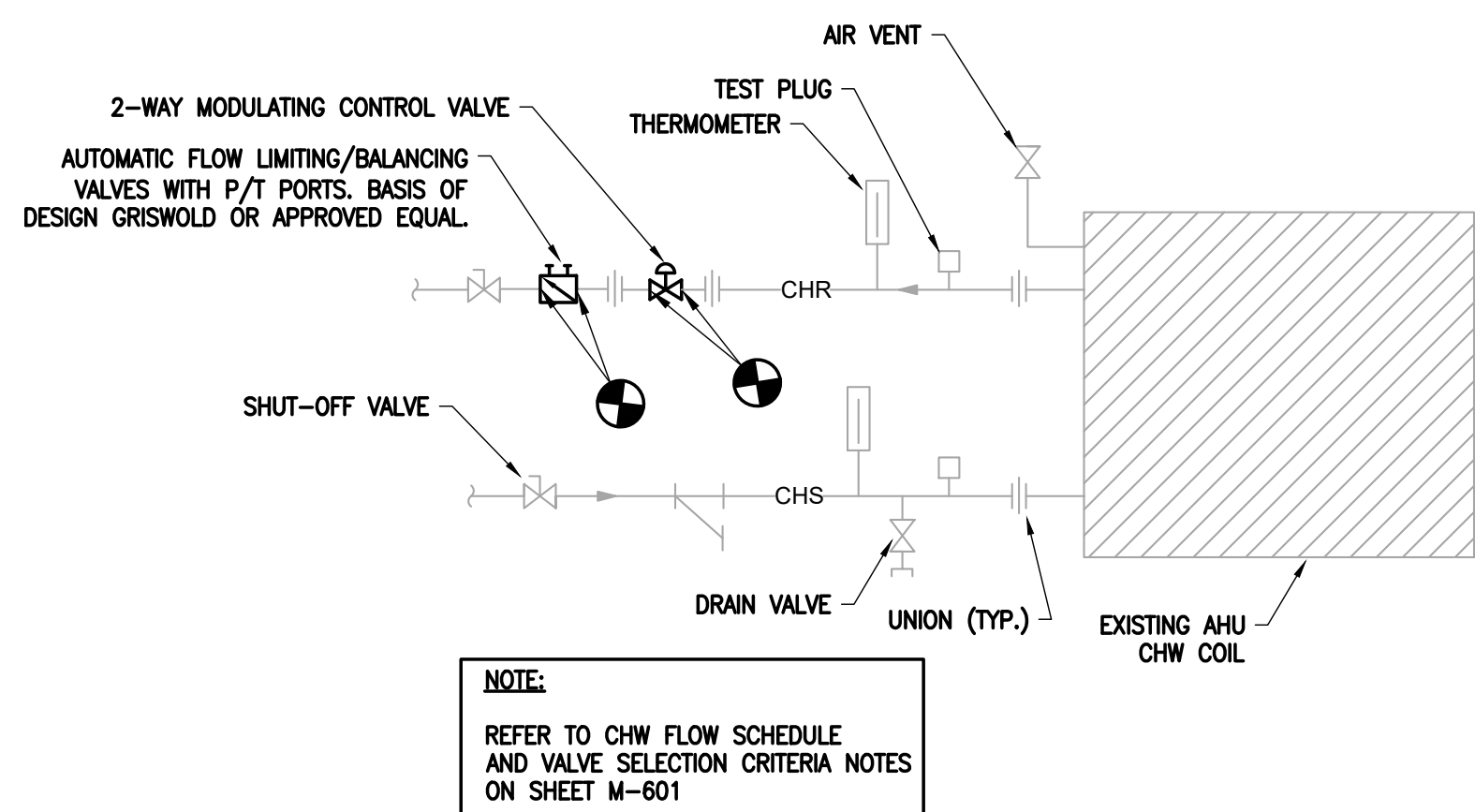
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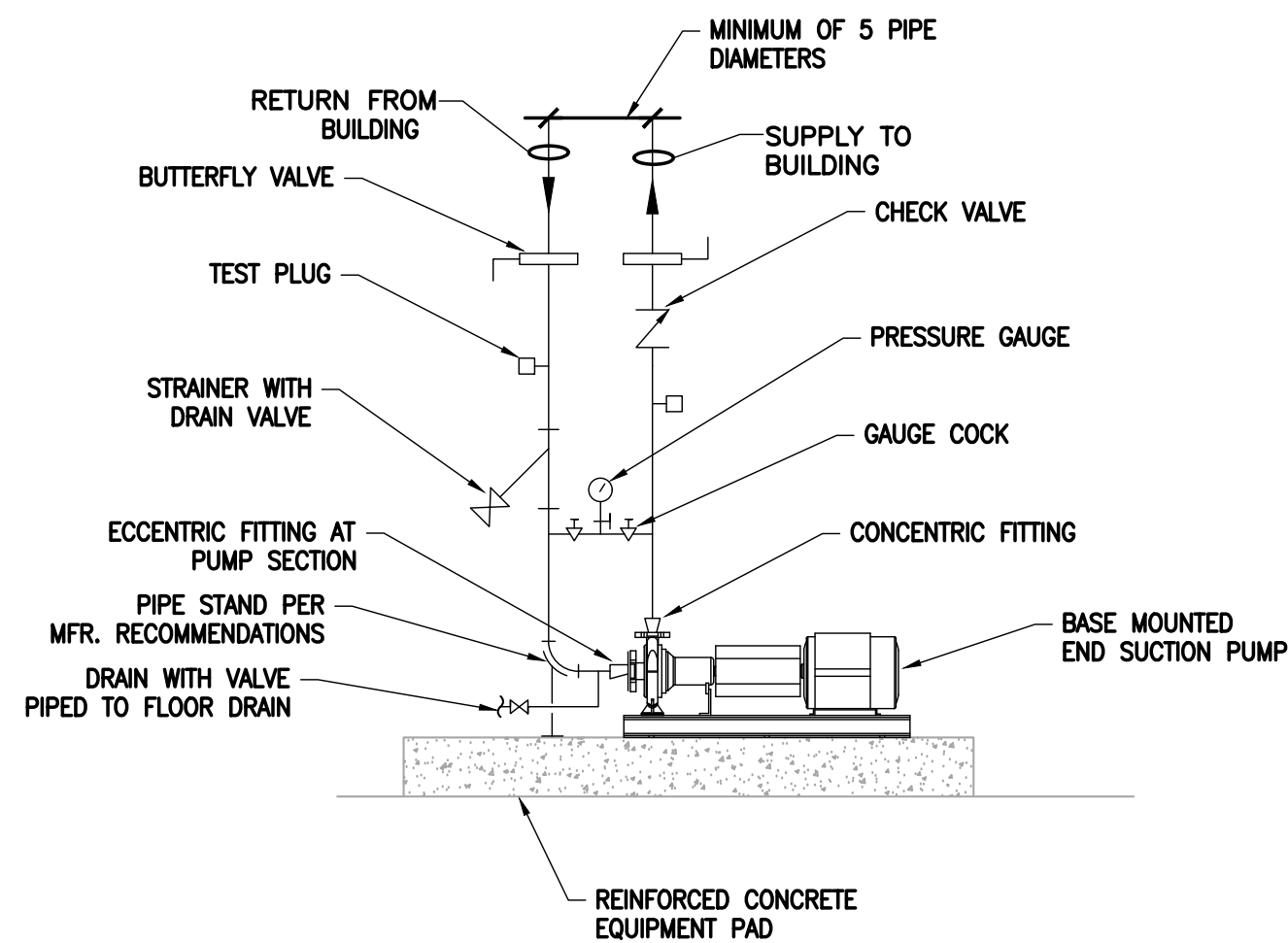
01 AIR-COOLED CHILLER PIPING DETAIL
NOT TO SCALE



02 SHOT FEEDER - CHEMICAL TREATMENT DETAIL
NOT TO SCALE

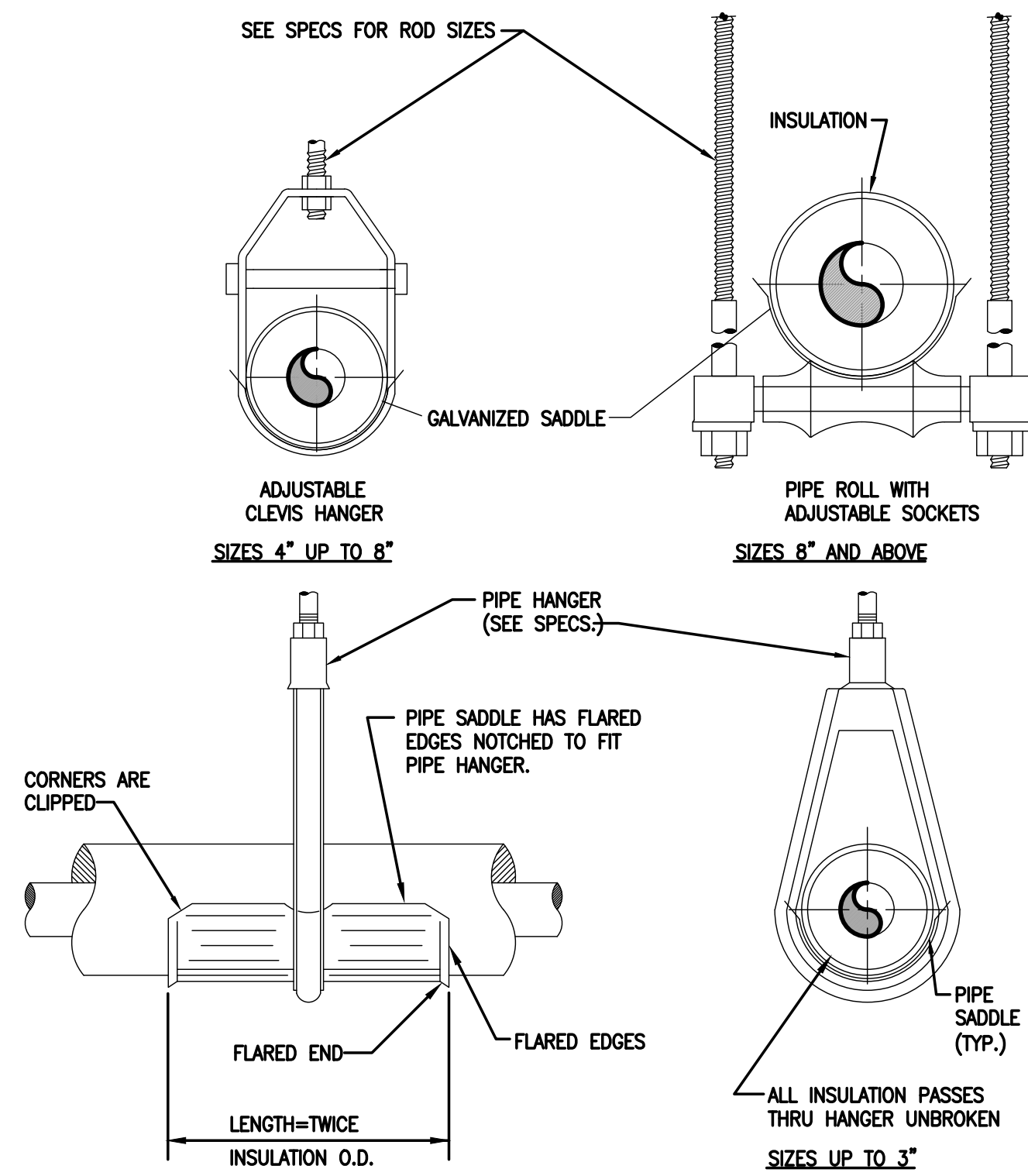


03 COIL PIPING DETAIL (2-WAY)
NOT TO SCALE

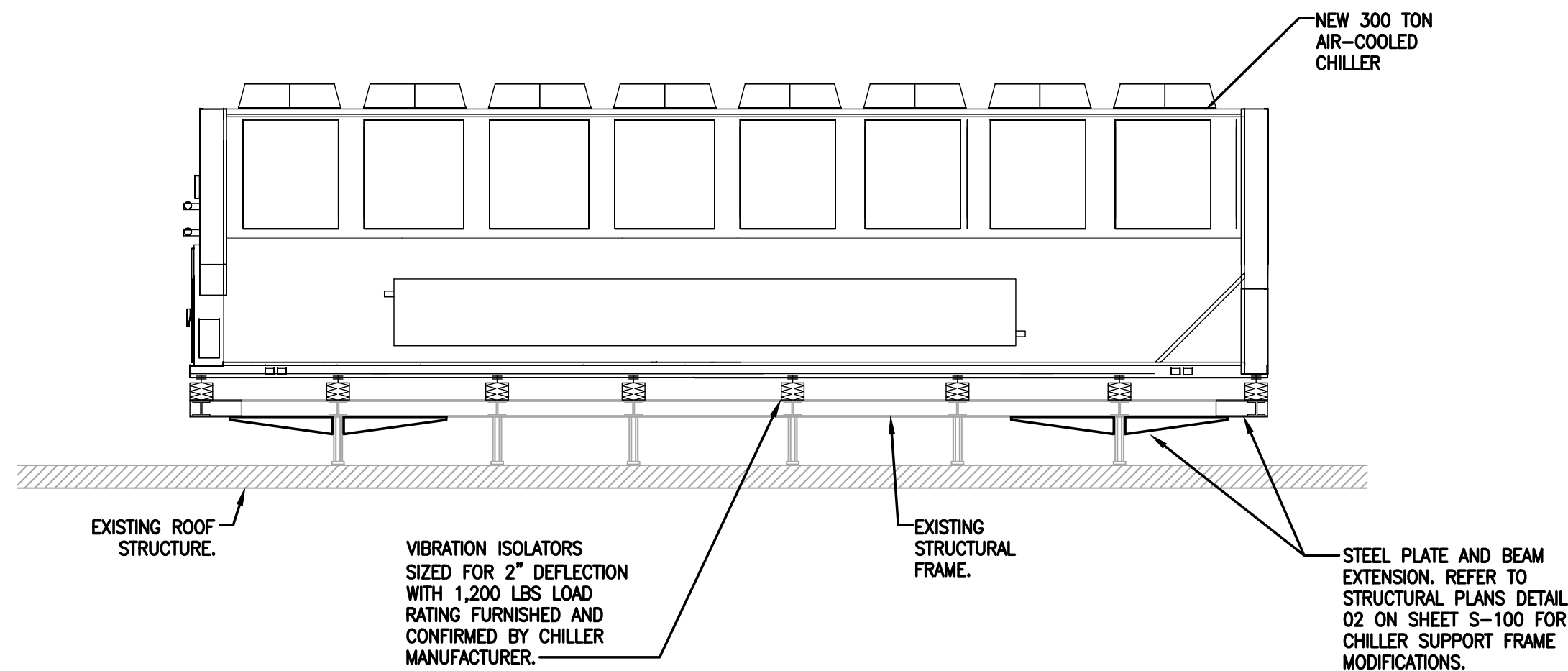


04 END SUCTION PUMP DETAIL
NOT TO SCALE

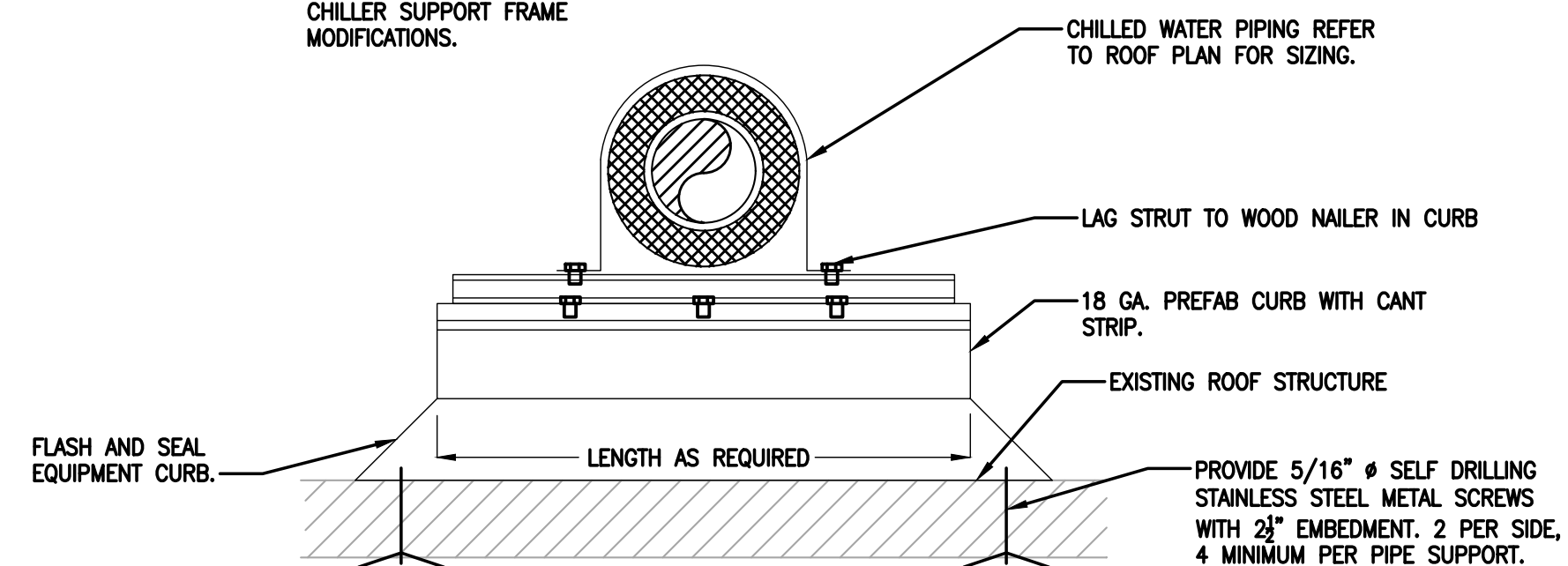
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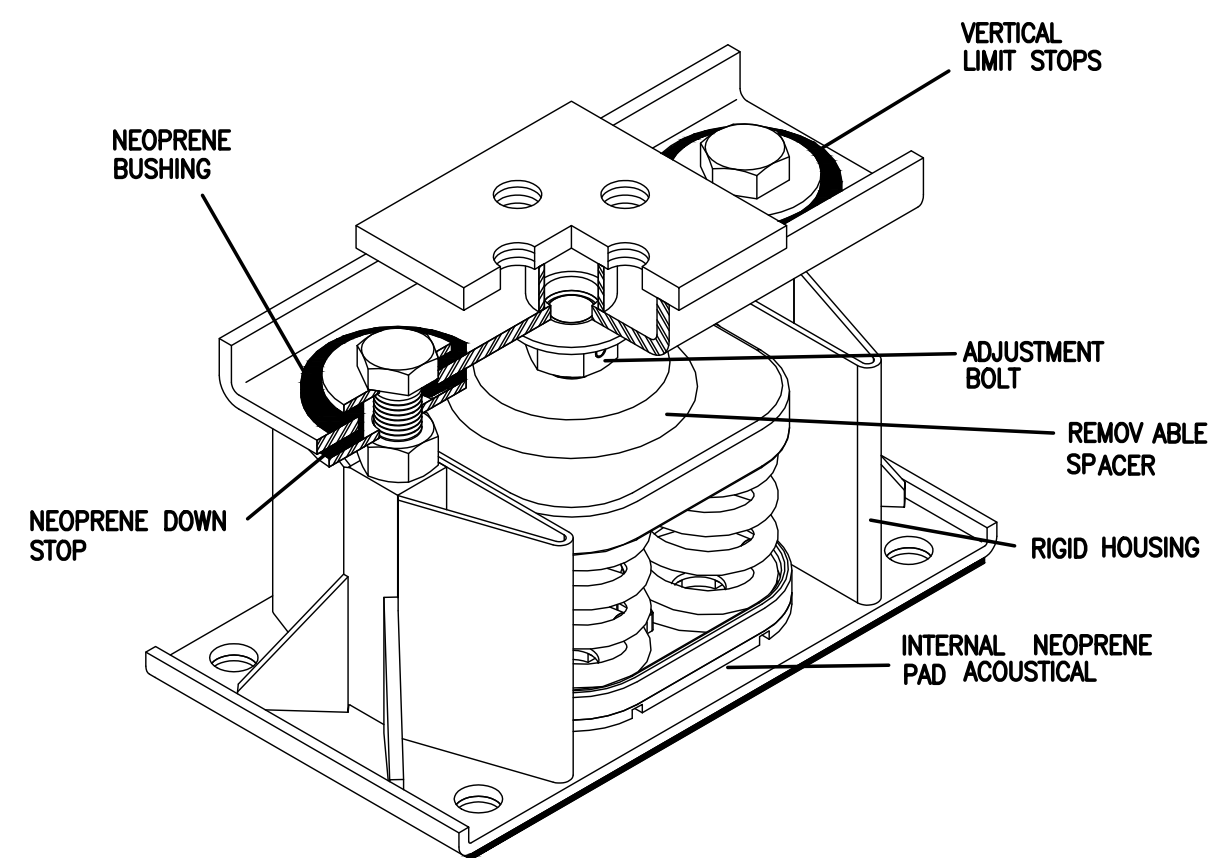
PIPE HANGERS INDOORS
NOT TO SCALE



02 AIR COOLED CHILLER ELEVATION
1/4" = 1'-0"



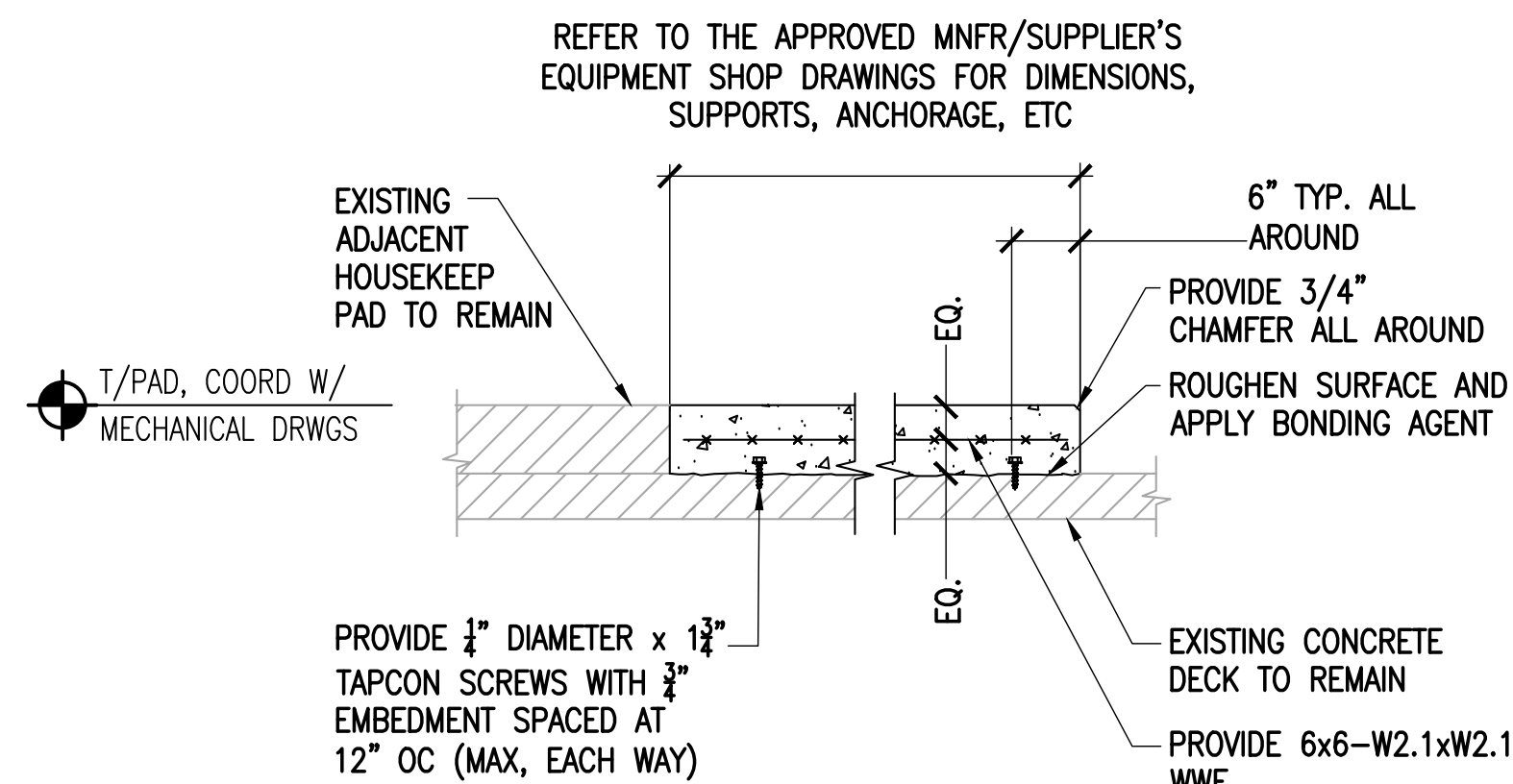
05 CHILLED WATER PIPING SUPPORT DETAIL
NOT TO SCALE



