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END OF SECTION

BID FORM

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for thirty (30) days from the date of opening of bids (60 days for School Districts and Department of Education), and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid.

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

Should I/We be awarded this contract, I/We pledge to achieve substantial completion of all the work within 60 calendar days of the Notice to Proceed.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

(State of Corporation)

Business Address: _____

Witness: _____ **By:** _____
(SEAL) (Authorized Signature)

(Title)
Date: _____

ATTACHMENTS

- Sub-Contractor List
- Non-Collusion Statement
- Affidavit(s) of Employee Drug Testing Program
- Bid Security
- (Others as Required by Project Manuals)

BID FORM

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor **must be listed for each category** where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the *Owner*, it is **required** that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work. This form must be filled out completely with no additions or deletions.

<u>Subcontractor Category</u>	<u>Subcontractor</u>	<u>Address (City & State)</u>	<u>Subcontractors tax payer ID # or Delaware Business license #</u>
1. Mechanical	_____	_____	_____
2. Electrical	_____	_____	_____
3. Controls	_____	_____	_____
4. Roofing	_____	_____	_____
5. Masonry	_____	_____	_____

BID FORM
NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date to the Office of Management and Budget, Division of Facilities Management.

All the terms and conditions of OMB/DFM # MJ1002000041 have been thoroughly examined and are understood.

NAME OF BIDDER: _____

**AUTHORIZED REPRESENTATIVE
(TYPED):** _____

**AUTHORIZED REPRESENTATIVE
(SIGNATURE):** _____

TITLE: _____

ADDRESS OF BIDDER: _____

E-MAIL: _____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____ . NOTARY PUBLIC _____ .

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

**AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM**

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors implement a program of mandatory drug testing for Employees who work on Large Public Works Contracts funded all or in part with public funds.

We hereby certify that we have in place or will implement during the entire term of the contract a Mandatory Drug Testing Program for our employees on the jobsite, including subcontractors that complies with this regulation:

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

END OF SECTION

ALLOWANCE AUTHORIZATION

Project:

Architect:

Project No.

Contractor:

AAA No.:

Initiation Date:

The Allowance is allocated as follows:

Total original Contract Allowance was:	\$
Amount of Contract Allowance Access previously authorized:	\$
Adjusted Contract Allowance prior to this authorization is:	\$
The amount of available Allowance will Decrease by this Access Authorization:	\$
The remaining Contract Allowance, after this Access Authorization will be:	\$

**Recommended by:
Architect**

By (Signature): _____
Date: _____

**Accepted by:
Contractor**

By (Signature): _____
Date: _____

**Approved by:
Owner**

By (Signature): _____
Date: _____

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CLOSEOUT FORMS

The Contract Closeout Forms to be used for this Contract are listed below. Draft samples of the AIA forms indicated have been included for reference.

___	00 65 16	Certificate of Substantial Completion Form	(AIA G704-2017)
___	00 65 19.13	Affidavit of Payment of Debts and Claims Form	(AIA G706-1994)
___	00 65 19.16	Affidavit of Release of Liens Form	(AIA G706A-1994)
___	00 65 19.19	Consent of Surety to Final Payment Form	(AIA G707-1994)

END OF SECTION

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DRAFT AIA[®] Document G704[™] - 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*
testing

CONTRACT INFORMATION:
Contract For: General Construction
Date:

CERTIFICATE INFORMATION:
Certificate Number:
Date:

OWNER: *(name and address)*

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.

(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE OF SUBSTANTIAL COMPLETION

WARRANTIES

The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:

(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first.

The Contractor will complete or correct the Work on the list of items attached hereto within () days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:

(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

OWNER *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

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DRAFT AIA[®] Document G706[™] - 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*
testing

ARCHITECT'S PROJECT NUMBER:

TO OWNER: *(Name and address)*

CONTRACT FOR: General Construction
CONTRACT DATED:

OWNER:
ARCHITECT:
CONTRACTOR:
SURETY:
OTHER:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment Yes No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

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DRAFT AIA[®] Document G706A[™] - 1994

Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i> testing	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
	CONTRACT FOR: General Construction	ARCHITECT: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

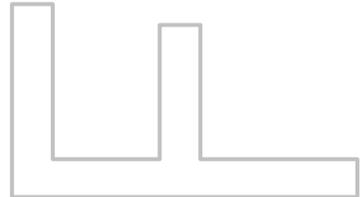
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DRAFT AIA[®] Document G707[™] - 1994

Consent Of Surety to Final Payment

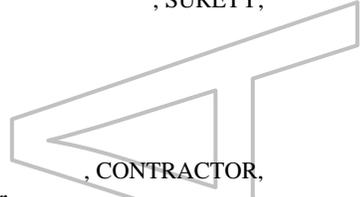
PROJECT: <i>(Name and address)</i> testing	