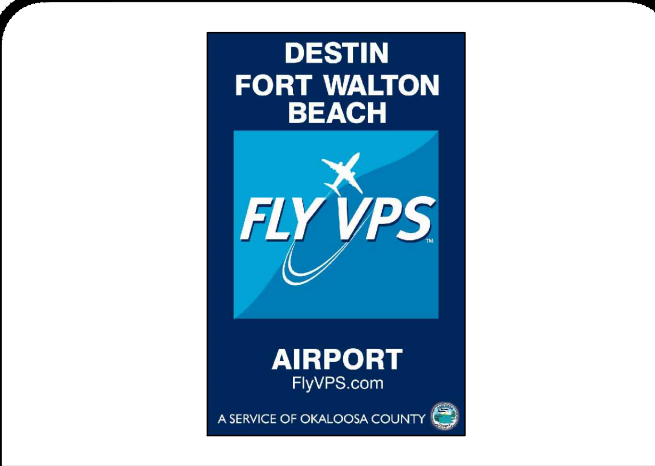
NOTES:

- 1) SPRING ISOLATOR ASSEMBLY SHALL BE COATED TO BE CORROSION RESISTANT.
- 2) MANUFACTURER TO PROVIDE CERTIFICATION REPORT BASED ON THE FLORIDA BUILDING CODE FOR THE PARTICULAR PROJECT LOCATION

TYPICAL SPRING MOUNT DETAIL
NOT TO SCALE



04 TYP. HOUSEKEEPING PAD EXT. DETAIL
SCALE: NTS



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

MECHANICAL DETAILS

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DATE: DEC 2017

AVCON PROJECT NO. 2017.050.11

SHEET NUMBER M-502

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AIR COOLED CHILLER SCHEDULE

MARK	TYPE	REFRIG.	NOMINAL CAPACITY (TONS)	MINIMUM		TURNDOWN CAPACITY (TONS)	EVAPORATOR						COMPRESSORS		UNIT ELECTRICAL DATA					UNIT WGT. (LBS)	DIMENSIONS (LxWxH)	
				E.E.R	I.P.L.V.		E.W.T. (°F)	L.W.T. (°F)	G.P.M. TOTAL	NO OF REF. CIRCUITS	FOULING FACTOR	PRESSURE DROP (FT.)	AMBIENT TEMPERATURE (°F)	QTY.	VOLTS/ PHASE	M.C.A.	M.O.C.P. AMP	UNIT K.W. INPUT	VOLTS/ PHASE			AIC RATING (AMPS)
ACCH-1	AIR COOLED - SCREW	R134A	300	10.72	18.6	75	56	44	600	2	0.0001	28	95	2	460/3	557	700	335.7	460/3	65,000	19,524	379"x88"x95"
ACCH-2	AIR COOLED - SCREW	R134A	300	10.72	18.6	75	56	44	600	2	0.0001	28	95	2	460/3	557	700	335.7	460/3	65,000	19,524	379"x88"x95"

NOTES:

- | | | |
|---|--|--|
| <ol style="list-style-type: none"> 1. PROVIDE WITH ALL ALUMINUM FIN, COPPER TUBE MICRO-CHANNEL CONDENSER COILS. 2. PROVIDE WITH REMOVABLE COMPRESSOR ACOUSTICAL SOUND ENCLOSURES. 3. PROVIDE WITH WYE-DELTA COMPRESSOR STARTERS. 4. PROVIDE WITH VARIABLE SPEED SCREW COMPRESSORS. 5. PROVIDE COASTAL COATING ON CONDENSER COILS FOR CORROSION PROTECTION. | <ol style="list-style-type: none"> 6. PROVIDE WITH STEP-DOWN TRANSFORMER FOR CONTROLS. 7. PROVIDE SINGLE POINT POWER CONNECTION THRU A UNIT-MOUNTED CIRCUIT BREAKER LOCKABLE EXTERNAL HANDLE. 8. PROVIDE WITH COMPRESSOR SUCTION AND DISCHARGE ISOLATION VALVES. 9. MAXIMUM 78 DBA A-WEIGHTED SOUND PRESSURE LEVEL AT 30' FROM CHILLER. 10. PROVIDE WITH COOLER FREEZE PROTECTION HEATER. | <ol style="list-style-type: none"> 11. PROVIDE BACNET PROTOCOL DDC INTERFACE FOR COMMUNICATION WITH EXISTING SIEMENS BAS SYSTEM. 12. PROVIDE SIDE AND END HAIL GUARD LOUVERED PANELS. 13. BASIS OF DESIGN JCI YORK YVAA0323EXV. |
|---|--|--|

PUMP SCHEDULE

PLAN MARK	SERVICE	TYPE	G.P.M.	TOTAL HEAD (FT.WC.)	PUMP EFF. (%)	IMP. DIA. (IN.)	MOTOR ELEC. DATA			MANUFACTURER MODEL NUMBER
							H.P.	R.P.M.	VOLTS/ PHASE	
CHWP-1	ACCH-1 & 2	SPLIT-CASE / END SUCTION	600	91	80.5	10.375	20	1800	460/3	B&G SERIES e1532 - 4EB
CHWP-2	ACCH-1 & 2	SPLIT-CASE / END SUCTION	600	91	80.5	10.375	20	1800	460/3	B&G SERIES e1532 - 4EB
CHWP-3	ACCH-1 & 2	SPLIT-CASE / END SUCTION	600	91	80.5	10.375	20	1800	460/3	B&G SERIES e1532 - 4EB

NOTES:

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. TOTALLY ENCLOSED FAN COOLED MOTOR. 2. PREMIUM EFFICIENCY MOTOR. 3. BRONZE FITTED WITH MECHANICAL SEALS. 4. PROVIDE VARIABLE FREQUENCY DRIVES. | <ol style="list-style-type: none"> 5. STAINLESS STEEL SHAFT. |
|---|---|

EXISTING AHU CHILLED WATER FLOWS

PLAN MARK	DESIGN CHW FLOW (GPM)	EXIST COIL WPD (FT.WC.)	EXIST CHW LINE SIZE (IN.)	LOCATION
AH-1	112	20.0	3	2ND FLOOR MECH MEZZANINE
AH-2	116	20.0	3	1ST FL ROOF - AREA A
AH-3	98	20.0	3	2ND FLOOR MECH MEZZANINE
AH-4	73	20.0	3	2ND FLOOR PUMP ROOM
AH-5	140	20.0	4	1ST FL AREA C MECH RM
AH-6	60	20.0	2-1/2	2ND FL AREA A MECH RM
AH-7	186	20.0	4	2ND FL ROOF - AREA C
AH-8	96	20.0	3	2ND FL ROOF - AREA C
AH-9	88	20.0	3	2ND FLOOR PUMP ROOM
FCU-1	3.2	4.0	3/4	1ST FL AREA C COMM RM
AH-14	164	10.0	4	2ND FL ROOF - AREA D

NOTE:

THE ABOVE DATA WAS OBTAINED FROM OWNER PROVIDED RECORD DRAWINGS OF THE EXISTING HVAC SYSTEM. THE ABOVE DATA SHALL SERVE AS REFERENCE FOR CONTROL VALVE SELECTION, TAB AND CX-ING PURPOSES.

CONTROL VALVE SELECTION CRITERIA:

1. ALL NEW AHU CHW COIL MODULATING CONTROL VALVES SHALL BE SELECTED TO MATCH THEIR RESPECTIVE AHU CHW COIL CIRCUIT. VALVES SHALL BE SELECTED WITH HIGH RANGEABILITY, LOW LEAKAGE, AND PROPORTIONAL PLUS INTEGRAL CONTROL FOR CLOSE ADJUSTMENT AND RESPONSE TIME. VALVES SHALL BE OF EQUAL PERCENTAGE CHARACTERISTIC. DO NOT PROVIDE OVERSIZE CONTROL VALVES. PROVIDE ECCENTRIC VALVE REDUCERS AS NECESSARY FOR PROPER VALVE FLOW CONTROL. BASIS OF DESIGN IS BELIMO OR APPROVED EQUAL.
2. CHW VALVES SHALL BE SPRING RETURN, FAIL OPEN TYPE (NO).
3. MINIMUM CLOSE-OFF DIFFERENTIAL PRESSURE SHALL BE 200 FT.WC.
4. AHU CHW COIL MODULATING CONTROL VALVES SHALL BE CHARACTERIZED BALL OR GLOBE VALVE TYPE.
5. PROVIDE 24V/1PH ELECTRICAL FEED TO NEW VALVE ACTUATORS THRU BAS CONTROL POWER.
6. PROVIDE NEW AHU CONTROLLER ANALOG OUTPUT SIGNAL WIRING FOR EACH SYSTEM.
7. REFER TO SPECIFICATION SECTION 23 09 13 FOR ADDITIONAL INFORMATION.



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

MECHANICAL SCHEDULES

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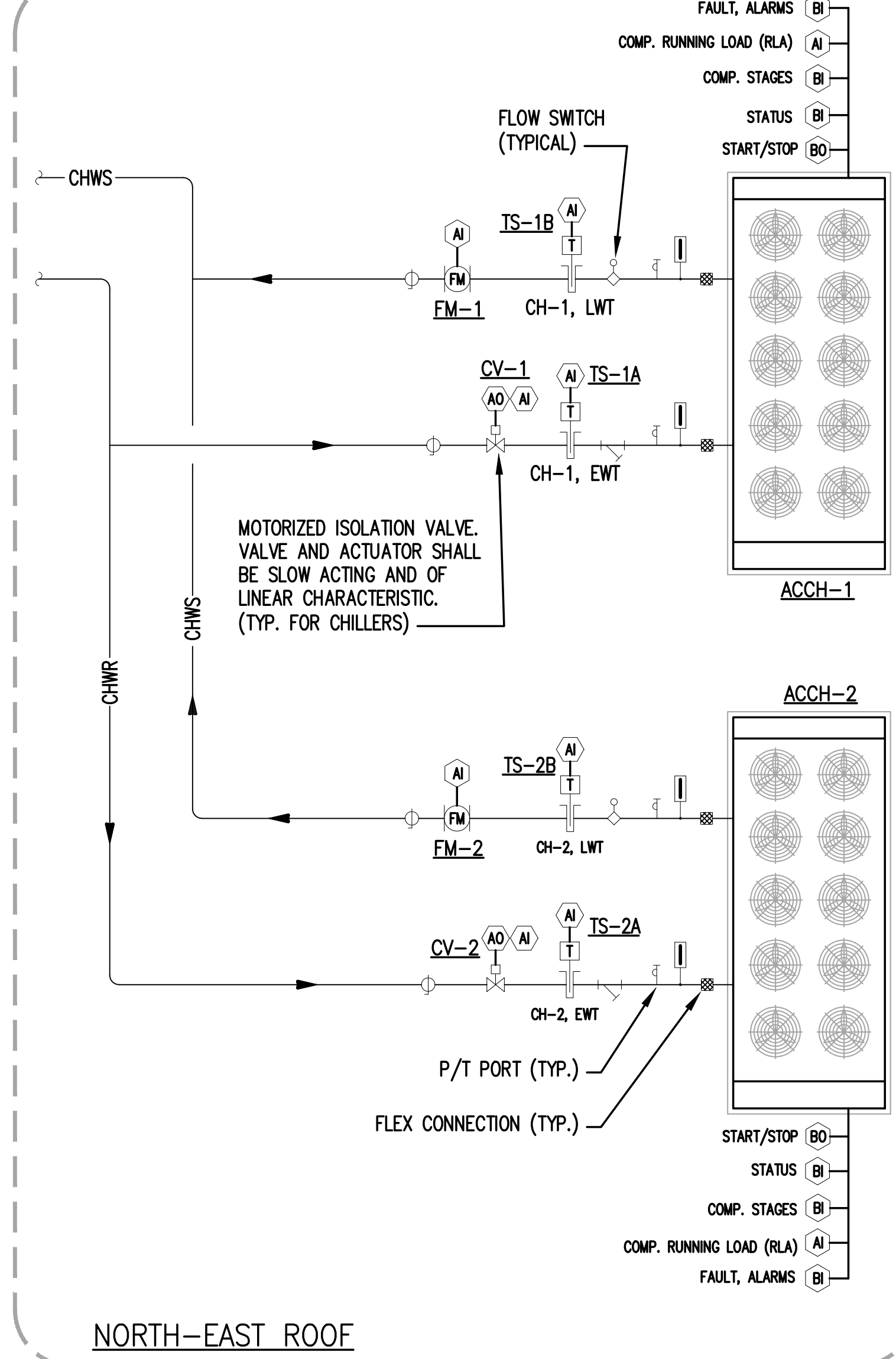
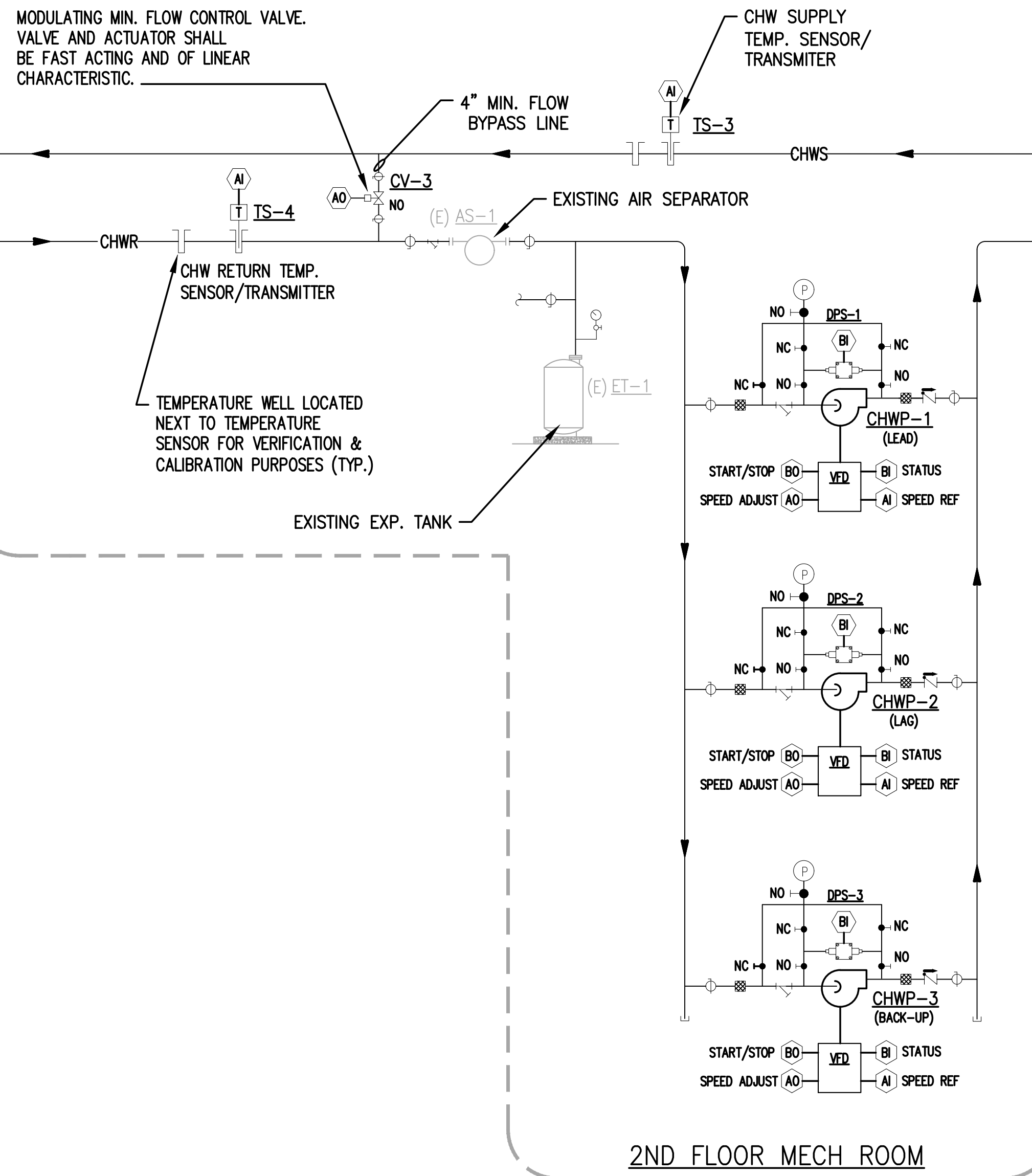
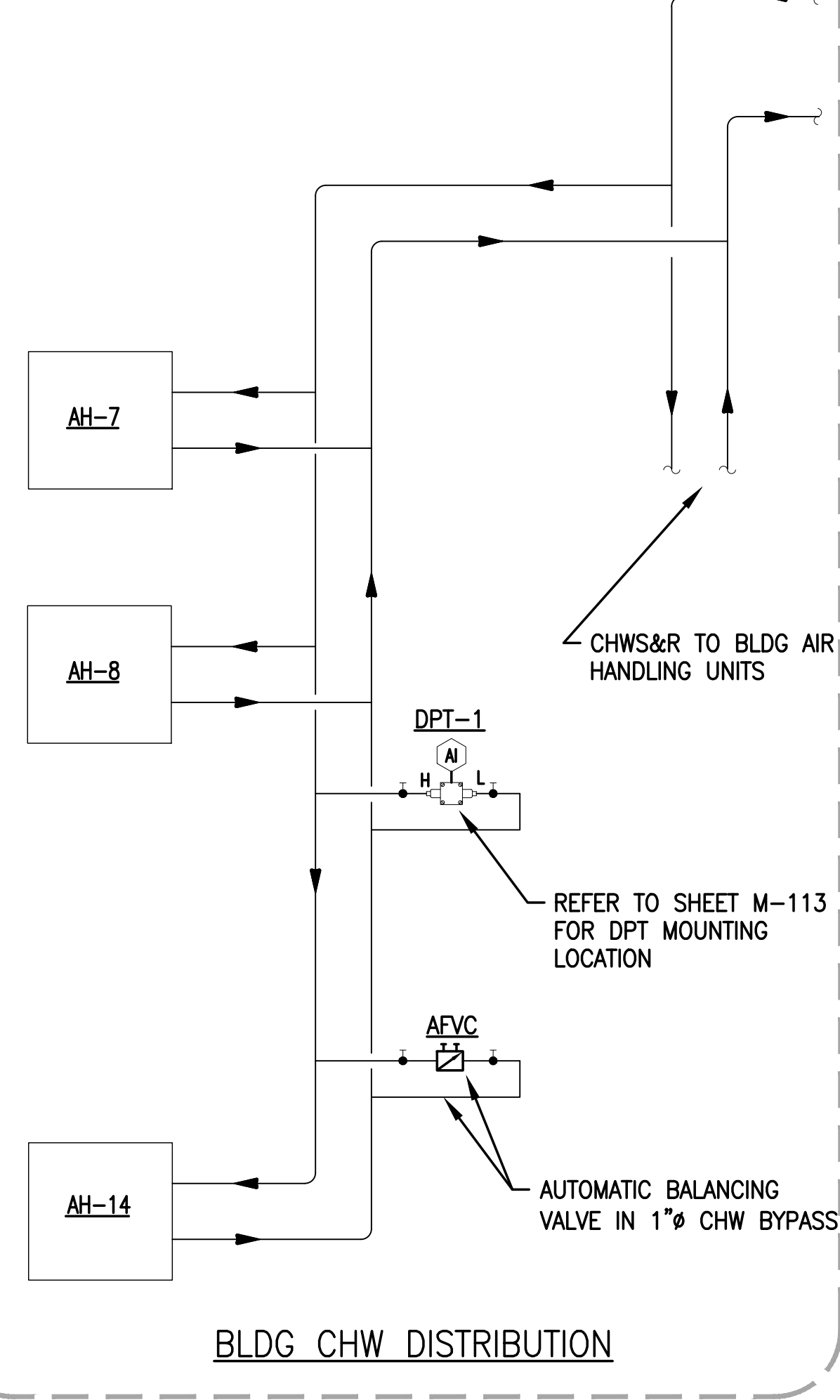
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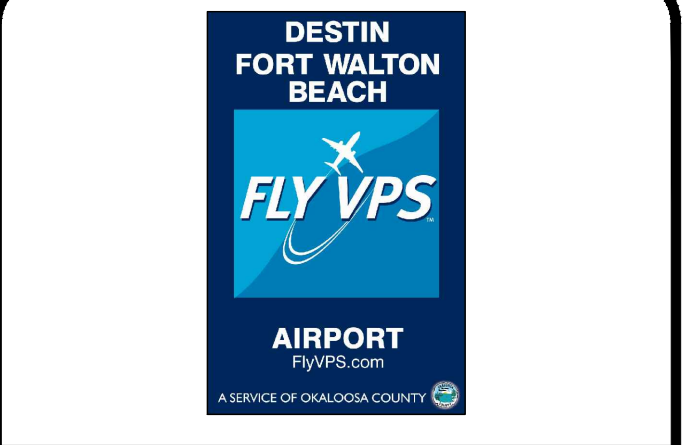
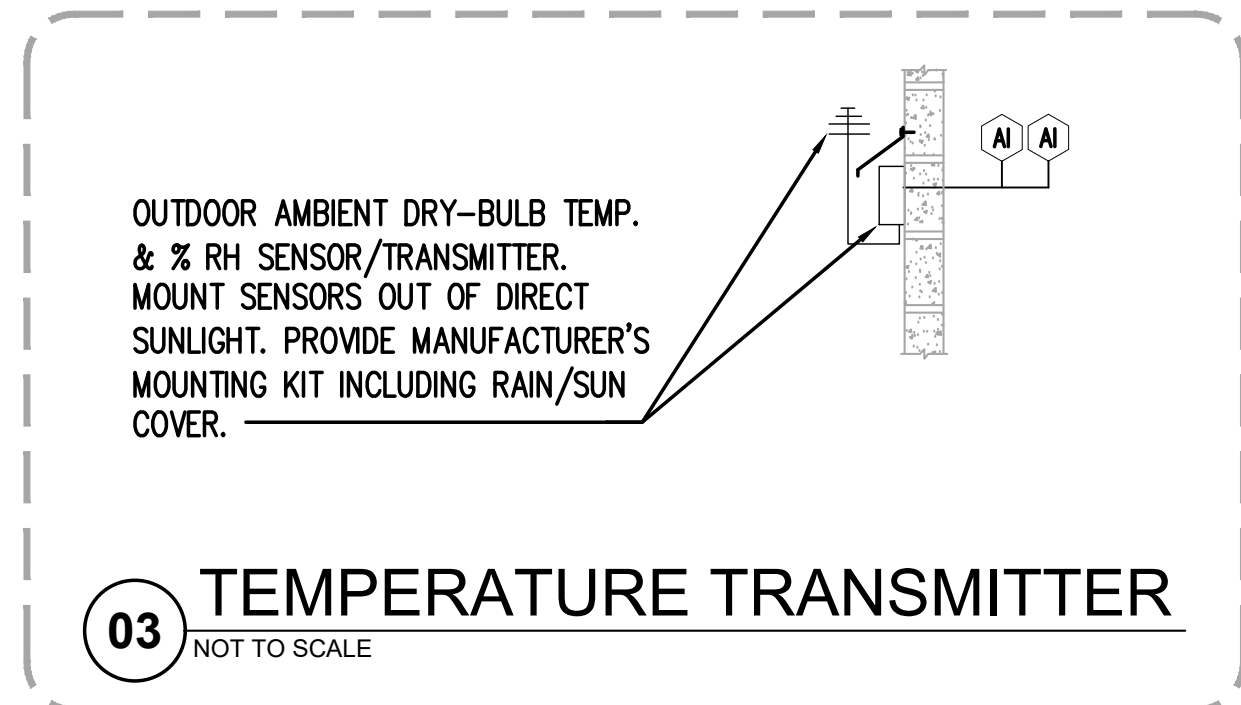
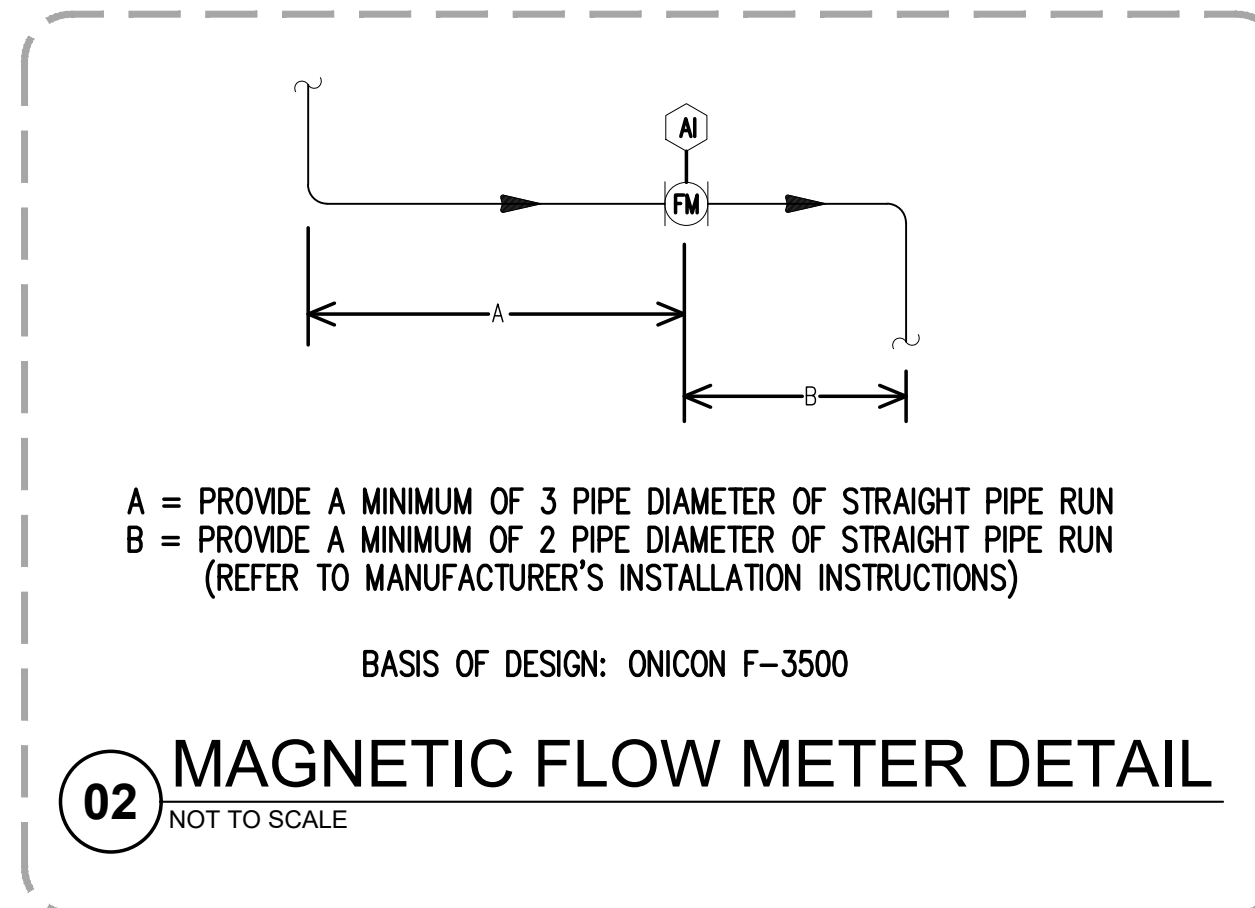
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SHEET NUMBER M-601

NOTE:
REFER TO CHW FLOW DIAGRAM
PLAN ON SHEET M-301 FOR
DETAILED BLDG CHW DISTRIBUTION
INFORMATION. REFER TO DETAIL
03/M501 FOR DETAIL CHW COIL
CONNECTION INFORMATION.



01 CHW SYSTEM CONTROL SCHEMATIC
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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

CONTROL DIAGRAMS AND SEQUENCE OF OPERATIONS

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AVCON PROJECT NO. 2017.050.11
SHEET NUMBER
M-701

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CHILLER PLANT SEQUENCE OF OPERATION

1. SYSTEM DESCRIPTION

A. THE RENOVATION OF THE AIRPORT'S EXISTING CHILLED WATER (CHW) SYSTEM CONSISTS OF REPLACING EXISTING AIR-COOLED CHILLERS WITH TWO 300 TON, VFD-DRIVEN, AIR-COOLED SCREW CHILLERS AND REPLACING EXISTING CHILLED WATER PUMPS WITH THREE BASE-MOUNTED, END-SUCTION, VFD-DRIVEN CENTRIFUGAL PUMPS. THE CHW DISTRIBUTION SYSTEM SHALL BE MODIFIED TO BE PIPED AND OPERATED IN A VARIABLE PRIMARY FLOW (VPF) CONFIGURATION. NEW CHW PUMPS SHALL BE PIPED TO A COMMON HEADER TO SERVE ANY CHILLER AND PROVIDE CHW DISTRIBUTION TO THE SYSTEM USING A PARALLEL PUMPING ARRANGEMENT. PUMPS SHALL BE SEQUENCED WITH CHILLERS. UNLESS OTHERWISE NOTED, EXISTING AIR-HANDLING UNITS' CHW COILS SHALL BE PROVIDED WITH NEW TWO-WAY MODULATING CONTROL VALVES. FACTORY INSTALLED MICROPROCESSOR CHILLER CONTROLLERS STAGE/DE-STAGE COMPRESSORS TO MAINTAIN A DISCHARGE CHW TEMPERATURE SETPOINT AND MONITOR CHILLER OPERATION AND SAFETIES. THE BAS CONTROLS STAGE/DE-STAGE OF CHILLERS, PUMPS, PROVIDE SETPOINT ADJUSTMENTS, AND MONITORS OTHER FUNCTIONS OF THE CHW SYSTEM. CHILLER CONTROLLERS SHALL HAVE THE ABILITY TO INTERFACE AND COMMUNICATE WITH THE AIRPORT'S EXISTING DDC BUILDING AUTOMATION SYSTEM (BAS). NEW CHILLERS SHALL BE CAPABLE OF TURNING-DOWN TO 25% OF THEIR RATED CAPACITY. A NEW MINIMUM CHW FLOW BYPASS AND CONTROL VALVE SHALL BE INSTALLED TO MAINTAIN MINIMUM FLOW ACROSS THE OPERATING CHILLER(S) DURING LOW LOAD VPF OPERATION. EACH CHILLER SHALL BE EQUIPPED WITH A CHW FLOW METER, AND MODULATING ISOLATION VALVES COMPLETE WITH ACTUATOR AND END SWITCHES.

2. CHILLER PLANT ENABLE/DISABLE

A. THE CHILLED WATER SYSTEM SHALL BE ENABLED AND DISABLED AUTOMATICALLY THROUGH THE BAS. CONTROL SYSTEM SHALL ALLOW MANUAL OVERRIDE BY THE OPERATOR. IN THE AUTOMATIC MODE, THE BAS SHALL ENABLE THE CHILLER PLANT WHENEVER THERE IS A CALL FOR COOLING FROM A SCHEDULED AHU (DETERMINED BY A CHW COIL VALVE BEING 15% OPEN FOR AT LEAST 10 MINUTES), AND THERE ARE NO ACTIVE ALARMS THAT INITIATE A SHUTDOWN. WHEN THE CHILLER PLANT IS DISABLED, ALL CHILLERS AND CHW PUMPS SHALL BE COMMANDED OFF. CHILLER ISOLATION VALVES SHALL CLOSE AND MINIMUM CHW FLOW BYPASS VALVE SHALL OPEN. AN ALARM SHALL BE POSTED TO THE BAS DDC SYSTEM ANYTIME THE "H-O-A" SWITCH IS INDEXED TO THE "HAND" OR "OFF" POSITIONS.

3. LEAD - LAG OPERATION

A. THE CHILLERS AND PUMPS OPERATING ORDER SHALL BE DETERMINED BY AN OPERATOR RANK NUMBER, OR BY EQUALIZATION OF RUN-TIME. THE SEQUENCE SHALL TOTALIZE RUN-HOURS FOR EACH DEVICE AND ADJUST THE OPERATING ORDER. IF A CHILLER OR PUMP FAILURE IS DETECTED OR BECOMES UNAVAILABLE FOR MAINTENANCE, IT SHALL BE SHUT DOWN IN AN ORDERLY MANNER AND THE NEXT AVAILABLE DEVICE IN THE SEQUENCE SHALL BE STARTED.

4. INITIAL CHILLER START-UP

A. THE FOLLOWING SEQUENCE APPLIES TO THE SPECIFIC CASE WHEN THE SEQUENCE NEEDS TO START THE FIRST CHILLER. THE STARTING SEQUENCE FOR ADDITIONAL CHILLERS WILL BE DIFFERENT AS DESCRIBED IN SECTION 5. UPON A CALL FOR COOLING:

- a. COMMAND LEAD CHILLER ISOLATION VALVE TO THE FULLY OPEN POSITION.
- b. ONCE VALVE POSITION HAS BEEN PROVEN FULLY OPEN BY END SWITCH, COMMAND THE LEAD CHW PUMP TO START. PROVE CHW PUMP RUNNING STATUS USING FLOW SWITCH AND/OR FLOW USING DIFFERENTIAL PRESSURE SWITCH ACROSS THE PUMP.
- c. AFTER A 60 SECOND STABILIZATION DELAY (ADJ.), PROVE CHW FLOW THROUGH LEAD CHILLER USING INPUT SIGNAL FROM DIFFERENTIAL PRESSURE SWITCH ACROSS THE EVAPORATOR BARREL.
- d. ONCE CHW FLOW THROUGH LEAD CHILLER HAS BEEN PROVEN, COMMAND THE LEAD CHILLER TO START. THE CHILLER'S INTERNAL CONTROLLER SHALL THEN MODULATE CHILLER CAPACITY THRU VSD COMPRESSORS TO MAINTAIN A LEAVING CHW TEMPERATURE SETPOINT OF 44°F (ADJ.). A PULLDOWN ROUTINE SHALL LOAD-LIMIT THE LEAD/OPERATING CHILLER (THROUGH ITS CURRENT-LIMIT SET-POINT) TO MAINTAIN AN OPERATOR ADJUSTABLE KW SET-POINT UNTIL THE CHW SUPPLY TEMPERATURE IS WITHIN 1°F (ADJ.) OF THE 44°F SET-POINT.

5. CHILLER STAGING

A. LAG CHILLER SHALL BE SIGNALLED "ON" WHENEVER:

- a. LEAD/OPERATING CHILLER LWT EXCEEDS THE 44°F SETPOINT BY 1.5°F CONTINUOUSLY FOR 15 MINUTES AND
- b. LEAD/OPERATING CHILLER'S CHW FLOW EXCEEDS THE CHILLER'S MAXIMUM DESIGN CHW FLOW FOR 20 MINUTES AS DETERMINED BY THE CHILLER FLOW METER (FM-1 OR FM-2), OR
- c. THE LEAD/OPERATING CHILLER IS 95% LOADED AS DETERMINED BY PERCENTAGE (%) OF RATED CURRENT.

B. AN ADDITIONAL CHILLER SHALL BE ADDED USING THE SEQUENCE DESCRIBED BELOW.

- a. LEAD OPERATING CHILLER SHALL BE UNLOADED (THROUGH CURRENT-LIMIT SET-POINT) TO A USER-ADJUSTABLE LEVEL (TYP. 60%) OR AS RECOMMENDED BY THE CHILLER MANUFACTURER.
- b. LAG CHILLER ISOLATION VALVE SHALL BE MODULATED OPEN. THE LAG CHILLER ISOLATION VALVE SHALL BE SET TO OPEN SLOWLY (120 SECONDS FROM CLOSE TO FULLY OPEN (ADJ.)) TO AVOID NOISANCE TRIPS OF THE OPERATING CHILLERS. AFTER THE VALVE POSITION IS PROVEN OPEN BY END-SWITCH, THE LAG CHILLER SHALL BE COMMANDED TO START. THE OPERATING CHILLERS' CURRENT-LIMIT-SET-POINTS SHALL BE RELEASED, ALLOWING THEM TO LOAD-UP AS REQUIRED. MINIMUM FLOW THROUGH CHILLER SHALL BE PROVEN BEFORE COMMANDED TO START.

6. STOPPING ADDITIONAL CHILLERS AND CHILLER PLANT SHUTDOWN

A. BAS SHALL DE-STAGE A CHILLER WHENEVER THE LOAD ON THE OPERATING CHILLERS DECREASES SUFFICIENTLY SO THAT A SINGLE CHILLER CAN SATISFY THE LOAD. THE LOAD ON THE OPERATING CHILLER(S) SHALL BE DETERMINED BASED ON THE ACTUAL CURRENT DRAW (% AMPS) AND/OF LOAD (BTUH) CALCULATED BY THE BAS. WHEN THE COMBINED CHILLER OPERATING LOAD IS LESS THAN A SINGLE CHILLER'S CAPACITY FOR 15 MINUTES THE SYSTEM SHALL SUBTRACT A CHILLER.

B. ALL CHILLERS AND PUMPS SHALL TURN OFF WHEN ALL AHU CHW COILS' CONTROL VALVES ARE LESS THAN 10% OPEN FOR 15 MINUTES, OR WHEN ALL AIR-HANDLERS ARE OFF. OR WHEN AN UNOCCUPIED SCHEDULE OCCURS (SUBJECT TO NIGHT SET-BACK CONDITIONS), OR WHEN FAILURE ALARMS ARE REPORTED (BAS AND CHILLER CONTROLS)

7. CHILLER PLANT MINIMUM FLOW BY-PASS CONTROL

A. THE VPF CHILLED WATER SYSTEM CHW MINIMUM FLOW BYPASS VALVE SHALL BE A NORMALLY OPEN VALVE. THE BAS SHALL MODULATE THE CHW BYPASS VALVE TO INSURE MINIMUM FLOW THROUGH THE OPERATING CHILLERS. THIS SHALL BE ACCOMPLISHED BY MEASURING SYSTEM FLOW TO THE BUILDING (FM-1 AND FM-2) AND USING THIS AS INPUT TO A FEEDBACK-CONTROL ALGORITHM WHICH MODULATES THE POSITION OF THE CHW BYPASS VALVE. THE DESIRED BYPASS FLOW IS EQUAL TO THE SUM OF THE MINIMUM CHILLED WATER FLOW RATES FOR EACH OPERATING CHILLER MINUS THE MEASURED FLOW OUT TO THE BUILDING. IF THIS CALCULATED VALUE IS LESS THAN ZERO THEN THE BYPASS VALVE SHOULD BE FULLY CLOSED. THE DEFAULT CHILLER MINIMUM FLOW RATE IS 150 GPM AND SHALL BE VERIFIED WITH CHILLER MANUFACTURER.

(SIDE NOTE: FLOW METERS SHALL BE HIGH ACCURACY (+/-0.2%) ELECTROMAGNETIC TYPE. BYPASS CONTROL VALVE SHALL BE CAPABLE OF MAINTAINING A LINEAR RELATIONSHIP BETWEEN VALVE POSITION AND FLOW RATE. THE BYPASS VALVE ACTUATOR SHALL BE PID LOOP CONTROLLED FAST ACTING TYPE. REFER TO SPECIFICATIONS FOR COMPLETE INFORMATION.)

8. PUMP OPERATION

A. UPON CHW SYSTEM STARTUP, THE DDC SYSTEM SHALL START CHWP-1 (OR BAS SYSTEM PRE-ASSIGNED LEAD PUMP). THE DDC SHALL ALTERNATE CHW PUMPS DAILY BASED ON RUN TIME. CHW PUMP SPEED SHALL BE CONTROLLED TO MAINTAIN THE SPECIFIED BUILDING LOOP DIFFERENTIAL PRESSURE (DPT) SET-POINT AS DETERMINED BY THE BALANCING CONTRACTOR. (PROVIDE A DPT SET-POINT DEAD-BAND TO PREVENT PUMPS FROM HUNTING) THE BUILDING LOOP DIFFERENTIAL-PRESSURE ERROR SHALL BE TAKEN INTO ACCOUNT WHEN ADDING PUMPS. STAGING AND DE-STAGING OF PUMPS SHALL BE ACCOMPLISHED, VIA CHW SYSTEM'S PUMP CONTROLLER, BY MEASURING CHW SYSTEM FLOW (FM-3) TO MAINTAIN OPERATING PUMPS BETWEEN 80% AND 105% OF THEIR BEST EFFICIENCY POINT. TO INSURE STABLE SYSTEM FLOW, THE RATE AT WHICH CHW PUMP SPEED MAY CHANGE SHALL BE LIMITED TO 15% PER MINUTE (ADJ.).

B. THE DPT SETPOINT SHALL BE RESET (WITH MAXIMUM AND MINIMUM SETPOINT LIMITS) BASED ON VALVE POSITION OF AIR HANDLER CHILLED WATER VALVES. AHU CHW CONTROL VALVES' POSITION SHALL BE POLLED EVERY 20 MINUTES (ADJ.). WHEN ALL OF THE VALVE POSITIONS ARE BETWEEN 45% AND 85% THE DPT SETPOINT WILL NOT CHANGE. IF ANY OF THE SELECTED VALVE POSITION EXCEED 90% (ADJ.) THE DPT SETPOINT SHALL BE INCREASED BY ONE PSI EVERY 5 MINUTES (ADJ.) TO THE MAXIMUM SETPOINT LIMIT. IF ANY SELECTED VALVE POSITION DROPS BELOW 40% (ADJ.) AND THE MAXIMUM VALVE POSITION OF ANY OF THE SELECTED VALVES IS LESS THAN 85% (ADJ.) THE DPT SETPOINT SHALL BE REDUCED BY ONE PSI EVERY 5 MINUTES (ADJ.) TO THE MINIMUM SETPOINT LIMIT.

C. IF ANY ONE PUMP FAILS TO OPERATE WHEN ENABLED, THE DDC SYSTEM SHALL START THE ALTERNATE PUMP (BACKUP/STANDBY PUMP CHWP-3) AND POST AN ALARM AT THE BAS.

9. SYSTEM MONITORING AND ALARMS

- A. IF ANY PIECE OF EQUIPMENT FAILS TO PROVE STATUS AFTER IT IS COMMANDED, WITH A 20 SEC. (ADJ.) TIME DELAY, AN ALARM SHALL BE SENT TO THE BAS. THIS INCLUDES CHILLERS, CHW PUMPS AND ISOLATION VALVES.
- B. IF THE CHW SUPPLY TEMPERATURE RISES 5°F (ADJ.) ABOVE SET-POINT FOR 10 MINUTES (ADJ.), AN ALARM SHALL BE GENERATED.
- C. ALL CHILLER AND VFD ALARMS AND FAULTS SHALL BE MONITORED THROUGH THEIR RESPECTIVE DDC INTERFACE. ALL CHILLER OPERATING PARAMETERS AVAILABLE AT THE CHILLER CONTROL PANEL, AND LISTED IN THE POINTS LIST, SHALL BE AVAILABLE TO THE BAS AND DISPLAYED AT THE BAS.

10. CHILLER FREEZE PROTECTION

A. SHOULD THE AMBIENT OUTDOOR AIR TEMPERATURE DROP TO 35°F AND THE CHILLED WATER LOOP IS INACTIVE, START LEAD CHILLER PUMP AND OPEN CHILLED WATER VALVES TO ALLOW MINIMUM FLOW THROUGH CHILLER HEAT EXCHANGER TO PREVENT FREEZING. CHILLED WATER PUMP SHALL BE DISABLED WHEN OUTSIDE AIR RISES ABOVE 38 DEG F.

11. SYSTEMS TRENDING AND REPORTS

- A. CUSTOMIZED REPORTS SHALL BE GENERATED TO PRINT ALARMS, TRENDS, MESSAGES, AND TO LOG KEY CHILLER PLANT PERFORMANCE INDICES. AT A MINIMUM, THE PARAMETERS TO BE MONITORED INCLUDE:
 - a. INDIVIDUAL CHILLER TONS (KW).
 - b. INDIVIDUAL CHILLER KW/TON (COP).
 - c. TOTAL CHW LOOP FLOW AND INDIVIDUAL CHILLER CHW FLOW.
 - d. CHW SUPPLY TEMPERATURE VERSUS CHW SUPPLY SET-POINT.
 - e. CHILLER PLANT EFFICIENCY KW/TON.
 - f. CHILLER STAGE-UP SET-POINT.
 - g. CHILLER STAGE-DOWN SET-POINT.
 - h. INDIVIDUAL CHILLER RUN-HOURS.
 - i. INDIVIDUAL PUMP RUN-HOURS.

TYPICAL CHW/HW VAV AIR-HANDLING UNIT MODIFIED SEQUENCE OF OPERATION

1. GENERAL DESCRIPTION:

- A. AS PART OF THE CHILLER/PUMP REPLACEMENT AND TRANSFORMATION OF THE EXISTING CHW DISTRIBUTION TO A VARIABLE-PRIMARY-FLOW SYSTEM, ALL AIR-HANDLING UNITS' CHW COILS (EXCEPT AH-10) SHALL BE CONVERTED FROM CONSTANT COIL FLOW 3-WAY MIXING VALVES TO VARIABLE FLOW 2-WAY MODULATING CONTROL VALVES.
- B. NEW 2-WAY CHW CONTROL VALVES SHALL MODULATED TO MAINTAIN THE CURRENT SUPPLY AIR TEMPERATURE SET-POINT. AHU SUPPLY AIR TEMPERATURE IS MEASURED BY EXISTING TEMPERATURE SENSORS.

SYSTEM OR APPARATUS POINT DESCRIPTION	BAS POINT SCHEDULE														NOTES													
	INPUTS							OUTPUTS				ALARMS				PROGRAMS												
	TEMPERATURE (F)	CHW FLOW (GPM)	DIFF. PRESSURE (I)	POSITION (%)	SPEED REFERENCE	STATUS (ON/OFF)	STATUS (OPEN/CLOSE)	CURRENT SWITCH (CONTACT)	PROOF (CONTACT)	MODULATE (V or VOLTS)	MODULATE (OPEN/CLOSE)	ADJUST SPEED (Hz)	OPEN/CLOSE	STAGE/DE-STAGE		START/STOP	HI ANALOG	LOW ANALOG	SENSOR FAIL	FLOW FAIL	REMOTE ALARM	COMM. FAIL	DIAGNOSTICS	TIME OVERRIDE	TIME SCHEDULE	RUN TIME	MODE CONTROL	ALTERNATE
CHILLER ACCH-1																												
CHILLER ACCH-2																												
CH-1 ENT. CHW TEMP. (TS-1A)																												
CH-2 ENT. CHW TEMP. (TS-2A)																												
CH-1 LVNG CHW TEMP. (TS-1B)																												
CH-2 LVNG CHW TEMP. (TS-2B)																												
CHILLER ISO. VALVE (CV-1)																												
CHILLER ISO. VALVE (CV-2)																												
CHILLER FLOW METER (FM-1)																												
CHILLER FLOW METER (FM-2)																												
SYSTEM MIN. CHW FLOW BYPASS (CV-3)																												
SYSTEM DP TRANSMITTER (DPT-1)																												
SYSTEM CHWS TEMP (TS-3)																												
SYSTEM CHWS TEMP (TS-4)																												
PUMP STATUS DPS (EA.)																												
CHWP-1 VFD																												
CHWP-2 VFD																												
CHWP-3 VFD																												
OUTDOOR WEATHER STATION																												
AIR-HANDLING UNITS																												
AH-1 TWO-WAY CONTROL VALVE																												
AH-2 TWO-WAY CONTROL VALVE																												
AH-3 TWO-WAY CONTROL VALVE																												
AH-4 TWO-WAY CONTROL VALVE																												
AH-5 TWO-WAY CONTROL VALVE																												
AH-6 TWO-WAY CONTROL VALVE																												
AH-7 TWO-WAY CONTROL VALVE																												
AH-8 TWO-WAY CONTROL VALVE																												
AH-9 TWO-WAY CONTROL VALVE																												
FC-1 TWO-WAY CONTROL VALVE																												
AH-14 TWO-WAY CONTROL VALVE																												

NOTES:

- 1. NOTE THE EXISTING SIEMENS BUILDING AUTOMATION SYSTEM SHALL BE UPGRADED TO INCLUDE ALL POINTS AND SEQUENCES TO MEET THE REQUIREMENTS SHOWN ON THE PLANS AND SPECIFICATIONS.
- 2. THE EXISTING AIR-HANDLERS CONTROLS SHALL REMAIN WITH MODIFICATIONS TO THE CONTROL VALVES AND INCIDENTALS AS REQUIRED. SYSTEM PROGRAMMING SHALL BE INCLUDED.

V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\M-M-702 CONTROL DIAGRAMS AND SEQUENCE OF OPERATIONS.DWG 1/12/2018 12:17 PM



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VPS CHILLER REPLACEMENT

CONTROL DIAGRAMS AND SEQUENCE OF OPERATIONS

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APPROVED BY: ZP
DATE: DEC 2017

AVCON PROJECT NO. 2017.050.11

SHEET NUMBER
M-702

ELECTRICAL SYMBOLS LEGEND

NOTE: THESE ARE STANDARD SYMBOLS AND ALL MAY NOT APPEAR ON THE PROJECT DRAWINGS. REFER TO DETAIL AND SPECIFICATIONS FOR MOUNTING HEIGHTS.

	DUPLEX RECEPTACLE AT 18"
	DUPLEX RECEPTACLE ABOVE COUNTER AT 42"
	DUPLEX RECEPTACLE GROUND FAULT TYPE
	DUPLEX RECEPTACLE ISOLATED GROUND TYPE
	(2) DUPLEX RECEPTACLES IN SINGLE OUTLET BOX WITH SINGLE COVER PLATE AT 18"
	(2) DUPLEX RECEPTACLES IN SINGLE OUTLET BOX WITH SINGLE COVER PLATE ABOVE COUNTER AT 42"
	LIGHT SWITCH
	OCCUPANCY SENSOR
	TIMER SWITCH
	CHAIN HUNG STRIP LIGHT FIXTURE, SEE FLOOR PLANS FOR FIXTURE TYPE, NUMBER OF LAMPS, AND MOUNTING HEIGHT.
	CHAIN HUNG STRIP LIGHT FIXTURE ON EMERGENCY POWER, SEE FLOOR PLANS FOR FIXTURE TYPE, NUMBER OF LAMPS, AND MOUNTING HEIGHT.
	HID, FLUORESCENT OR INCANDESCENT FIXTURE - WALL MOUNTED
	JUNCTION BOX
	WALL MOUNTED SHUNT TRIP STATION.
	TRANSFORMER
	277/480V PANELBOARD
	120/208V PANELBOARD
	ELECTRIC MOTOR
	FIRE ALARM SHUT DOWN RELAY
	NON FUSIBLE HEAVY DUTY SAFETY SWITCH, SIZE AND NUMBER OF POLES ARE INDICATED.
	FUSIBLE HEAVY DUTY SAFETY SWITCH, SIZE AND NUMBER OF POLES ARE INDICATED.
	MAGNETIC STARTER. * (VFD) PROVIDE WITH VARIABLE FREQUENCY DRIVE CONTROLLER COMPATIBLE WITH VARIABLE FREQUENCY DRIVE.
	COMBINATION MAGNETIC STARTER WITH FUSIBLE HEAVY DUTY SAFETY SWITCH. * (VFD) PROVIDE WITH VARIABLE FREQUENCY DRIVE CONTROLLER COMPATIBLE WITH VARIABLE FREQUENCY DRIVE.
	MANUAL MOTOR STARTER TOGGLE SWITCH
	MANUAL MOTOR STARTER TOGGLE SWITCH AS NOTED, "P" INDICATES PILOT LIGHT
	MANUAL MOTOR STARTER TOGGLE SWITCH AS NOTED, "WP" INDICATES WEATHERPROOF
	BRANCH CIRCUIT CONDUIT EXPOSED OR ABOVE GRADE. SLASH MARKS INDICATE NUMBER OF CONDUCTORS, LONGER SLASH IS NEUTRAL, #12 GROUND MINIMUM MARKED BY A SMALL DOT (UNLESS OTHERWISE NOTED OR MARKED); PROVIDE EQUIPMENT GROUNDING CONDUCTOR IN ALL BRANCH CIRCUITS.
	CIRCUIT ROUTED BELOW GRADE.
	CIRCUIT BELOW GRADE TO BE DEMOLISHED.
	CIRCUIT ABOVE GRADE TO BE DEMOLISHED.
	EXPLOSION PROOF SEAL FITTING.

ELECTRICAL SYMBOL LEGEND NOTES:

1. AN OUTLET BOX OF THE APPROPRIATE SIZE AND TYPE SHALL BE PROVIDED FOR ALL LIGHTING FIXTURES, SWITCHES, RECEPTACLES, ETC.
2. ALL SWITCHES AND RECEPTACLES SHALL BE SPECIFICATION GRADE 20A MINIMUM UNLESS OTHERWISE NOTED. COORDINATE COLOR WITH OWNER PRIOR TO ORDERING.
3. ALL JUNCTION BOX COVERS SHALL BE MARKED WITH PANEL, CIRCUIT NUMBER AND VOLTAGE WITH PERMANENT BLACK MARKER.

REFERENCE STANDARDS AND REGULATORY REQUIREMENTS:

CONFORM TO ALL THE APPLICABLE REQUIREMENTS OF THE FOLLOWING CODE, 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.

- a. FLORIDA BUILDING CODE (FBC), LATEST EDITION
- b. NATIONAL ELECTRIC CODE (NEC), 2011 EDITION [NFPA 70]
- c. NATIONAL FIRE ALARM CODE, LATEST EDITION [NFPA 52]
- d. LIFE SAFETY CODE, LATEST EDITION [NFPA 101]

ABBREVIATIONS:

A	AMPERES
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AL	ALUMINUM
ANNUN	ANNUNCIATOR
ARCH	ARCHITECT
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BFG	BELOW FINISHED GRADE
BLDG	BUILDING
C	CONDUIT
CAT	CATALOG
CWP	CHILLED WATER PUMP
CTWP	COOLING TOWER WATER PUMP
CKT	CIRCUIT
CU	COPPER
C/B	CIRCUIT BREAKER
C/T	CURRENT TRANSFORMERS
Δ	DELTA
DWG	DRAWING
FT	FEET
G	GROUND
GEN	GENERATOR
GFI	GROUND FAULT INTERRUPT
IG	ISOLATED GROUND
KVA	KILOVOLT - AMPERES
KW	KILOWATTS
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCM	THOUSAND CIRCULAR MILS
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NF	NON-FUSED
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT CIRCUIT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
∅	PHASE
POS	POINT OF SALE
PVC	POLYVINYL CHLORIDE
P/T	POTENTIAL TRANSFORMER
R	RECESSED
RGC	RIGID METAL CONDUIT
SOW	STATEMENT OF WORK
SCR	SHORT CIRCUIT RATING
SURF	SURFACE
TEL	TELEPHONE
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
UG	UNDERGROUND
UNIV	UNIVERSAL
UNO	UNLESS NOTED OTHERWISE
V	VOLTS
W	WATTS
WP	WEATHERPROOF
WPG	WEATHERPROOF WITH GROUND FAULT INTERRUPT
XFMR	TRANSFORMER
Y	WYE

GENERAL ELECTRICAL NOTES:

1. GENERAL ELECTRICAL NOTES LISTED BELOW APPLY TO ALL ELECTRICAL SHEETS, INCLUDING ALL DETAILS, SECTIONS, AND/OR DRAWINGS ISSUED AS ADDENDA TO THESE DRAWINGS.
2. THESE DOCUMENTS, INCLUDING THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICES, ARE THE PROPERTY OF AVCON, INC. AND ARE NOT TO BE USED IN WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT WRITTEN AUTHORIZATION OF AVCON, INC.
3. ALL WORK SHALL COMPLY WITH CODES AND STANDARDS LISTED ON THE DRAWINGS AND PER THE SPECIFICATIONS.
4. ALL MATERIALS SHALL BE LISTED BY THE UNDERWRITERS LABORATORIES, INC. (UL) OR NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA).
5. DO NOT SCALE FROM THESE DRAWINGS.
6. THE DRAWINGS ARE DIAGRAMMATIC AND THE OMISSION OF AN ITEM NECESSARY FOR THE PROPER FUNCTIONING OF THE SYSTEM DOES NOT RELIEVE THE CONTRACTOR FROM FURNISHING AND INSTALLING THAT ITEM.
7. THE SUBMISSION OF A BID OR PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT THE CONTRACTOR HAS FAMILIARIZED THEMSELVES WITH THE PLANS, SPECIFICATIONS, AND BUILDING SITE. CLAIMS MADE SUBSEQUENT TO THE PROPOSAL FOR MATERIALS AND/OR LABOR DUE TO DIFFICULTIES ENCOUNTERED WILL NOT BE RECOGNIZED, UNLESS DIFFICULTIES COULD NOT HAVE BEEN FORESEEN EVEN THOUGH PROPER EXAMINATION HAD BEEN MADE.
8. IN THE EVENT OF CONTRADICTIONS, ON THESE PLANS FROM SHEET TO SHEET (ELECTRICAL, AND/OR MECHANICAL), THE CONTRACTOR SHALL INCLUDE IN THEIR BID THE COST OF THE MOST RESTRICTIVE (COSTLY) ACTION SPECIFIED. ALL DISCREPANCIES SHALL BE BROUGHT TO THE ARCHITECT'S AND ENGINEER'S ATTENTION PRIOR TO THE PRE-CONSTRUCTION MEETING FOR CLARIFICATION OF THE WORK TO BE PERFORMED. ANY COSTS GENERATED AS A RESULT OF FAILURE TO IDENTIFY THESE DISCREPANCIES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
9. PRIOR TO BID, COORDINATE ALL ELECTRICAL WORK WITH MECHANICAL WORK. COORDINATE ALL MECHANICAL LOADS, VOLTAGES AND LOCATIONS WITH THE MECHANICAL CONTRACTOR AND MAKE NECESSARY ADJUSTMENTS WITHOUT EXTRA CHARGES.
10. SHOULD ANY QUESTIONS AND/OR DISCREPANCIES ARISE REGARDING THE CONTRACT DOCUMENTS AND/OR FIELD CONDITIONS, THE CONTRACTOR SHALL CONTACT THE ENGINEER FOR PROPER INTERPRETATION AND/OR CLARIFICATION PRIOR TO THE COMMENCEMENT OF ANY WORK. IN THE ABSENCE OF SUCH REQUEST AND/OR AUTHORIZATION FROM THE ARCHITECT /ENGINEER, THE CONTRACTOR WILL BE PROCEEDING AT HIS OWN RISK.
11. THE ELECTRICAL CONTRACTOR SHALL NOT CONCEAL ANY WORK UNTIL INSPECTED AND APPROVED BY ELECTRICAL INSPECTOR AND/OR ARCHITECT/ENGINEER. THE CONTRACTOR SHALL NOTIFY ARCHITECT/ENGINEER OF A SCHEDULED INSPECTION TIME WITHIN 72 HOURS.
12. THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH GENERAL CONTRACTOR ON REQUIREMENTS FOR STRUCTURAL SUPPORT AND FRAMING FOR ALL ELECTRICAL EQUIPMENT AND SYSTEMS. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND VERIFYING STRUCTURAL SUPPORT AND FRAMING.
13. WHERE CROWDED LOCATIONS EXIST OR WHERE THERE IS A POSSIBILITY OF CONFLICT BETWEEN TRADES, THE CONTRACTOR SHALL MAKE COMPOSITE DRAWINGS SHOWING THE EXACT LOCATION OF DUCTS, CONDUIT, AND EQUIPMENT. DRAWINGS SHALL BE BASED ON FIELD MEASUREMENTS AND, AFTER CONSULTATION AND AGREEMENT BETWEEN THE TRADES, SHALL BE APPROVED BY THE ARCHITECT AND ENGINEER BEFORE INSTALLATION OF THE WORK.
14. FOR SPACES WITH INACCESSIBLE HARD CEILINGS, PROVIDE 30" x 30" HINGED ACCESS PANELS AS REQUIRED FOR ELECTRICAL EQUIPMENT ACCESS OR CLEARANCE.
15. EXPOSED INTERIOR CONDUIT IS NOT PERMITTED.
16. THE ELECTRICAL CONTRACTOR IS TO PROVIDE PULL STRINGS IN ALL EMPTY CONDUIT AND RACEWAYS WITH LABELING TAGS AT EACH END.
17. ALL BARE METAL SURFACES SHALL BE PRIMED AND PAINTED TO PREVENT ANY RUST, INCLUDING BUT NOT LIMITED TO ANGLE FRAMING, EQUIPMENT SUPPORTS, MOUNTING HARDWARE, ETC.
18. ALL MATERIALS AND EQUIPMENT INSTALLED IN RETURN AIR PLENUMS SHALL BE NON-COMBUSTIBLE AND UL LABELED AND LISTED FOR THE APPLICATION. ALL WIRING SHALL BE PLENUM RATED OR ENCLOSED IN A METAL RACEWAY.
19. ALL RACEWAYS SHALL HAVE A GREEN GROUNDING CONDUCTOR.
20. THE ELECTRICAL CONTRACTOR SHALL PROVIDE A INDIVIDUAL NEUTRAL CONDUCTOR FOR EACH CIRCUIT.
21. THE ELECTRICAL CONTRACTOR SHALL FIRESTOP ALL NEW AND EXISTING ELECTRICAL PENETRATIONS IN FIRE RATED PARTITIONS (WALLS, FLOORS, OR CEILINGS) WITH AN APPROVED FIRESTOP SYSTEM RATED FOR THE APPLICATION. FIRESTOP SYSTEM SHALL BE UL LISTED AND INSTALLED IN STRICT COMPLIANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
22. COORDINATE LIGHTING, SWITCHING, AND RECEPTACLE LOCATIONS IN MECHANICAL SPACES WITH RESPECT TO ACTUAL MECHANICAL EQUIPMENT INSTALLATION FOR OPTIMUM LIGHTING AND UTILIZATION OF RECEPTACLES.
23. THE ELECTRICAL CONTRACTOR MAY INSTALL MULTIPLE CIRCUITS INDICATED ON PANEL SCHEDULE IN A SINGLE CONDUIT. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING CONDUIT FILL AND CONDUCTOR DERATING.
24. SURGE PROTECTION SHALL BE PROVIDED ON ALL CABLES ENTERING/ EXITING BUILDINGS THAT CONNECT TO ELECTRICAL EQUIPMENT.
25. CONDUCTORS FOR BRANCH CIRCUITS SHALL BE INCREASED TO PREVENT VOLTAGE DROP EXCEEDING 3% AT THE FARTHEST DEVICE. LOADS FOR DETERMINING CONDUCTOR SIZE SHALL BE BASED ON ACTUAL CONNECTED LOAD OR 80% OF BREAKER SIZE, WHICHEVER IS GREATER. CONTACT ENGINEER OF RECORD FOR ALL RUNS IN EXCESS OF 100 FT. FOR DETERMINATION OF WIRE SIZE. FOR BID PURPOSES, INCREASE WIRE BY ONE (1) WIRE SIZE FOR RUNS 100 FT. TO 200 FT. AND TWO (2) WIRE SIZES FOR RUNS OVER 200 FT.
26. ALL ELECTRICAL BOXES INSTALLED IN 1 HOUR RATED BARRIER AND 2 HOUR SHAFT WALLS ARE REQUIRED TO HAVE THE SAME FIRE RATING AS THE WALLS, HAVE SIZE AND SPACING AS PER FBC 712.3.2 EXPECTATIONS.



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

ELECTRICAL LEGEND AND NOTES

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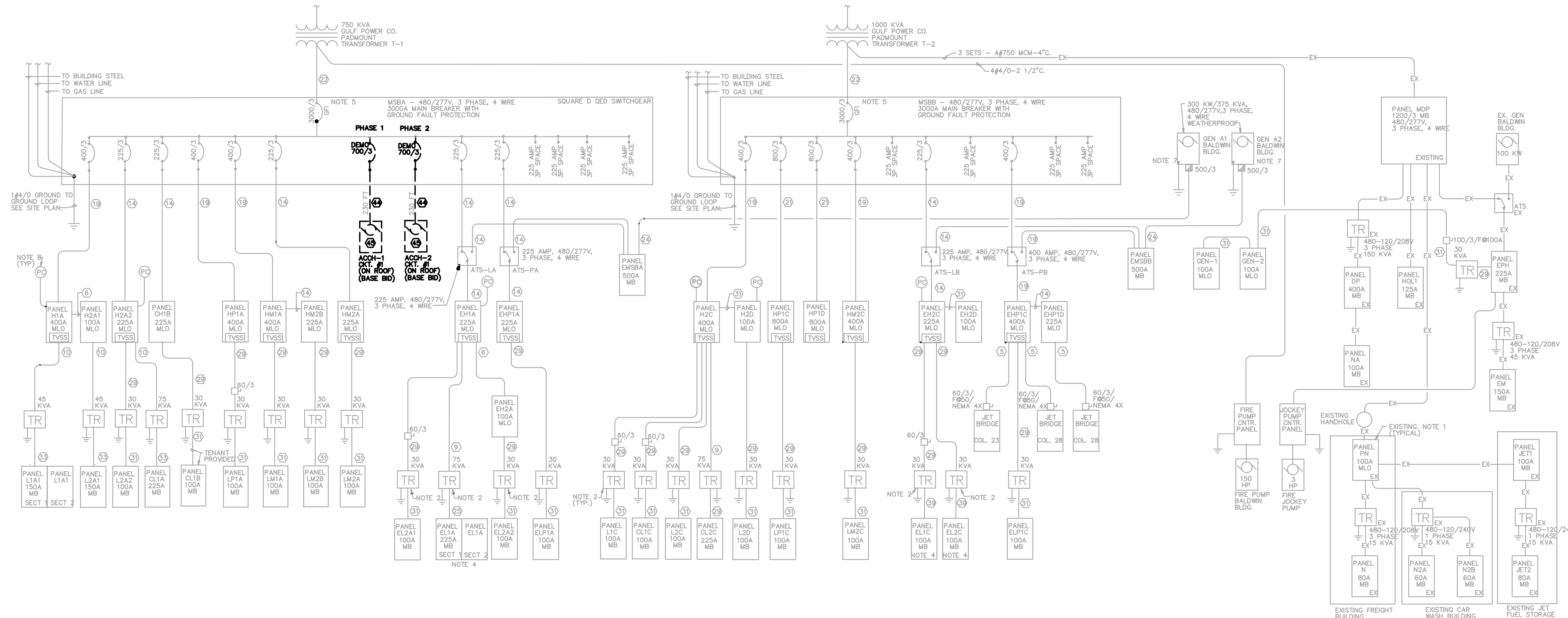
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I:\PROJECTS\ORL_AIRPORTS_060709\PROJECTS\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\E-001 ELECTRICAL LEGEND AND NOTES.DWG 1/17/2018 10:55 AM

\\AVPROJECTS\ORL_AIRPORTS_06709\PROJECTS\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\E-002 ELECTRICAL ONE LINE DIAGRAM - DEMOLITION.DWG 1/17/2018 10:55 AM

FEDER SCHEDULE

- | | | |
|-----------------------------------|---|--|
| ① 3#10 & 1#10 (G) - 3/4". | ⑩ (2) SETS - 3#350mm & 1#1/0 (G) - 2 1/2" | ⑲ 4#3 & 1#8 (G) - 1 1/4". |
| ② 2#8 & 1#10 (G) - 3/4". | ⑪ (4) SETS - 4#350mm & 1#2 (G) - 3" | ⑳ 4#1 & 1#8 (G) - 1 1/4". |
| ③ 3#6 & 1#10 (G) - 3/4". | ⑫ (2) SETS - 3#500mm & 1#1/0 (G) - 3" | ㉑ 4#1/0 & 1#8 (G) - 1 1/2". |
| ④ 3#6 & 1#8 (G) - 3/4". | ⑬ 4#500mm & 1#3 (G) - 3 1/2" | ㉒ 4#250mm & 1#4 (G) & 1#4 (G) - 3". |
| ⑤ 4#6 & 1#8 (G) - 1". | ⑭ 4#500mm & 1#1/0 (G) - 3 1/2" | ㉓ 4#2/0 & 1#4 (G) - 2". |
| ⑥ 4#2 & 1#8 (G) - 1 1/4". | ⑮ (2) SETS - 4#500mm & 1#2/0 (G) - 3 1/2" | ㉔ 3#2/0 & 1#1/0 (G) - 2". |
| ⑦ 3#3 & 1#8 (G) - 1". | ⑯ (8) SETS - 4#500mm - 4" | ㉕ (2) sets - 3#350mm & 1#2/0(G)-3". |
| ⑧ 3#3 & 1#8 (G) 1#8 (G) - 1 1/4". | ⑰ 3#350mm & 1#3 (G) - 2 1/2" | ㉖ 3#350mm & 1#3 (G) - 2 1/2" |
| ⑨ 3#2 & 1#8 (G) - 1 1/4". | ⑱ (2) SETS - 4#250mm & 1#2 (G) - 3" | ㉗ (2) SETS - 4#250mm & 1#2 (G) - 3" |
| ⑩ 3#4 & 1#8 (G) - 1". | ⑲ 4#4/0 & 1#4 (G) & 1#4 (G) - 2 1/2". | ㉘ 4#3, 1#8(G) & 1#8(G)-1 1/4" |
| ⑪ 4#2/0 & 1#4 (G) (G) - 2". | ㉚ 3#1 & 1#6 (G) - 1 1/2" | ㉙ 4#4/0 - 3" |
| ⑫ 4#2/0 & 1#4 (G) & 1#4 (G) - 2". | ㉛ (7) SETS - 4#750mm & 1#500mm(G)- 4" | ㉚ 3#3, 1#3/0(N) & 1#8 (G) - 1 1/4". |
| ⑬ 4#3/0 & 1#4 (G) - 2 1/2". | ㉜ (2) SETS - 3#250mm & 1#1/0 (G) - 2 1/2" | ㉛ 3#4/0, 1#500 mm(N) & 1#4 (G) 1#4 (G) - 2 1/2". |
| ⑭ 4#4/0 & 1#4 (G) - 2 1/2". | ㉝ 3#8 & 1#10 (G) - 3/4". | ㉜ (2) SETS - 3#500 KCMIL & 1#1/0(G) - 3" CONDUIT TO BE REUSED. REFERENCE PHASING PLANS ON SHEET M-103 (BASE BID) |
| ⑮ 4#4/0 & 1#2 (G) - 2 1/2". | ㉞ 4#12 - 3/4". | ㉝ DEMO EXISTING CHILLERS ACH-1 AND ACH-2. (BASE BID) REFERENCE PHASING PLANS ON SHEET M-103 SHEET (BASE BID) |



DEMO ELECTRICAL ONE-LINE DIAGRAM - MSBA, MSBB & MDP
NOT TO SCALE



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

ELECTRICAL ONE LINE DIAGRAM DEMOLITION

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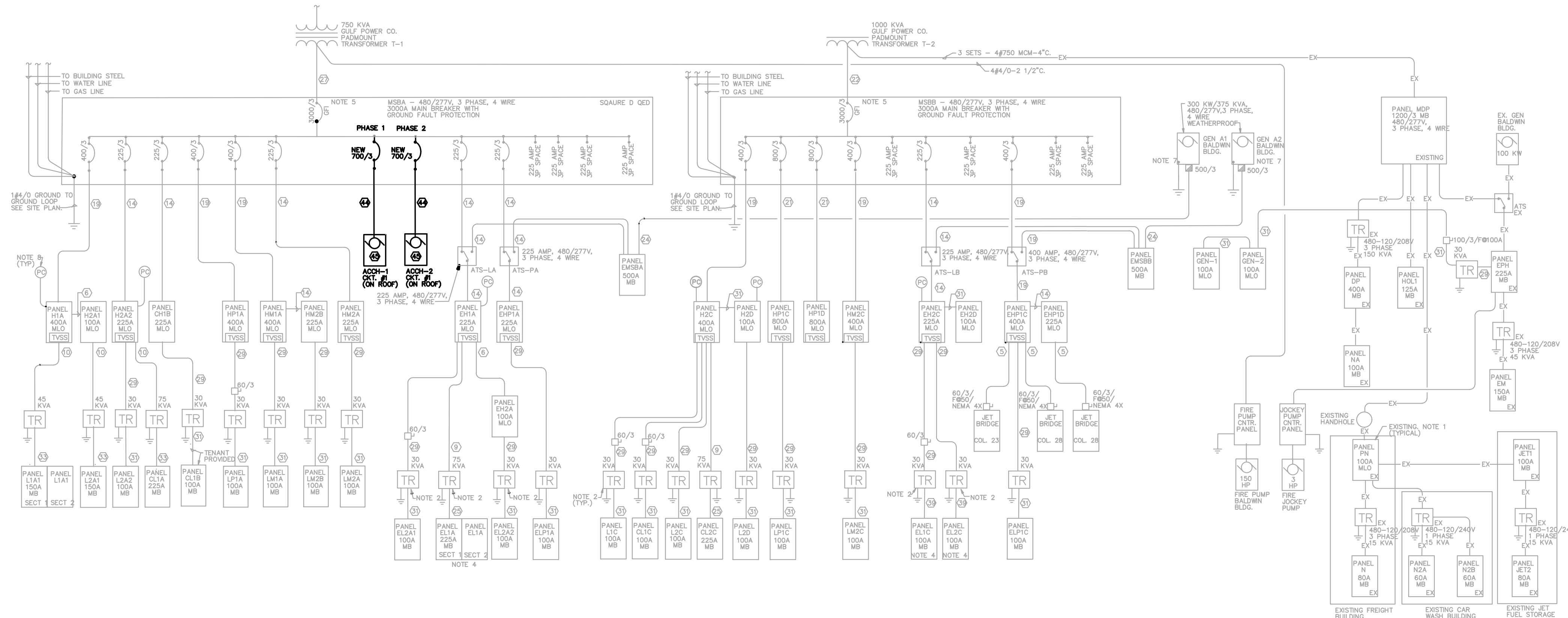
\\AVPROJECTS\ORL_AIRPORTS_060709\PROJECTS\2017\050.11 - VPS CHILLER REPLACEMENT\CADD\E-003 ELECTRICAL ONE LINE DIAGRAM - REVISED.DWG 1/17/2018 10:55 AM

GENERAL ELECTRICAL NOTES

1. ALL SERVICE AND DISTRIBUTION EQUIPMENT SHALL COMPLY WITH NFPA 70, NATIONAL ELECTRICAL CODE (NEC), AND SPECIFICALLY ARTICLES 110.9 AND 110.10. EQUIPMENT SHALL HAVE A MINIMUM UL LISTED SHORT CIRCUIT CURRENT RATING OF UPSTREAM DISTRIBUTION EQUIPMENT, OR VALUE AS NOTED IN CONTRACT DOCUMENTS, OR AS CALCULATED BY THE SHORT CIRCUIT/COORDINATION/ARC-FLASH HAZARD ANALYSIS, WHICHEVER VALUE IS GREATER.
2. FURNISH AND INSTALL ALL RECOMMENDED OVERCURRENT PROTECTION AND SHORT CIRCUIT PROTECTION REQUIRED BY THE NEC. THE OVERCURRENT SHALL BE SIZED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND THE NEC.

FEEDER SCHEDULE

- | | | |
|-----------------------------------|---|---|
| ① 3#10 & 1#10 (G) - 3/4". | ⑭ (2) SETS - 3#350mm & 1#1/0 (G) - 2 1/2" | ⑳ 4#3 & 1#8 (G) - 1 1/4". |
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| ③ 3#6 & 1#10 (G) - 3/4". | ⑯ (2) SETS - 3#500mm & 1#1/0 (G) - 3" | ㉒ 4#1/0 & 1#8 (G) - 1 1/2". |
| ④ 3#6 & 1#8 (G) - 3/4". | ⑰ 4#500mm & 1#3 (G) - 3 1/2" | ㉓ 4#250mm & 1#4 (G) & 1#4 (G) - 3". |
| ⑤ 4#6 & 1#8 (G) - 1". | ⑱ 4#500mm & 1#1/0 (G) - 3 1/2" | ㉔ 4#2/0 & 1#4 (G) - 2". |
| ⑥ 4#2 & 1#8 (G) - 1 1/4". | ⑲ (2) SETS - 4#500mm & 1#2/0 (G) - 3 1/2" | ㉕ 3#2/0 & 1#1/0 (G) - 2". |
| ⑦ 3#3 & 1#8 (G) - 1". | ⑳ (8) SETS - 4#500mm - 4" | ㉖ (2) sets - 3#350mm & 1#2/0(G)-3". |
| ⑧ 3#3 & 1#8 (G) 1#8 (G) - 1 1/4". | ㉑ 3#350mm & 1#3 (G) - 2 1/2" | ㉗ (2) SETS - 4#750mm & 1#6(0)-2 1/2" |
| ⑨ 3#2 & 1#8 (G) - 1 1/4". | ㉒ (2) SETS - 4#250mm & 1#2 (G) - 3" | ㉘ 4#3, 1#8(0) & 1#8(0)-1 1/4" |
| ⑩ 3#4 & 1#8 (G) - 1". | ㉓ 4#4/0 & 1#4 (G) & 1#4 (G) - 2 1/2". | ㉙ 4#4/0 - 3" |
| ⑪ 4#2/0 & 1#4 (G) (G) - 2". | ㉔ 3#1 & 1#6 (G) - 1 1/2" | ㉚ 3#3, 1#3/0(N) & 1#8 (G) - 1 1/4". |
| ⑫ 4#2/0 & 1#4 (G) & 1#4 (G) - 2". | ㉕ (7) SETS - 4#750mm & 1#500mm(G)- 4" | ㉛ 3#3, 1#3/0(N) & 1#8 (G) & 1#8 (G) - 1 1/4". |
| ⑬ 4#3/0 & 1#4 (G) - 2 1/2". | ㉖ (2) SETS - 3#250mm & 1#1/0 (G) - 2 1/2" | ㉜ 3#4/0, 1#500 mcm(N) & 1#4 (G) 1#4 (G) - 2 1/2". |
| ⑭ 4#4/0 & 1#4 (G) - 2 1/2". | ㉗ 3#8 & 1#10 (G) - 3/4". | ㉝ 3#3, 1#3/0(N) & 1#8 (G) - 1 1/4". |
| ⑮ 4#4/0 & 1#2 (G) - 2 1/2". | ㉘ 4#12 - 3/4". | ㉞ (2) SETS - 3#500mm & 1#2/0(G)-3". |
- ㉟ PROVIDE 2 NEW SETS OF 3#500 KCMIL & 1#1/0(G) IN EXISTING CONDUIT, - REFERENCE PHASING PLAN ON SHEET M-103 (BASE BID)
 ㊱ EXISTING CHILLER ACCH-1 & 2 TO BE REPLACED - (BASE BID) REFERENCE PHASING PLANS ON SHEET M-103 SHEET - (BASE BID)



REVISED ELECTRICAL SINGLE-LINE DIAGRAM - MSBA, MSBB & MDP
NOT TO SCALE

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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

ELECTRICAL ONE LINE DIAGRAM REVISED

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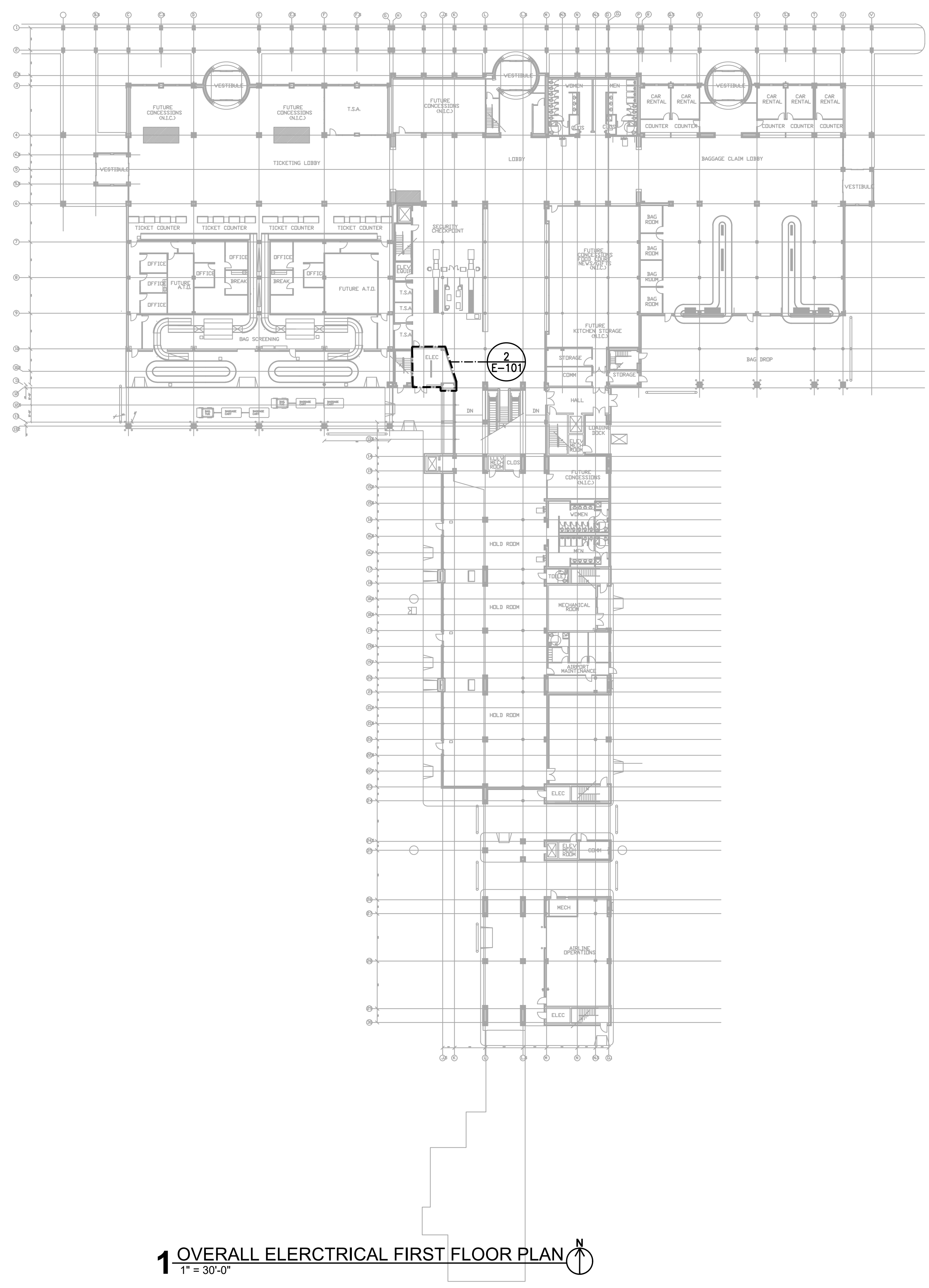
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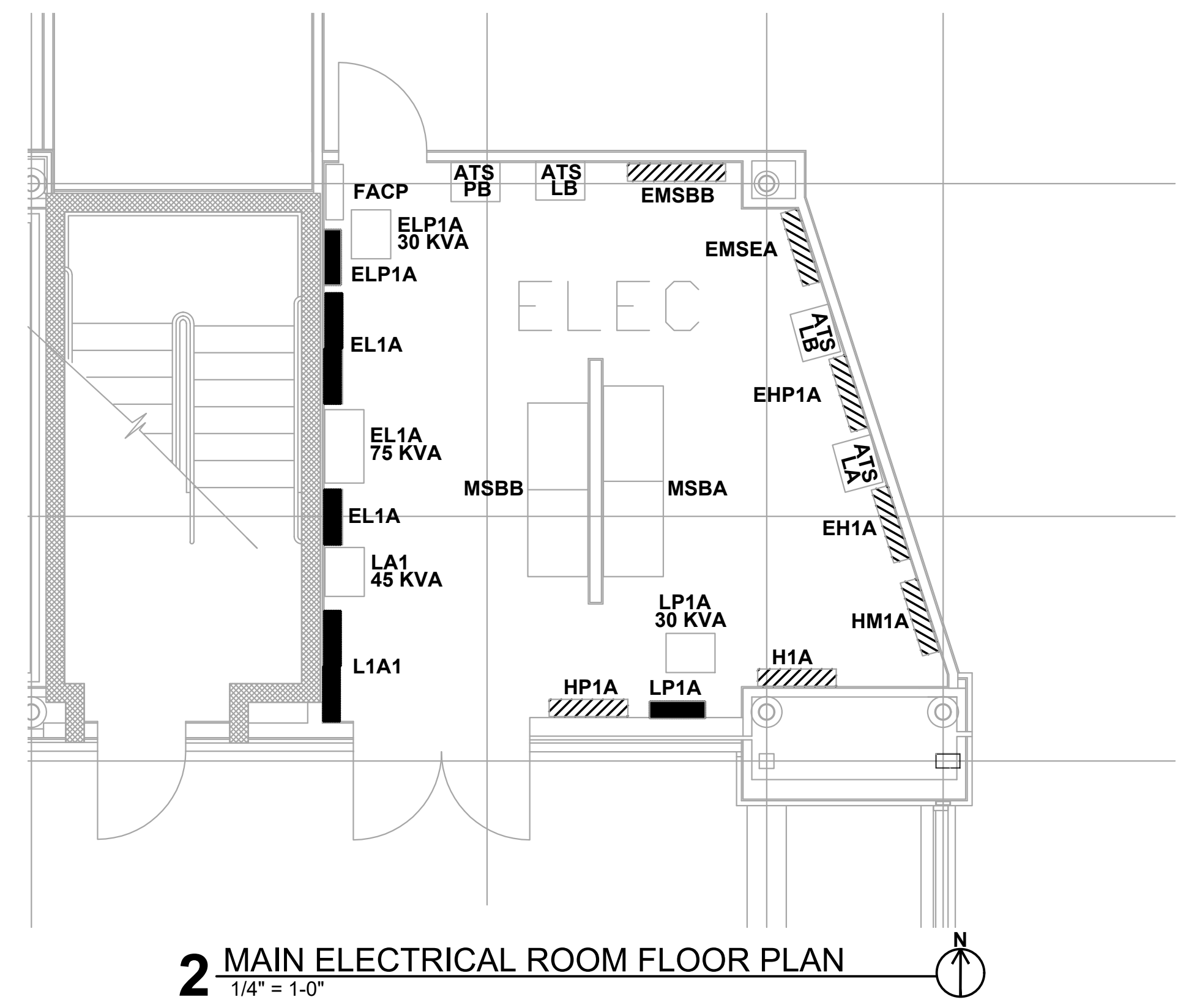
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SHEET NUMBER
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\\AVPROJECTS\ORL_AIRPORTS_060709\PROJECTS\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\E-101 ELECTRICAL OVERALL FIRST FLOOR PLAN.DWG 1/17/2018 10:55 AM



1 OVERALL ELERCTRICAL FIRST FLOOR PLAN
1" = 30'-0"



2 MAIN ELECTRICAL ROOM FLOOR PLAN
1/4" = 1'-0"



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ELECTRICAL OVERALL FIRST FLOOR PLAN

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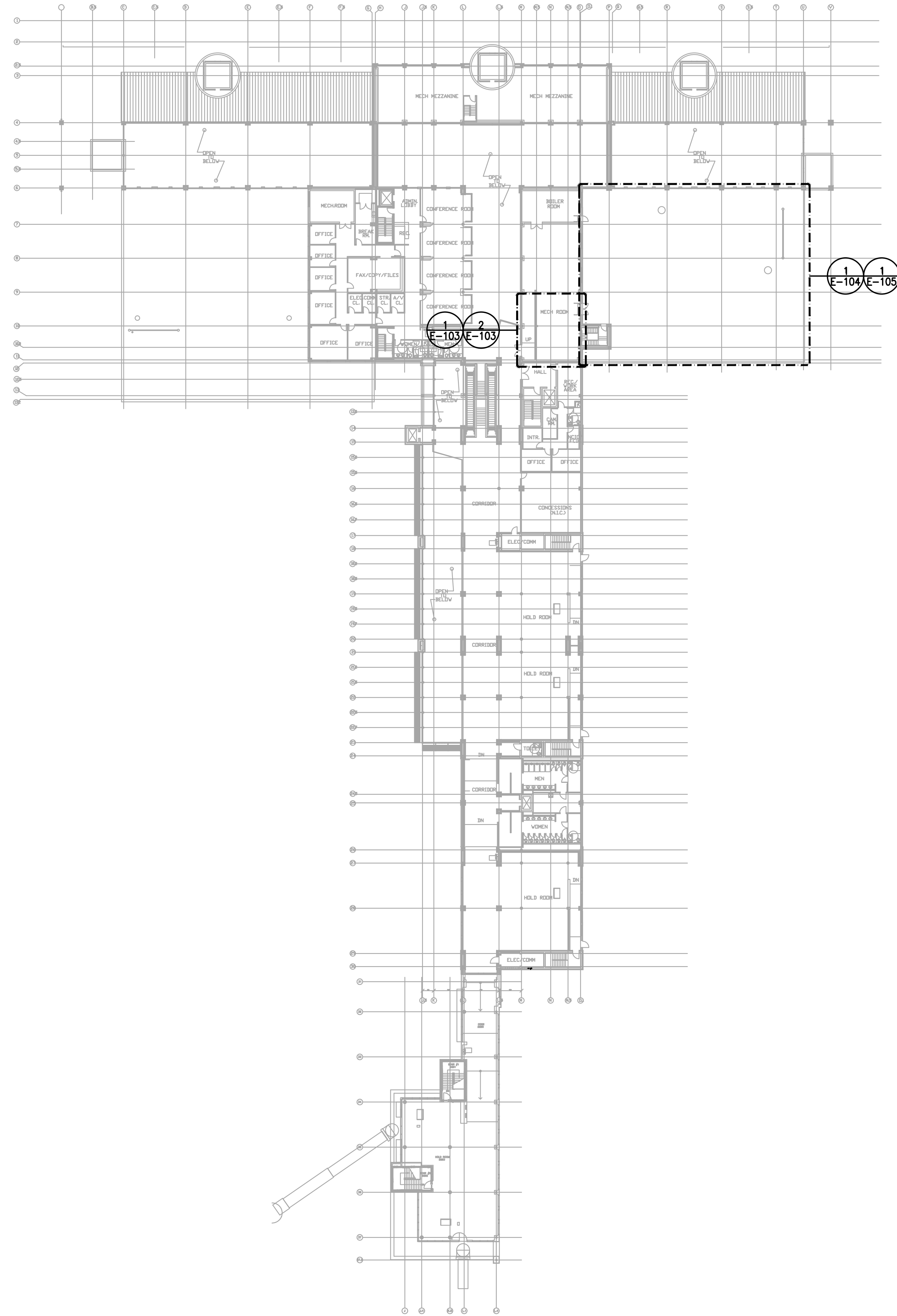
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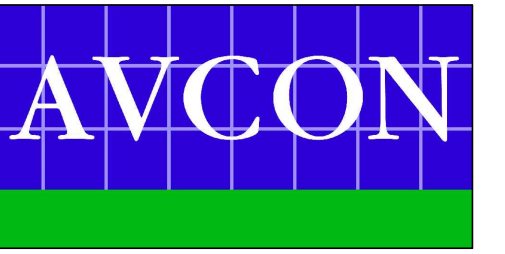
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\\AVPROJECTS\ORL_AIRPORTS_060709\PROJECTS\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\E-E-102 ELECTRICAL OVERALL SECOND FLOOR PLANDWG 1/17/2018 10:55 AM



1 OVERALL ELECTRICAL SECOND FLOOR PLAN
1" = 30'-0"



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VPS CHILLER REPLACEMENT

ELECTRICAL OVERALL SECOND FLOOR PLAN

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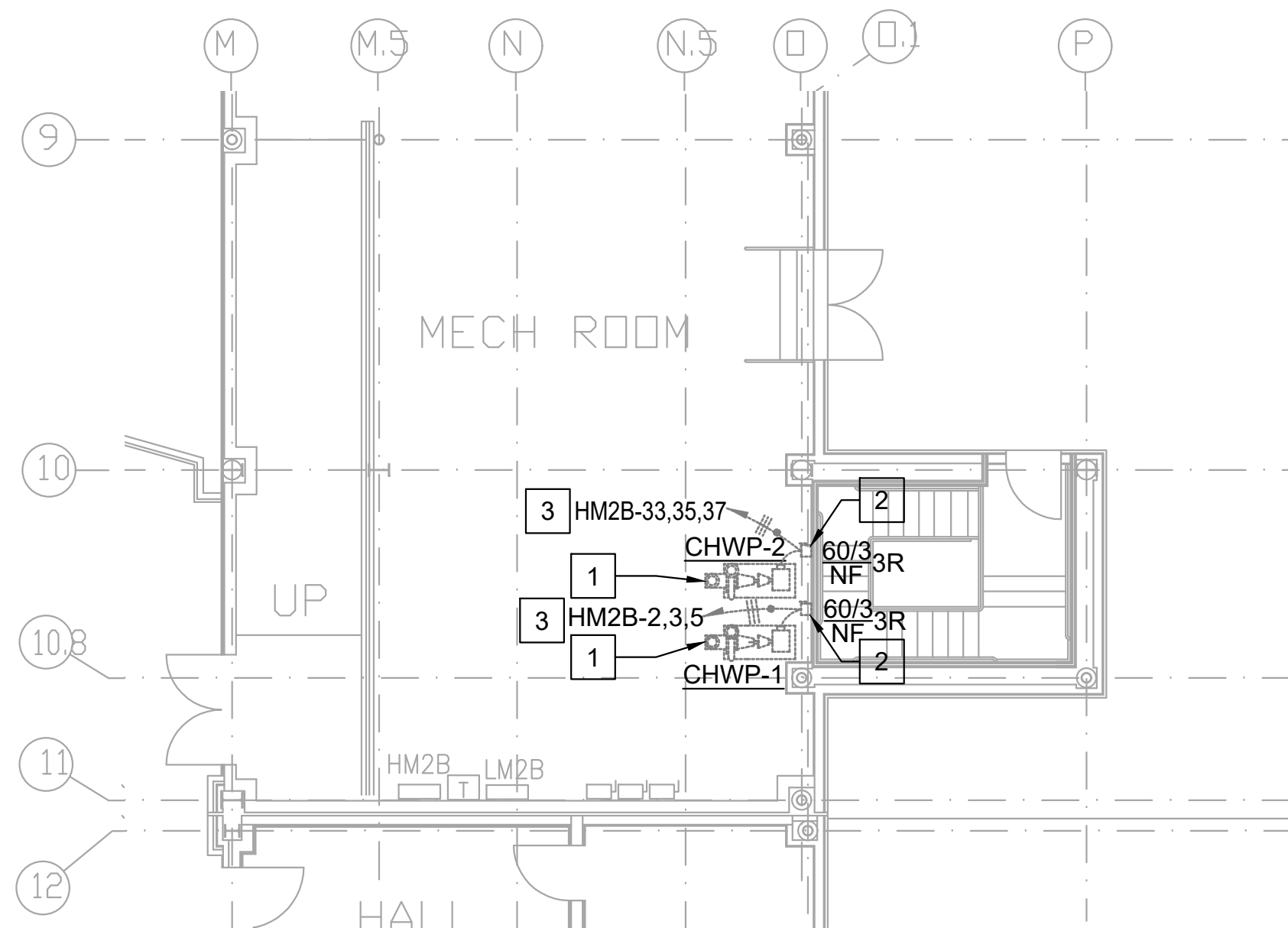
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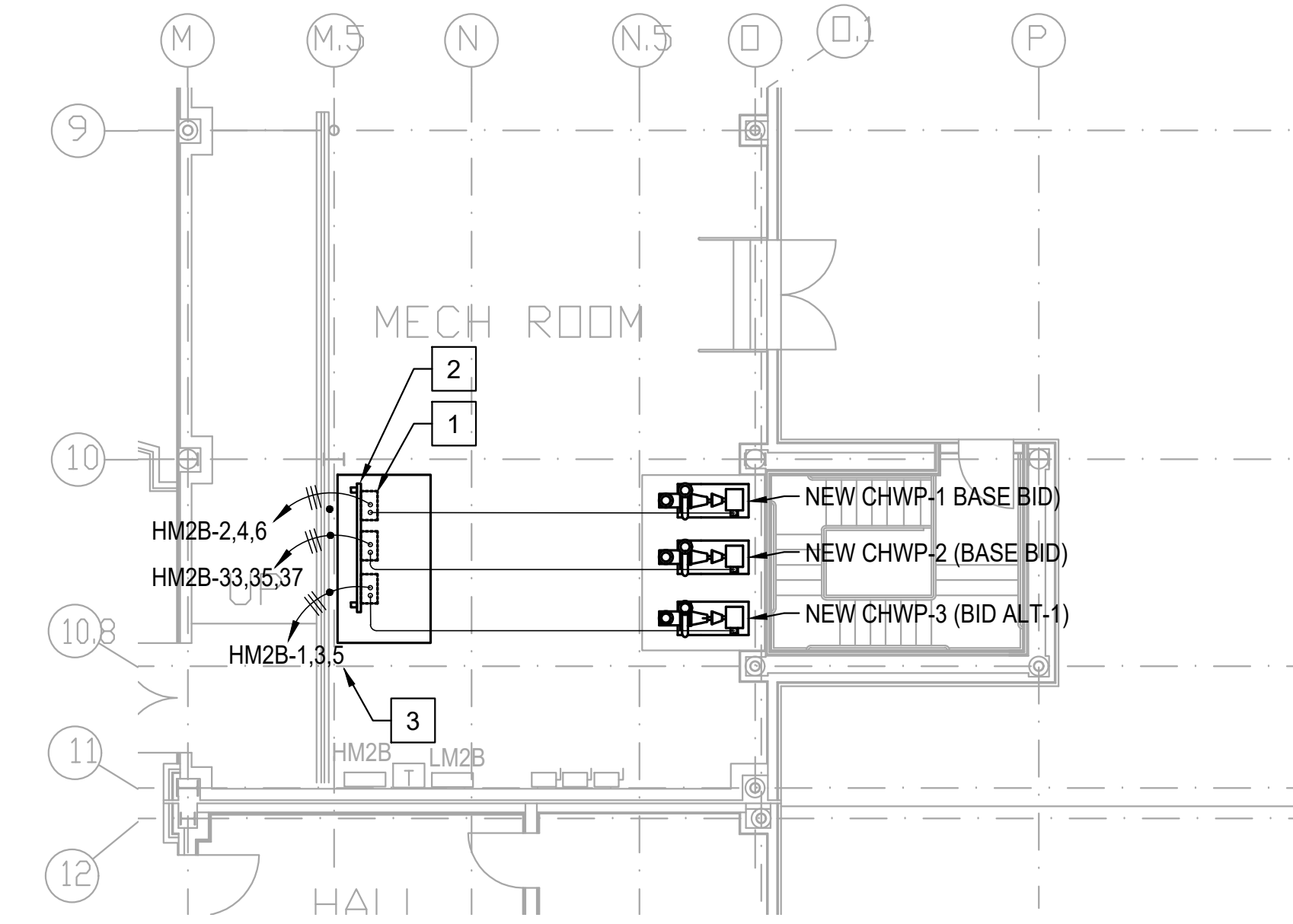
\\AVPROJECTS\ORL_AIRPORTS_060709\PROJECTS\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\VE-103 ELECTRICAL SECOND FLOOR DETAIL PLANS.DWG 1/17/2018 10:55 AM



1 ELECTRICAL SECOND FLOOR DEMOLITION PLAN
1/8" = 1'-0"

GENERAL ELECTRICAL NOTES

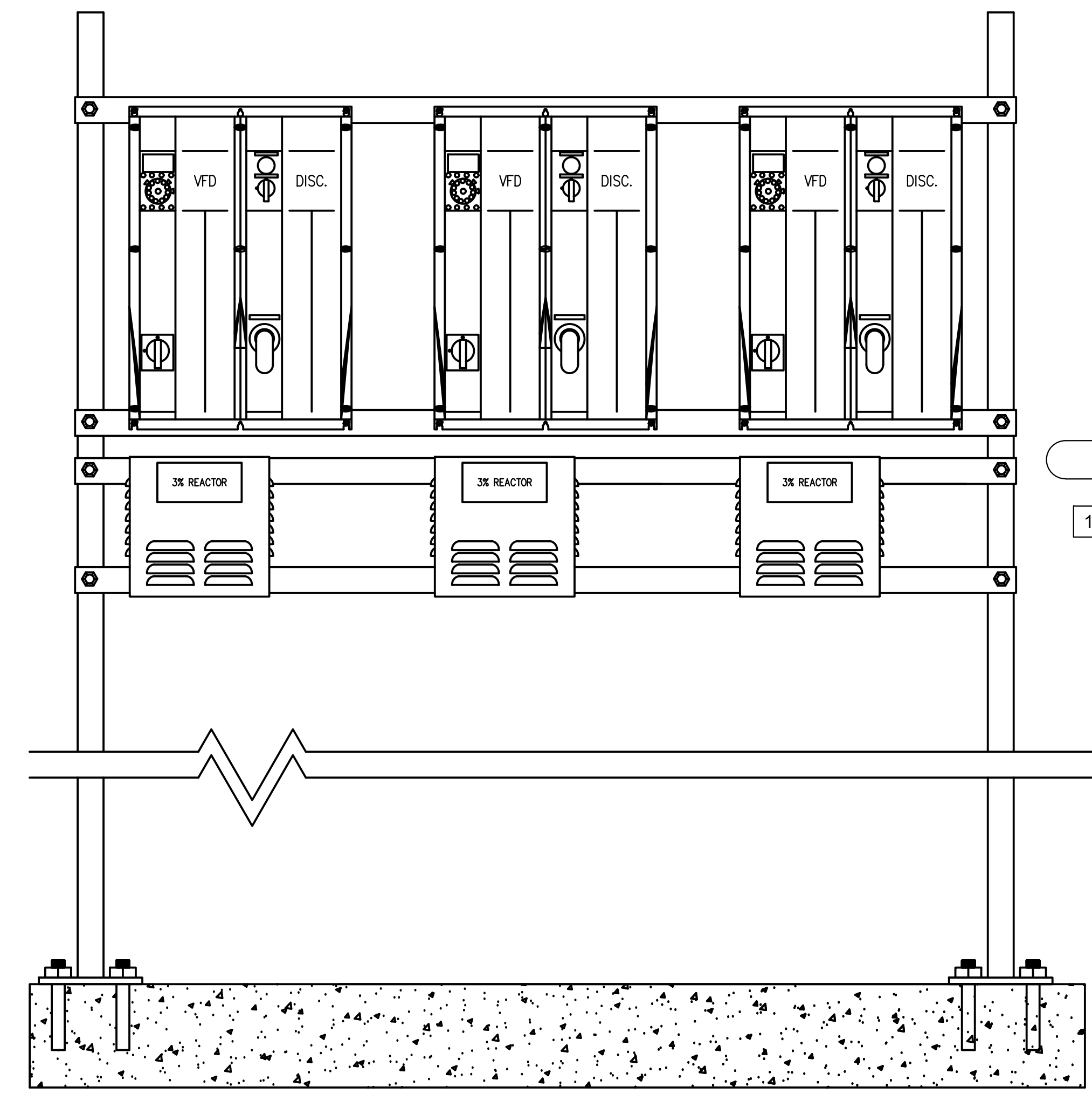
1. REFERENCE PHASING PLAN ON SHEET M-104.



1 ELECTRICAL SECOND FLOOR NEW PLAN
1/8" = 1'-0"

ELECTRICAL DEMOLISHION KEY NOTES

- 1 DEMOLISH CHWP-1 AND CHWP-2 (BASE BID).
- 2 DEMOLISH EXISTING DISCONNECT SWITCHES. (BASE BID)
- 3 DEMOLISH EXISTING CONDUIT AND WIRE BACK TO PANEL 'HM2B'. EXISTING CIRCUIT BREAKER FEEDING PUMPS SHALL BE DEMOLISHED (BASE BID).



RACK MOUNTED COMBINATION VFD / DISC. AND 3% REACTOR

SCALE: N.T.S.

ELECTRICAL KEY NOTES

- 1 NEW VFD, TYPICAL FOR 3. DANFOSS 20 HP, W/OPTIONAL DRIVE DISCONNECT. (VFD'S FOR CHWP #1 & 2 ARE BASE BID. CHWP #3 IS BID ALT)
- 2 CONTRACTOR SHALL PROVIDE 4"THICK SERVICE PAD WITH KINDORF RACK FOR VFD'S. SEE DETAIL '1' ON THIS SHEET. (BASE BID)
- 3 PROVIDE NEW FEEDER WIRING AND CIRCUIT BREAKERS IN PANEL HM2B. COORDINATE WITH PUMP MANUFACTURER FOR CIRCUIT BREAKER SIZING REQUIREMENTS . (BASE BID)

ELECTRICAL KEY NOTES

- 1 BOND VFD AND REACTOR CASES TO METAL MOUNTING RACK WITH MINIMUM 8AWG BONDING JUMPER.



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ELECTRICAL SECOND FLOOR PLAN

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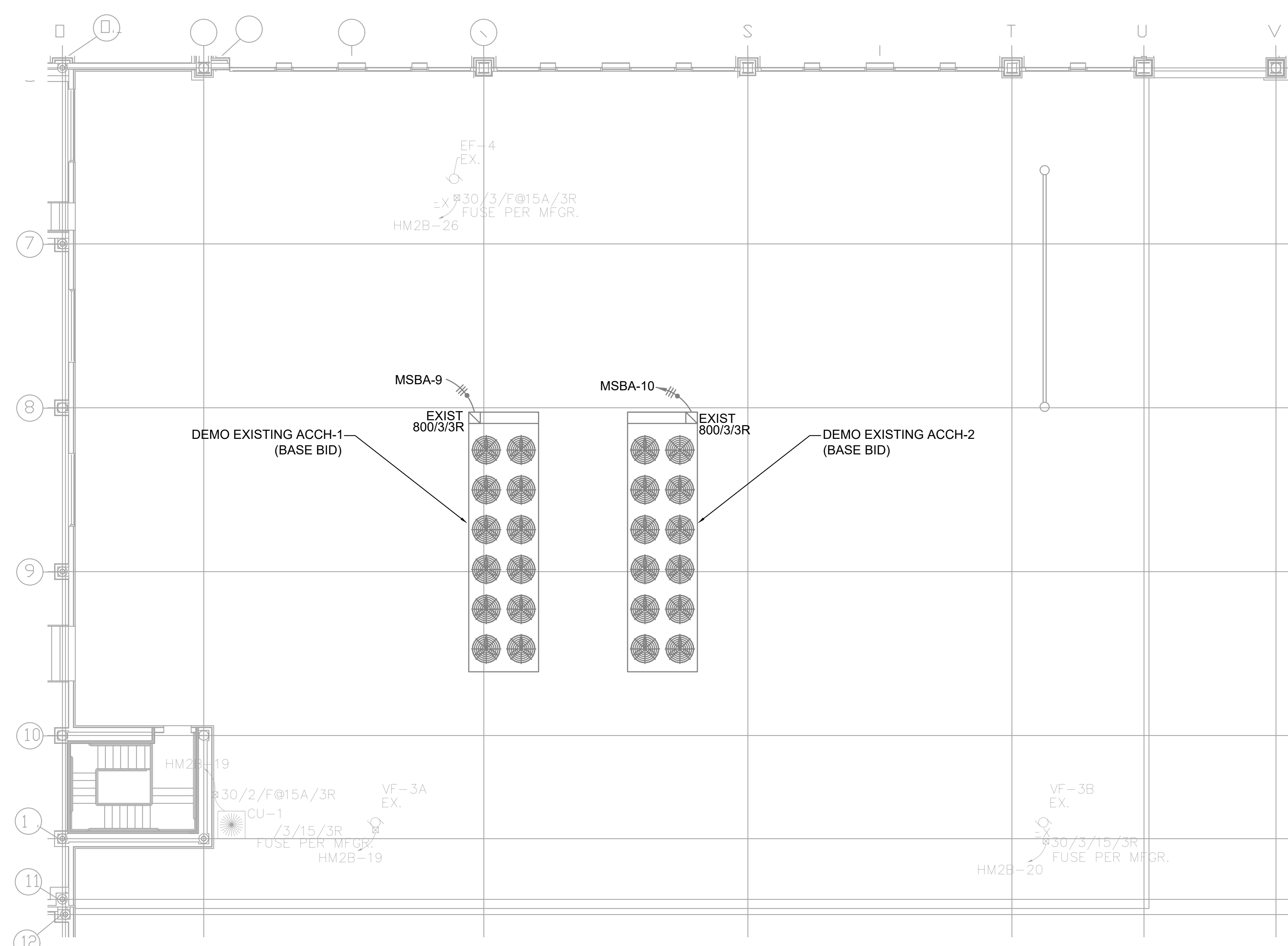
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AVCON PROJECT NO. 2017.050.11
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\\AVPROJ\CTS\ORL_AIRPORTS\PROJ\CTS\2017\050.11 - VPS CHILLER REPLACEMENT\CADD\1-104-1-CTRICAL S-COND - _ROO -MO PLANS.DWG 1/17/2018 10:55 AM



1 ELECTRICAL SECOND FLOOR ROOF DEMOLITION PLAN
1/8" = 1'-0"

GENERAL ELECTRICAL NOTES

1. REMOVE EXISTING CONDUIT FROM SWITCHBOARD 'MSBA' TO LOCATION O-CCH-1 AND ACCH-2 TO THE EXTENT POSSIBLE. EXISTING CONDUIT AS REQUIRED (BASE BID)
2. DEMOLISH EXISTING WIRING, SEAL TIGHT, EQUIPMENT, AND APPURTENANCES AS REQUIRED FROM THE DEMOLITION OF THE EXISTING ACCH-1 AND ACCH2 (BASE BID)
3. DEMOLISH EXISTING CHILLER 700/3 POLAR CIRCUIT BREAKERS LOCATED IN SWITCHBOARD 'MSBA' (BASE BID)
4. DEMOLISH EXISTING LIGHTNING PROTECTION 18" AIR TERMINALS MOUNTED ON BOTH CHILLERS (BASE BID)
5. DEMOLISH ALL EXISTING LIGHTNING PROTECTION BONDING CABLES AND CONNECTION TERMINALS ON BOTH EXISTING CHILLERS (BASE BID)
6. REMOVE PHASING PLANS ON SHEET M-103. CONTRACTOR SHALL PROVIDE TEMPORARY POST MOUNTED NEMA 3R 800 AMP DISCONNECT WITH A TEMPORARY DEREGULATED TEMPORARY CHILLER. CONTRACTOR SHALL CONFORM TEMPORARY DISCONNECT SIZING WITH CHILLER MANUFACTURER.



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

ELECTRICAL SECOND FLOOR ROOF DEMOLITION PLAN

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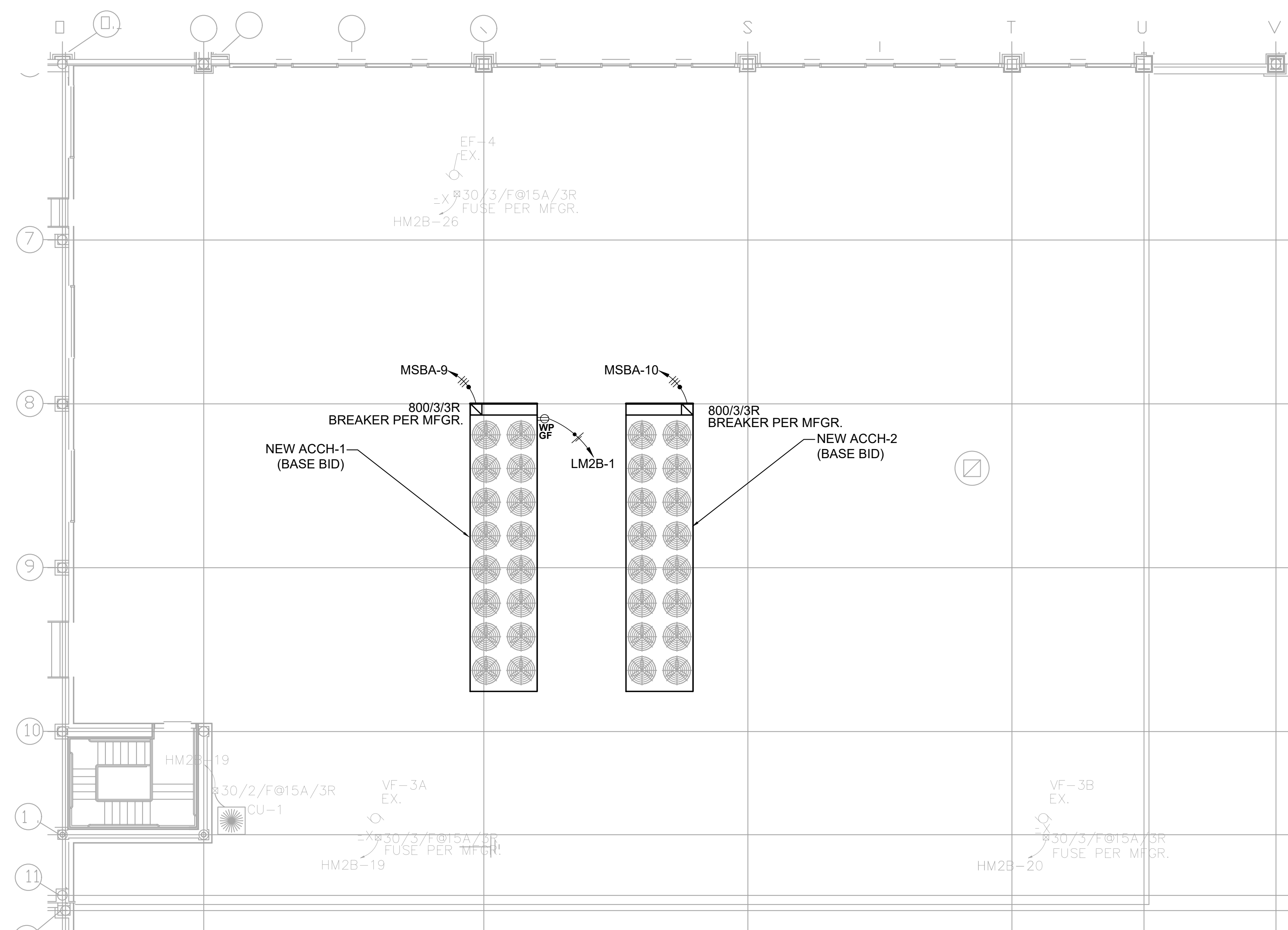
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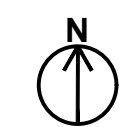
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1 ELECTRICAL SECOND FLOOR ROOF NEW WORK PLAN
1/8" = 1'-0"



GENERAL ELECTRICAL NOTES

1. R=US= EXISTING CONDUIT FROM 'MSBA' TO LOCATION O- CCH-1 AND ACCH-2.
2. PROVIDE NEW WIRING, SERIAL TIGHT, EQUIPMENT, AND APPURTENANCES AS REQUIRED - THE INSTALLATION OF THE NEW ACCH-1 AND ACCH2. R=RENC= PANEL SCHEDULES ON SHEET --601 - WIRING SIZES. (BASE BID)
3. R=RENC= LIGHTNING PROTECTION PLANS ON SHEET --106 - NEW CHILLER LIGHTNING PROTECTIONS PLANS (BASE BID)
4. R=RENC= PHASING PLANS ON SHEET M-103. CONTRACTOR SHALL PROVIDE TEMPORARY POST MOUNTED NEMA 3R 800 AMP 2D DISCONNECT WITH A TEMPORARY 2D-R TO TEMPORARY CHILLER. CONTRACTOR SHALL CONFIRM TEMPORARY 2D DISCONNECT SIZING WITH CHILLER MANUFACTURER.



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VPS CHILLER REPLACEMENT

ELECTRICAL SECOND FLOOR ROOF NEW WORK PLAN

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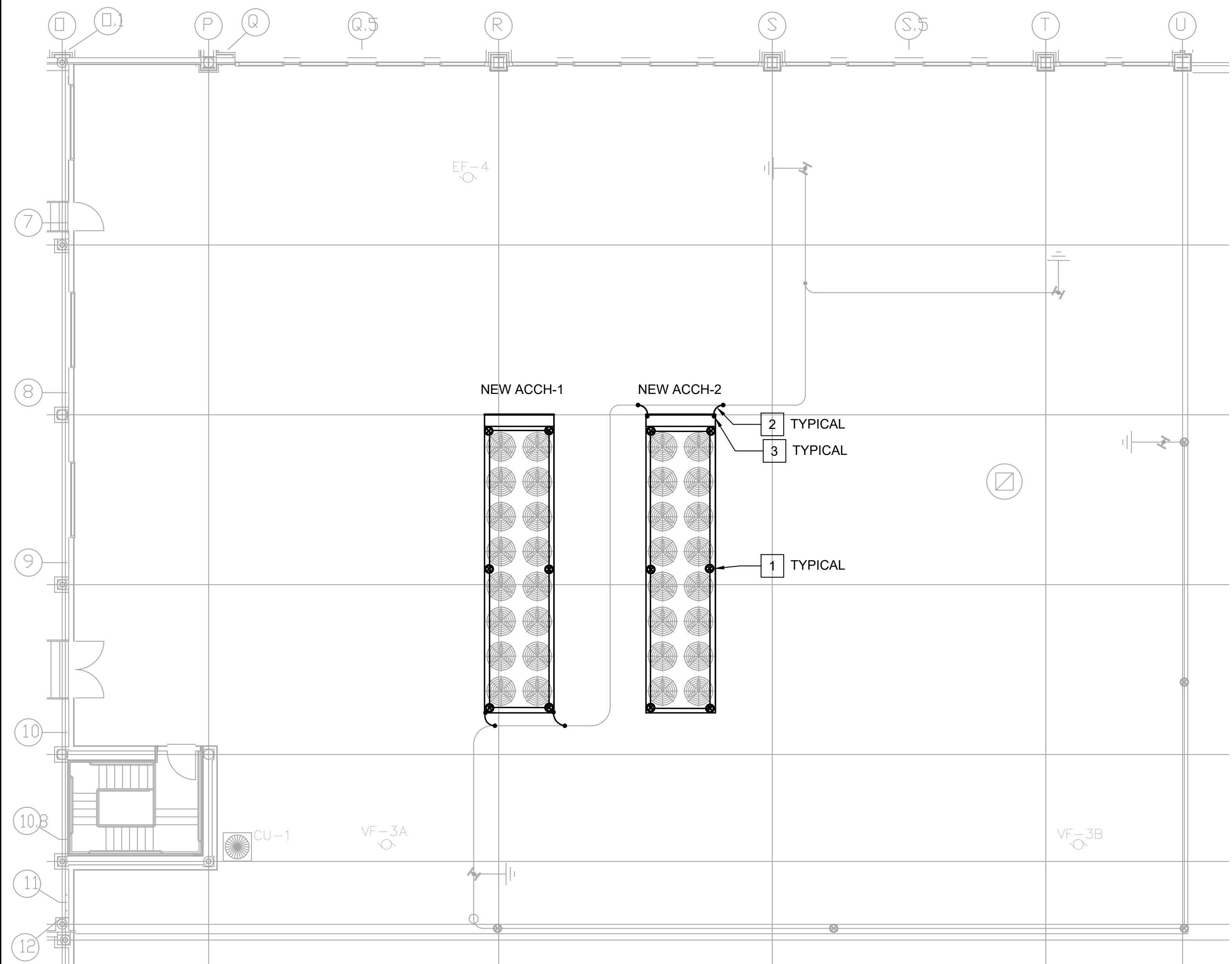
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\\AVPROJECTS\ORL_AIRPORTS_060709\PROJECTS_2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\VE-106 LIGHTNING PROTECTION PLANS.DWG 1/17/2018 10:55 AM



1 LIGHTNING PROTECTION SECOND FLOOR ROOF PLAN
1/8" = 1'-0"

LIGHTNING PROTECTION SYMBOL LEGEND

⊗	AIR TERMINAL – ALUMINUM
○	EXISTING DOWN CONDUCTOR – REUSE EXISTING ALL DOWN CONDUCTORS IF POSSIBLE. CONTRACTOR SHALL VERIFY CONNECTION RESISTANCE TO GROUND ROD.
•	TEE SPLICE
—	EXISTING CLASS 1, 28 STRAND BONDING CONDUCTOR, ALUMINUM (ABOVE GRADE)
—	NEW CLASS 1, 28 STRAND BONDING CONDUCTOR, ALUMINUM (ABOVE GRADE)

LIGHTNING PROTECTION GENERAL NOTES

- A. THE COMPLETED INSTALLATION SHALL MEET THE REQUIREMENTS OF THE NATIONAL FIRE PROTECTION ASSOCIATION'S LIGHTNING PROTECTION CODE – 2011 (NFPA 780), IAW UFC 3-600-01, 03 AND THE 'INSTALLATION REQUIREMENTS FOR LIGHTING PROTECTION SYSTEMS, UL 96A' OF UNDERWRITERS LABORATORIES INC. THE MASTER LABEL SHALL BE FURNISHED TO THE OWNER UPON COMPLETION.
- B. COPPER LIGHTNING PROTECTION SYSTEM COMPONENTS SHALL NOT BE MOUNTED TO ALUMINUM SURFACES. ALUMINUM COMPONENTS SHALL BE USED TO AVOID ELECTROLYTIC CORROSION.
- C. GROUNDED METAL BODIES WITHIN THE BONDING DISTANCE DETERMINED BY NFPA 780 – 2011 SHALL BE BONDED TO THE SYSTEM IN ACCORDANCE WITH CODE REQUIREMENTS.
- D. UNDERGROUND METALLIC PIPING ENTERING THE BUILDING SHALL BE BONDED TO THE NEAREST DOWN CONDUCTOR OR GROUND ELECTRODE.
- E. ADHESIVE USED WITH ADHESIVE AIR TERMINAL BASES AND CONDUCTOR FASTENERS SHALL BE COMPATIBLE WITH ROOFING MEMBRANE – VERIFY WITH ROOFING CONTRACTOR.
- F. AIR TERMINALS HAVE BEEN LOCATED ON THE ROOF TOP EQUIPMENT AS REQUIRED. IF THE METAL THICKNESS OF AN OBJECT IS 3/16" OR GREATER, AIR TERMINALS MAY BE ELIMINATED IF THE OBJECT IS PROPERLY CONNECTED TO THE SYSTEM.
- G. REFERENCE LIGHTNING PROTECTION DEVICE DETAILS.
- H. ALL LIGHTNING PROTECTION MATERIALS SHALL BE CLASS 1.
- I. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND LIGHTNING PROTECTION EQUIPMENT PRIOR TO BEGINNING WORK.

LIGHTNING PROTECTION KEY NOTES

- 1 PROVIDE 6 NEW 18" AIR TERMINALS ON EACH NEW CHILLER. (BASE BID)
- 2 NEW ROOF MOUNTED BONDING CONDUCTORS. (BASE BID)
- 3 BOND NEW CHILLER TO EXISTING CHILLER SUPPORT AT EACH LIGHTNING PROTECTION BONDING CONNECTION. (BASE BID)



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

SECOND FLOOR ROOF LIGHTNING PROTECTION PLAN

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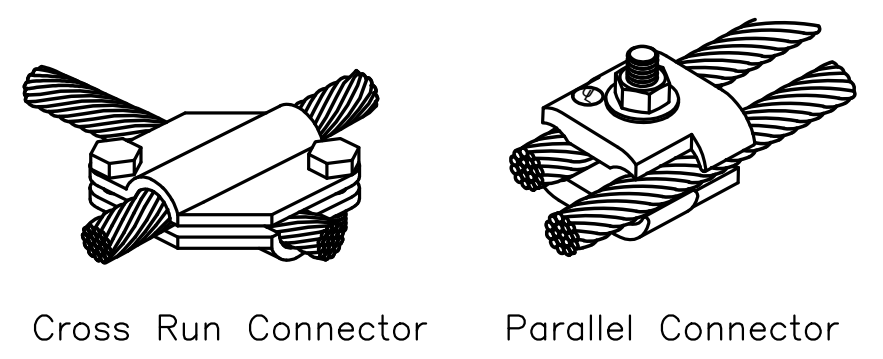
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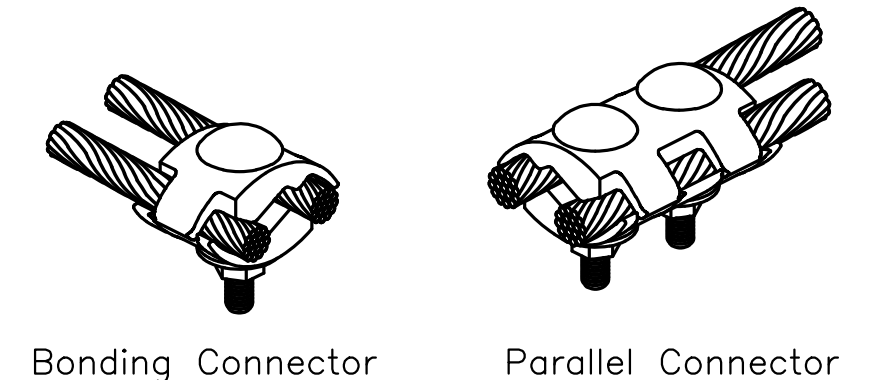
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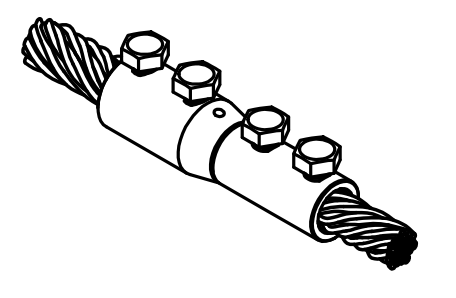
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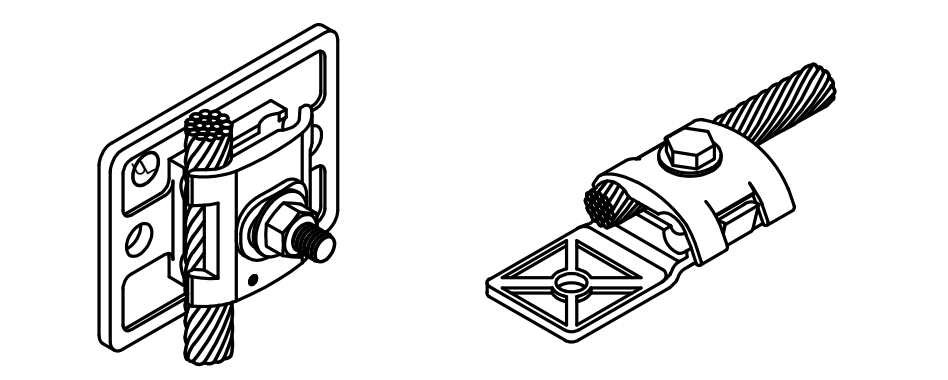
Cross Run Connector Parallel Connector



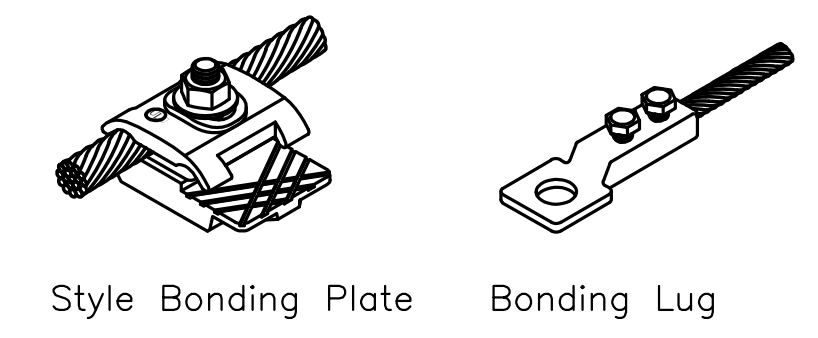
Bonding Connector Parallel Connector



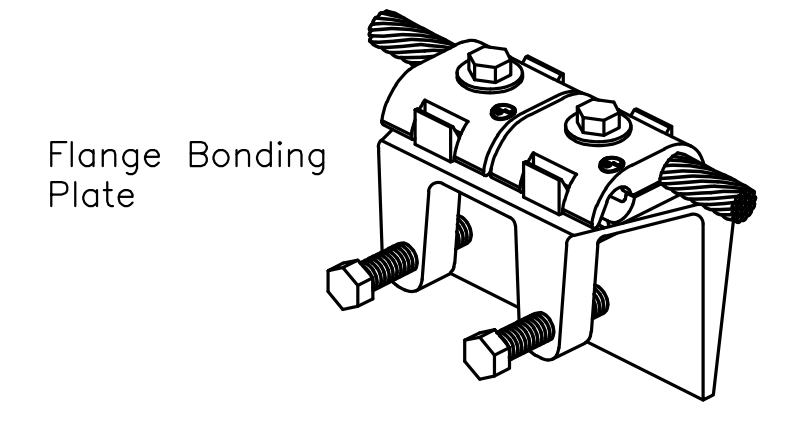
TYPICAL CABLE CONNECTORS
SCALE: N.T.S.



Style Bonding Plate Heavy Duty Bonding Lug

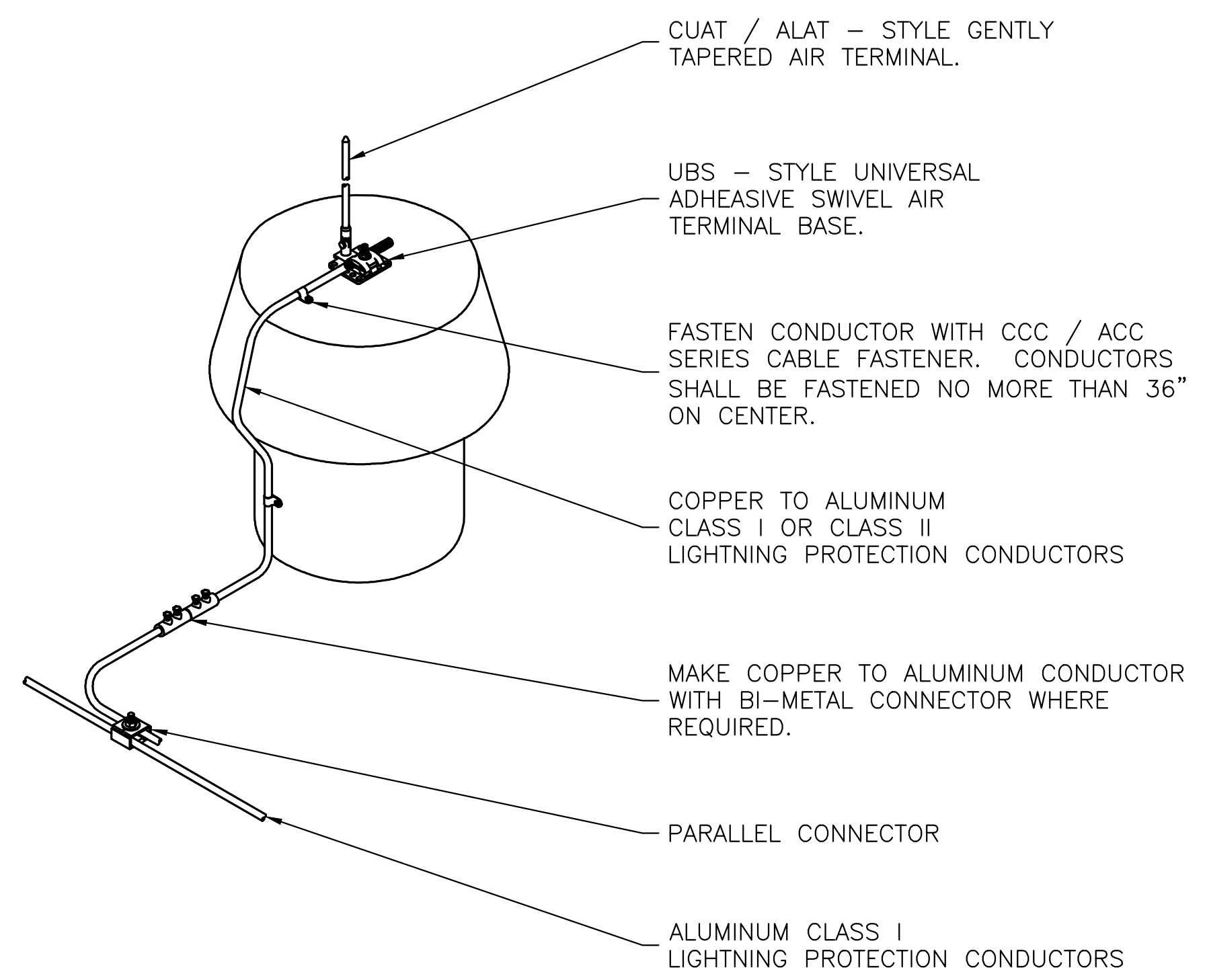
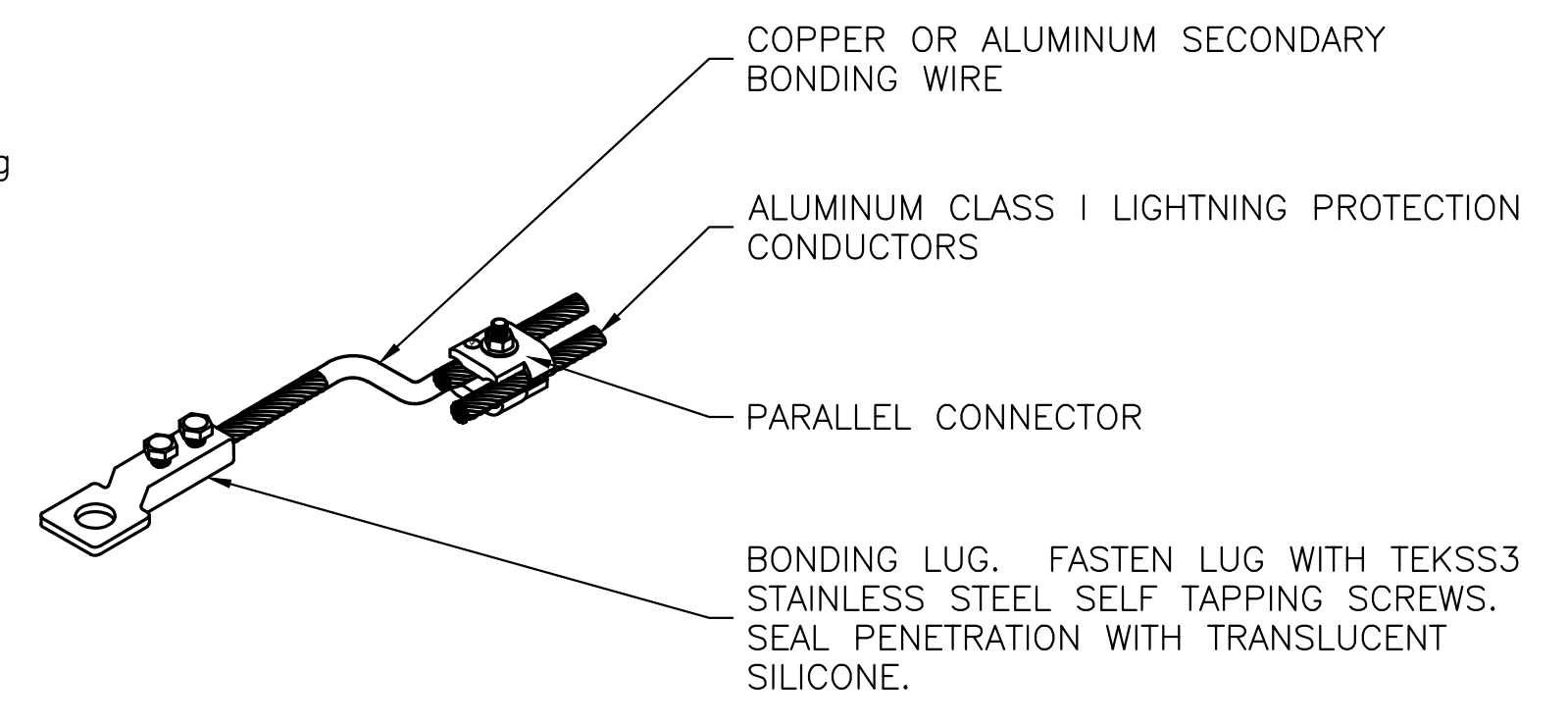


Style Bonding Plate Bonding Lug

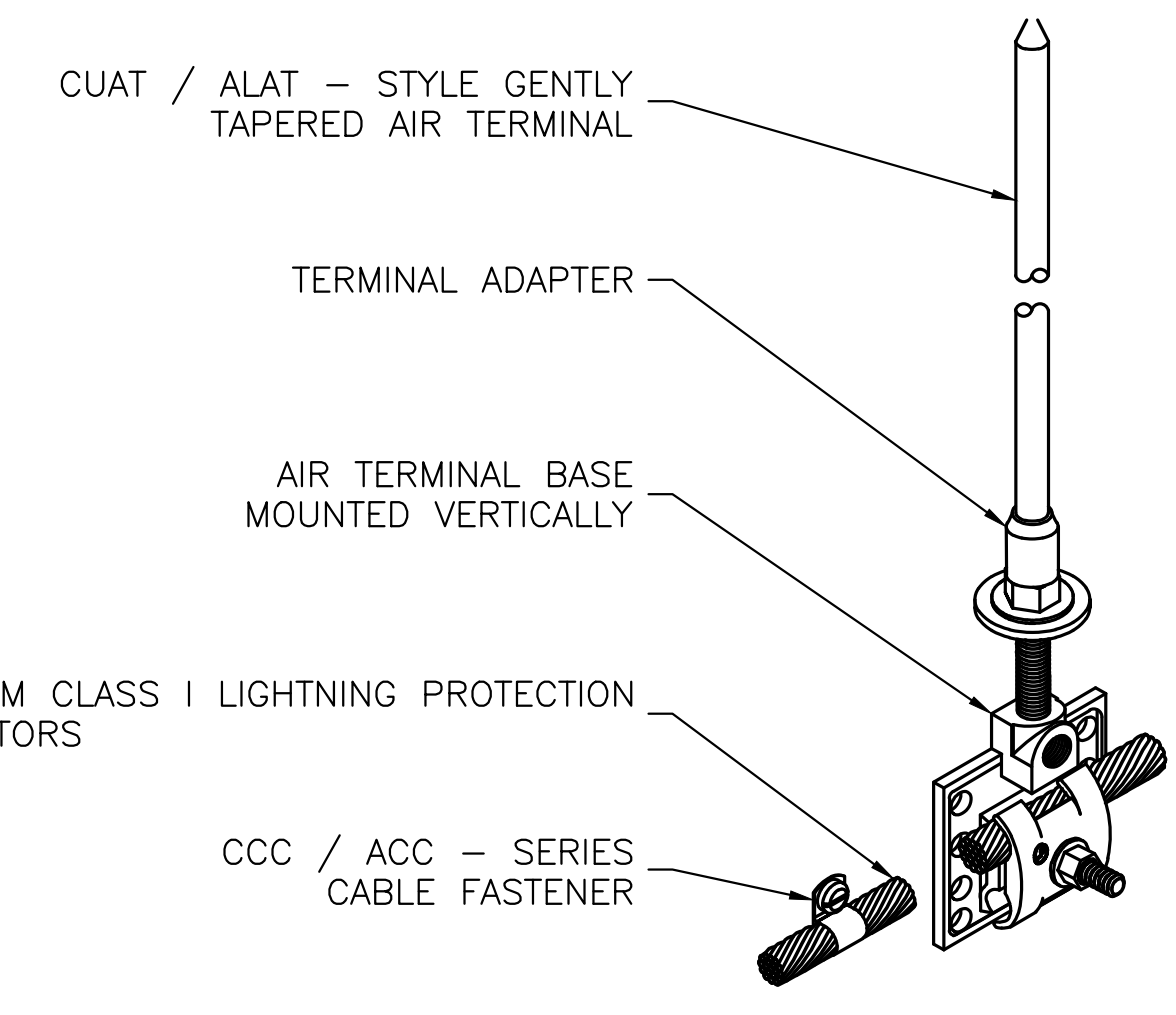
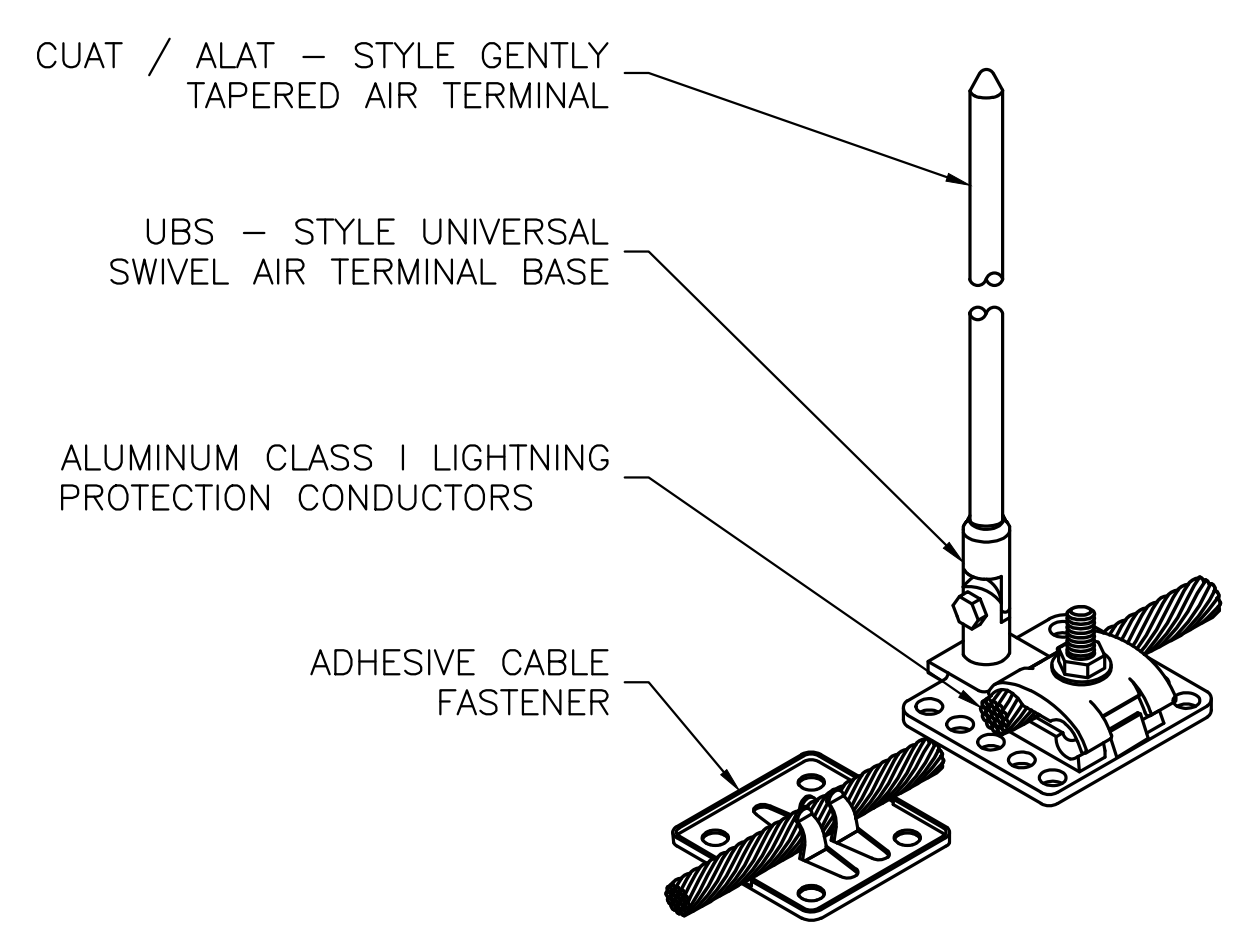


Flange Bonding Plate

TYPICAL BONDING LUGS & PLATES
SCALE: N.T.S.



AIR TERMINAL INSTALLATIONS
SCALE: N.T.S.



AVCON
ENGINEERS & PLANNERS
320 BAYSHORE DRIVE, SUITE A - NICEVILLE, FL 32578-2425
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DESTIN-FORT WALTON BEACH AIRPORT
VPS CHILLER REPLACEMENT
LIGHTNING PROTECTION DETAILS PLAN

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REVISIONS:

NO.	DATE	BY	DESCRIPTION

RELEASE FOR BID

DESIGNED BY: RS
DRAWN BY: RS
CHECKED BY: OC
APPROVED BY: SD
DATE: DEC 2017

AVCON PROJECT NO. 2017.050.11
SHEET NUMBER E107

\\AVPROJECTS\ORL_AIRPORTS_060709\PROJECTS\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\E-107 LIGHTNING PROTECTION DETAIL_PLANS.DWG, 1/17/2018 10:55 AM

\\AVPROJECTS\ORL_AIRPORTS_060709\PROJECTS\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\E-602 ELECTRICAL_SCHEDULES.DWG 1/17/2018 11:01 AM

PANEL: LM2B		SERVICE: 120/208V 3 PHASE, 4 WIRE		AIC RATING: 10,000 AIC	
LOCATION: -		RATING: 100A		MAIN TYPE: MCB	
MOUNTING: SURFACE		SUPPLY FROM: HM2B		PANEL TYPE: SQUARE D	

CKT.	LOAD DESCRIPTION	WIRE SIZE			BREAKER		KVA			BREAKER			WIRE SIZE			LOAD DESCRIPTION	CKT.		
		# WIRE	GROUND	CONDUIT	TRIP	POLE	ΦA	ΦB	ΦC	ΦA	ΦB	ΦC	POLE	TRIP	# WIRE			GROUND	CONDUIT
1	ROOF REC @ CHILLERS**	2#10	#10G	3/4"	1	20A	0.18			0.00			2	50A	-	-	-	SPARE	2
3	UH-3, 1/25 HP	-	-	-	1	15A		0.53		0.00			-	-	-	-	-	-	4
5	UH-14, 15, 11	-	-	-	1	15A			0.58		0.00		2	15A	-	-	-	SPARE	6
7	SPARE	-	-	-	1	20A	0.00			0.00			-	-	-	-	-	-	8
9	BOILER CNTRLs	-	-	-	1	20A		0.80		-			-	-	-	-	-	SPACE	10
11	APU, AH-4	-	-	-	1	20A			1.00		0.70		1	15A	-	-	-	EF-5A, 1/4 HP	12
13	VFD, ATC AH-9	-	-	-	1	20A	0.50			-			-	-	-	-	-	SPACE	14
15	VFD, ATC AH-4	-	-	-	1	20A		0.50		-			-	-	-	-	-	SPACE	16
17	APU, AH-9	-	-	-	1	20A			1.00		-		-	-	-	-	-	SPACE	18
19	SPACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SPACE	20
21	SPACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SPACE	22
23	SPACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SPACE	24
						0.68		1.83	2.58	0.00	0.00	0.70					** BASE BID.		

CONDUIT TYPE:	PVC-40			
REC LOAD:	50%>10KVA	0.00	TOTAL CONNECTED LOAD	5.78
LIGHTING LOAD:	125%	0.00	DEMAND LOAD	0.00
MOTOR LOAD:	25% of Largest	0.00	TOTAL LOAD	5.78
HVAC LOAD:	100%**	0.00		16.06
TOTAL DEMAND:	0.00			



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VPS CHILLER REPLACEMENT

ELECTRICAL PANEL SCHEDULES

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REVISIONS:			
NO.	DATE	BY	DESCRIPTION

RELEASE FOR BID

DESIGNED BY: **RS**
 DRAWN BY: **RS**
 CHECKED BY: **OC**
 APPROVED BY: **SD**
 DATE: **DEC 2017**

AVCON PROJECT NO. **2017.050.11**
SHEET NUMBER
E-602

GENERAL

1. ALL STRUCTURAL WORK SHALL BE IN ACCORDANCE WITH THE MINIMUM STANDARDS OF THE FLORIDA BUILDING CODE 2010, REGULATIONS AS PER LOCAL JURISDICTION, AND SEALED AND SIGNED PROJECT CONTRACT DOCUMENTS AND LATEST ADDENDA. CONTRACT DOCUMENTS DO NOT INCLUDE SHOP DRAWINGS AND OTHER UNSEALED SUBMITTAL DOCUMENTS PREPARED AND SUBMITTED BY THE CONTRACTOR.

2. STRUCTURAL DRAWINGS SHALL BE USED IN CONJUNCTION WITH PROJECT SPECIFICATIONS AND ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING, AND SITE DRAWINGS. REFER TO THESE DRAWINGS FOR DIMENSIONS, EMBEDDED ITEMS, AND OTHER DETAILS NOT SHOWN ON STRUCTURAL DRAWINGS. THE GENERAL CONTRACTOR SHALL REVIEW AND COMPARE ALL DRAWINGS AND REPORT ANY DISCREPANCIES BETWEEN AND WITHIN EACH SET OF DRAWINGS TO THE ARCHITECT AND STRUCTURAL ENGINEER OF RECORD IN WRITING PRIOR TO SECURING MATERIALS, FABRICATING, OR PROCEEDING WITH THE INSTALLATION OF THE AFFECTED PART OF THE WORK. THE MORE STRINGENT REQUIREMENTS SHALL GOVERN UNLESS OTHERWISE STATED IN WRITING BY THE ARCHITECT AND STRUCTURAL ENGINEER OF RECORD.

3. DO NOT SCALE DRAWINGS. THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND FIELD CONDITIONS DURING THE CONSTRUCTION SUBMITTALS PHASE.

4. NO STRUCTURAL MEMBER SHALL BE CUT, NOTCHED, OR OTHERWISE ALTERED UNLESS APPROVED IN WRITING BY THE ENGINEER OF RECORD.

5. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER ITS CONSTRUCTION IS COMPLETE. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE AND THEY DO NOT INDICATE THE METHOD OR MEANS OF CONSTRUCTION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ALL MEANS AND METHODS TO ENSURE STABILITY AND SAFEKEEPING OF THE STRUCTURE AND ITS COMPONENTS DURING CONSTRUCTION AS PER ASCE 37 'DESIGN LOADS ON STRUCTURES DURING CONSTRUCTION'. THE ENGINEER DOES NOT HAVE CONTROL OR CHARGE OF, AND SHALL NOT BE RESPONSIBLE FOR, CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, OR PROCEDURES, FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK, FOR THE ACTS OR OMISSION OF THE CONTRACTOR, SUBCONTRACTOR OR ANY OTHER PERSONS PERFORMING ANY OF THE WORK, OR FOR THE FAILURE OF ANY OF THEM TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

6. DETAILS LABELED "TYPICAL DETAILS" ON THE DRAWINGS SHALL APPLY TO ALL SITUATIONS OCCURRING ON THE PROJECT THAT ARE THE SAME OR SIMILAR TO THOSE SPECIFICALLY DETAILED. THE APPLICABILITY OF THE DETAIL TO ITS LOCATION ON THE PLANS CAN BE DETERMINED BY THE TITLE OF DETAIL. SUCH DETAILS SHALL APPLY WHETHER OR NOT THEY ARE KEYED IN AT EACH LOCATION. QUESTIONS REGARDING APPLICABILITY OF TYPICAL DETAILS SHALL BE DETERMINED BY THE ENGINEER OF RECORD.

7. PERIODIC, LIMITED SITE OBSERVATION BY FIELD REPRESENTATIVES OF AVCON INC IS SOLELY FOR THE PURPOSE OF DETERMINING IF THE CONTRACTOR'S WORK IS PROCEEDING IN ACCORDANCE WITH THE STRUCTURAL CONTRACT DOCUMENTS. SITE OBSERVATIONS SHALL NOT BE CONSTRUED AS EXHAUSTIVE OR CONTINUOUS CHECK OF THE QUALITY OR QUANTITY OF THE WORK, BUT RATHER AS A PERIODIC SPOT CHECK OF READILY APPARENT DEFECTS OR DEFICIENCIES IN THE WORK. LIMITED SITE VISITS BY THE ENGINEER OF RECORD DOES NOT RELIEVE OR TAKE THE PLACE OF SCHEDULED TESTING AND INSPECTIONS BY AUTHORIZED AGENT OR INSPECTOR.

8. ALL STRUCTURES REQUIRED PERIODIC MAINTENANCE. A PLANNED MAINTENANCE PROGRAM SHALL BE ESTABLISHED BY THE OWNER AND SHALL INCLUDE ITEMS SUCH AS, BUT NOT LIMITED TO, PROTECTIVE COATINGS FOR STEEL AND SEALANTS FOR CRACKED CONCRETE SURFACES, SEALANTS WITHIN EXPANSIONS AND CONTROL JOINTS, AND GENERAL CLEANING OF EXPOSED STRUCTURAL ELEMENTS TO HARSH ENVIRONMENTS OR CHEMICALS.

9. THE USE OF REPRODUCTIONS OF THESE CONTRACT DOCUMENTS AND/OR USE OF CAD FILES BY ANY CONTRACTOR, SUBCONTRACTOR, ERECTOR, FABRICATOR OR MATERIAL SUPPLIER IN LIEU OF PREPARATION OF SHOP DRAWINGS SIGNIFY HIS ACCEPTANCE OF ALL INFORMATION SHOWN HEREIN AS CORRECT, AND OBLIGATES HIMSELF TO ANY JOB EXPENSE, REAL OR IMPLIED, ARISING DUE TO ANY ERRORS THAT MAY OCCUR.

10. THE CONTRACTOR SHALL PROTECT EXISTING FACILITIES, STRUCTURES, AND UTILITIES FROM DAMAGE. INFORMATION SHOWN RELATED TO EXISTING STRUCTURES WAS GATHERED FROM DRAWINGS PREPARED FOR DISNEY BY E.O. OLSON AND ASSOCIATES, DATED 9/9/91. THE STRUCTURAL PLANS ASSUMES THAT THE CONSTRUCTION OF EXISTING STRUCTURES WERE PERFORMED IN ACCORDANCE WITH THE PREVIOUSLY PREPARED DRAWINGS INCLUDING, BUT NOT LIMITED TO, DIMENSIONS, ELEVATIONS, MEMBER SIZES, MATERIALS, DETAILS, ETC. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR VERIFY THE CONDITIONS OF THE EXISTING CONDITIONS AND NOTIFY THE ENGINEER OF RECORD IN WRITING IMMEDIATELY.

11. WORK SHALL BE INSPECTED BY QUALIFIED INSPECTORS. FIELD INSPECTION REPORTS SHALL BE FILED WITH THE STRUCTURAL ENGINEER WITHIN 5 DAYS OF TIME OF ACTUAL INSPECTION.

12. SUBSTITUTIONS IN PRODUCTS, MATERIALS, EQUIPMENT, AND INSTRUCTIONS WITHIN THE CONTRACT DOCUMENTS FOR ANY REASON SHALL BE APPROVED BY THE ARCHITECT/ENGINEER PRIOR TO SECURING MATERIALS AND COMMENCING WITH INSTALLATION. THE CONTRACTOR SHALL SUBMIT REQUEST FOR SUBSTITUTION IN WRITING IMMEDIATELY UPON DISCOVERY OF NEED AND 15 DAYS PRIOR TO INITIAL LEAD TIME DATE. THE SIGNED AND DATED SUBSTITUTION REQUEST SHALL INCLUDE, BUT NOT LIMITED TO INCLUDE, IDENTIFIED MATERIAL OR INSTRUCTION WITH REFERENCE TO SPECIFICATIONS AND DRAWINGS, STATEMENT OF REASONS FOR SUBSTITUTIONS AND CHANGES TO CONTRACT COST AND SCHEDULE, MANUFACTURER'S TECHNICAL PRODUCT DATA SHEETS AND TEST REPORTS, STATEMENT OF COMPLIANCE WITH THE FLORIDA BUILDING CODE, AND STATEMENT OF COMPATIBILITY WITH OTHER PORTIONS OF WORK.

13. THE CONTRACTOR SHALL MAINTAIN AS-BUILT DRAWINGS AT THE SITE FOR THE OWNER CONSISTING OF ONE COLLECTIVE COPY OF ALL DRAWINGS, SPECIFICATIONS, ADDENDA, APPROVED SHOP OR SETTING DRAWINGS, CHANGE ORDERS AND OTHER MODIFICATIONS IN GOOD ORDER AND MARKED TO RECORD ALL CHANGES AS THEY OCCUR DURING CONSTRUCTION. THESE SHALL BE AVAILABLE TO THE ARCHITECT/ENGINEER, THE OWNER/OWNER AUTHORIZED REPRESENTATIVE, AND THE PROJECT INSPECTOR. THE DRAWINGS SHALL BE NEATLY AND CLEARLY MARKED IN COLOR DURING CONSTRUCTION TO RECORD ALL VARIATIONS MADE DURING CONSTRUCTION. THE REPRESENTATION OF SUCH VARIATIONS SHALL INCLUDE SUCH SUPPLEMENTARY NOTES, SYMBOLS, LEGENDS, AND DETAILS AS MAY BE NECESSARY TO CLEARLY SHOW THE AS-BUILT CONSTRUCTION. UPON COMPLETION OF THE WORK AND PRIOR TO THE FINAL INSPECTION, THE CONTRACTOR SHALL DELIVER TO THE ARCHITECT/ENGINEER, FOR PREPARATION OF THE RECORD DRAWINGS, ONE COMPLETE SET OF AS-BUILT DRAWINGS.

DESIGN LOADS

1. THE DESIGN AND WORK SHALL BE IN ACCORDANCE WITH THE 2017 FLORIDA BUILDING CODE.
2. THE FOLLOWING SUPERIMPOSED LOADS HAVE BEEN UTILIZED AS PER THE ASCE 7-10:

DEAD LOADS:

MECHANICAL ROOF TOP UNITS* 19,524 LBS (ACCH-1 AND ACCH-2)

* SEE PLAN FOR ADDITIONAL CONCENTRATED ROOF LOADS. CONTRACTOR TO FIELD VERIFY WEIGHT OF MECHANICAL UNITS SHOWN ABOVE AND REPORT DISCREPANCY IN WRITING TO ENGINEER OF RECORD PRIOR TO INSTALLATION.

WIND LOADS:

BASIC WIND SPEED (V) 150 MPH
 OCCUPANCY CATEGORY II
 EXPOSURE CATEGORY B
 GUST EFFECT FACTOR (G) 0.85
 WIND DIRECTIONALITY FACTOR (Kd) 0.85
 C&C WIND PRESSURE 50 PSF

SUBMITTALS

1. THE GENERAL CONTRACTOR SUBMITTALS FOR ENGINEER REVIEW ARE AS FOLLOWS:

STRUCTURAL STEEL

2. THE CONTRACT DOCUMENTS WILL GOVERN OVER THE SHOP DRAWINGS UNLESS OTHERWISE SPECIFIED IN WRITING BY THE ENGINEER.

3. SUBMITTALS SHALL CLEARLY IDENTIFY THE PROJECT NAME, SPECIFIC PRODUCT UTILIZED, APPLICABLE CODES, DESIGN CRITERIA, AND SHOW ALL DETAILS AND PLANS NECESSARY FOR PROPER FABRICATION AND INSTALLATION. HAND-WRITTEN COMMENTS AND/OR MARKINGS ON THE SUBMITTALS BY THE CONTRACTOR SHALL BE MADE USING A GREEN COLOR PEN AND THE ENGINEER/ARCHITECT SHALL UTILIZE A RED COLOR PEN.

4. SHOP DRAWINGS SHALL BE REVIEWED FOR FULL COORDINATION OF ALL CONSTRUCTION TRADES WITH THE LATEST DESIGN DISCIPLINES DOCUMENTS REVISIONS/CLARIFICATIONS AND RESPONSES TO RFIs AND MARKED BY THE GENERAL CONTRACTOR "APPROVED" PRIOR TO SUBMITTING TO THE OWNER/ARCHITECT/ENGINEER. CONTRACTOR-GENERATED QUESTIONS OR REQUEST FOR INFORMATION WITHIN THE SUBMITTALS SHALL BE CONSPICUOUSLY AND CLEARLY MARKED. CHANGES AND ADDITIONS MADE ON RE-SUBMITTALS SHALL BE CLEARLY FLAGGED AND NOTED. THE PURPOSE OF THE RE-SUBMITTALS SHALL BE CLEARLY NOTED ON THE LETTER OF TRANSMITTAL. ARCHITECT/ENGINEER REVIEW WILL BE LIMITED TO ONLY THOSE ITEMS CAUSING THE RE-SUBMITTAL. NON-CONFORMING DRAWINGS SUBMITTALS WILL BE RETURNED WITHOUT REVIEW.

5. SHOP DRAWINGS WILL BE REVIEWED FOR GENERAL COMPLIANCE WITH THE DESIGN INTENT OF THE CONTRACT DOCUMENTS AND PRODUCTS FUNCTIONAL EQUIVALENCE ONLY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY COMPLIANCE WITH THE CONTRACT DOCUMENTS AS TO QUANTITY, LENGTH, ELEVATIONS, DIMENSIONS, ETC.

STRUCTURAL STEEL

1. UNLESS OTHERWISE NOTED, STEEL SHAPES AND MATERIALS SHALL CONFORM TO THE FOLLOWING STANDARDS:

ANGLES, PLATES, AND ROUNDS ASTM A36
 WIDE FLANGE SHAPES ASTM A992, GRADE 50
 GALV HIGH-STRENGTH BOLTS ASTM A153

2. UNLESS OTHERWISE DETAILED HEREIN, THE FABRICATOR SHALL PREPARE AND SUBMIT DETAILED STRUCTURAL STEEL SHOP DRAWINGS IN ACCORDANCE WITH THE AISC MANUAL OF STEEL CONSTRUCTION LOAD AND RESISTANCE FACTOR DESIGN (13TH EDITION) FOR ENGINEER'S REVIEW.

3. SHOP AND ERECTION DRAWINGS, FABRICATION, AND ERECTION SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE AISC CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES AND OSHA STEEL ERECTION STANDARDS. SHOP FABRICATE AND ASSEMBLE STRUCTURAL STEEL TO THE GREATEST EXTENT POSSIBLE.

4. FIELD SPLICES, NOTCHES, CUTS, OPENINGS, OR OTHER FIELD MODIFICATIONS IN STEEL MEMBERS SHALL NOT BE PERMITTED WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER OF RECORD. THE USE OF A GAS-CUTTING TORCH IN THE FIELD FOR CUTTING HOLES OR FOR CORRECTING FABRICATION ERRORS WILL NOT BE PERMITTED ON NEW STRUCTURAL FRAMING MEMBERS EXCEPT WITH THE WRITTEN APPROVAL FOR EACH SPECIFIC CONDITION.

5. WELDS INDICATED IN THE DETAILS ARE MINIMUM DESIGN REQUIREMENTS AND SHALL BE MADE USING LOW HYDROGEN (SMAW) E70XX ELECTRODES MEETING THE REQUIREMENTS OF THE AWS CODES. WELDERS SHALL BE CERTIFIED FOR '6G' WELDS WITHIN ONE YEAR OF CONSTRUCTION NOTICE-TO-PROCEED DATE.

6. ERECTED STRUCTURAL STEEL SHALL BE INSPECTED BY QUALIFIED, INDEPENDENT INSPECTORS. FIELD INSPECTION REPORTS SHALL BE FILED WITH THE ENGINEER OF RECORD WITHIN 5 DAYS OF ACTUAL INSPECTION. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY ALL INSPECTORS OF ALL PHASES OF CONSTRUCTION AND WELDING. A RANDOMLY SELECTED 10% OF ALL COMPLETE-JOINT-PENETRATION WELDS AND WELDS WITHIN MOMENT CONNECTIONS SHALL BE INSPECTED AND TESTED BY LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING, RESPECTIVELY. ULTRASONIC OR RADIOGRAPHIC TESTING MAY BE REQUIRED FOR RETESTING OF DEFICIENT WELDS AT THE DISCRETION OF THE INSPECTOR.

7. ALL STRUCTURAL STEEL TO REMAIN PERMANENTLY IN CONDITIONED SPACES SHALL RECEIVE SHOP PRIMER AND PAINTED IN ACCORDANCE WITH SSPC STANDARDS. ALL STRUCTURAL STEEL TO REMAIN PERMANENTLY IN UNCONDITIONED SPACES OR PERMANENTLY EXPOSED TO WEATHER SHALL BE HOT-DIPPED GALVANIZED (ASTM A123) AND GALVANIZED CONNECTIONS OR EMBEDDED PLATES SHALL REQUIRE TEMPORARY PREPARATION FOR WELDS AND COATED USING COLD GALVANIZING COMPOUND.

REHABILITATION OF STEEL SURFACE FINISH

1. SURFACE PREPARATION SHALL INCLUDE CLEANING SURFACES FOUND TO HAVE SURFACE CORROSION BY REMOVING LOOSE RUST AND MILL SCALE AND SPATTER, SLAG, OR FLUX DEPOSITS. PREPARE SURFACES ACCORDING TO THE FOLLOWING SPECIFICATIONS AND STANDARDS:

1. SSPC-SP 2, "HAND TOOL CLEANING."
2. SSPC-SP 3, "POWER TOOL CLEANING."

2. PRIMING SURFACES IMMEDIATELY AFTER SURFACE PREPARATION, APPLY PRIMER ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS AND AT RATE RECOMMENDED BY SSPC TO PROVIDE A DRY FILM THICKNESS OF NOT LESS THAN 1.5 MILS (0.038 MM). USE PRIMING METHODS THAT RESULT IN FULL COVERAGE OF JOINTS, CORNERS, EDGES, AND EXPOSED SURFACES.

3. APPLY A 2-COAT, EPOXY POLYAMIDE PAINT COMPLYING WITH SSPC-PS GUIDE 7.00, "PAINTING SYSTEM GUIDE 7.00: GUIDE FOR SELECTING ONE-COAT SHOP PAINTING SYSTEMS," TO PROVIDE A DRY FILM THICKNESS OF NOT LESS THAN 3 MILS EACH. REFER TO WDWPR FOR COLOR SELECTION.



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DESTIN-FORT WALTON BEACH AIRPORT

VPS CHILLER REPLACEMENT

STRUCTURAL GENERAL NOTES

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REVISIONS:

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DESIGNED BY: LDV
 DRAWN BY: LDV
 CHECKED BY: RVB
 APPROVED BY: LDV
 DATE: DEC 2017

AVCON PROJECT NO. 2017.050.11

SHEET NUMBER

S-001

V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\S-S-001.DWG, 11/17/2018 12:06 PM



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STRUCTURAL DETAILS

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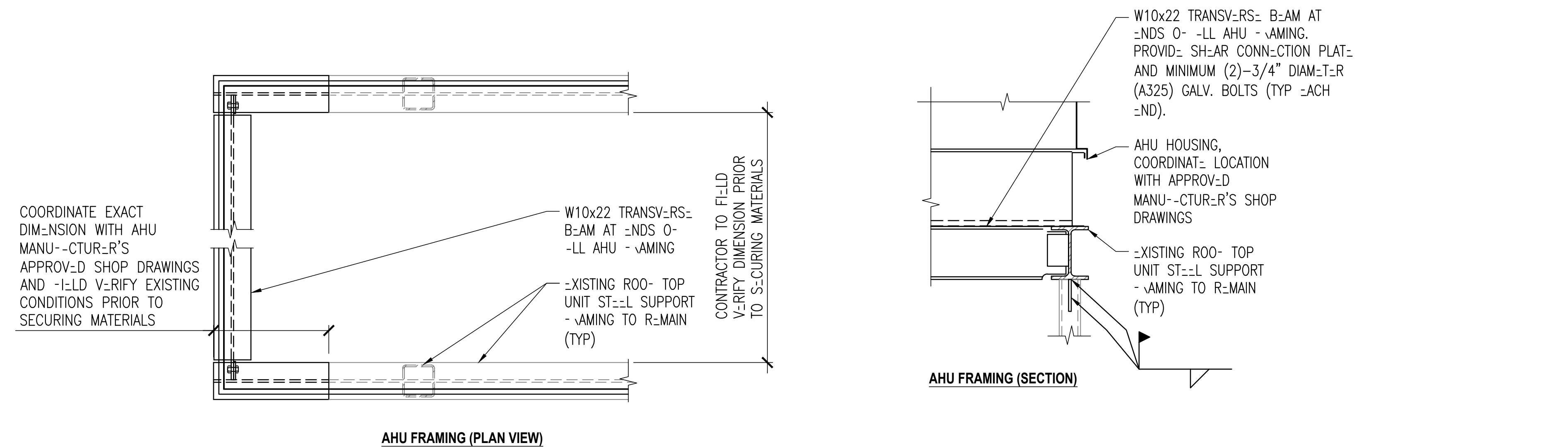
RELEASE FOR BID

DESIGNED BY: LDV
DRAWN BY: LDV
CHECKED BY: RVB
APPROVED BY: LDV
DATE: DEC 2017

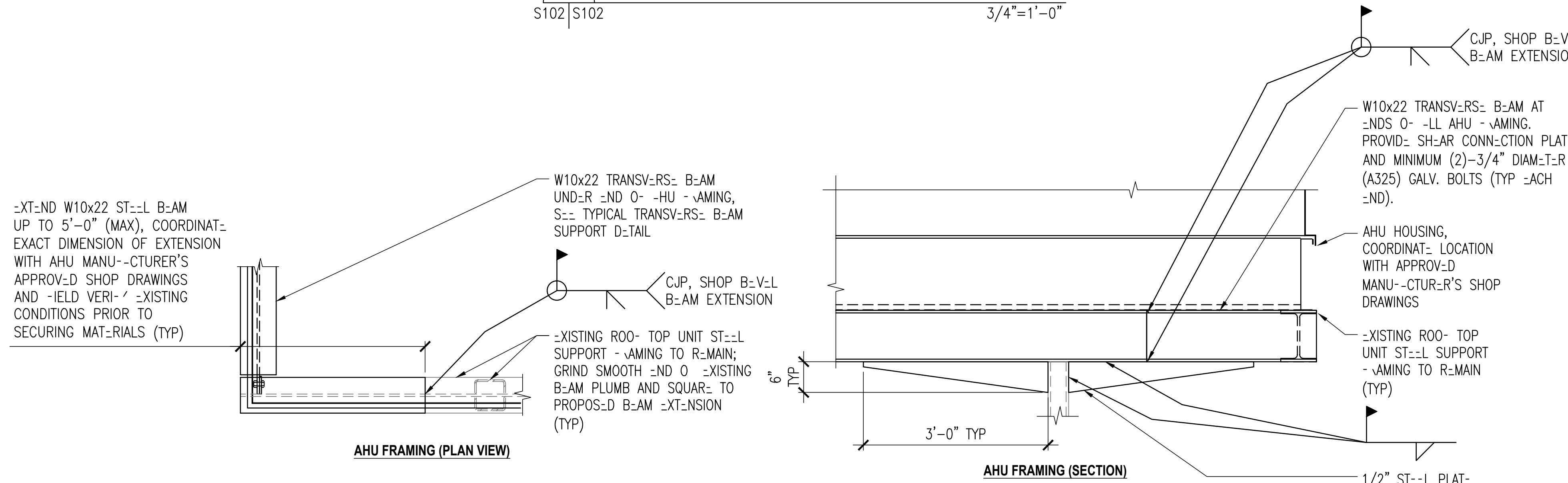
AVCON PROJECT NO. 2017.050.11

SHEET NUMBER

S-100



1 TYPICAL TRANSVERSE BEAM SUPPORT
S102 | S102 3/4"=1'-0"



NOT:
ADJUST AHU ONTO EXISTING AMING AND EXTEND ONLY ON SIDE OF THE AMING

2 TYPICAL EXTENSION OF BEAM SUPPORT
S102 | S102 3/4"=1'-0"

V:\2017\2017.050.11 - VPS CHILLER REPLACEMENT\CADD\SS-100.DWG 11/17/2018 12:06 PM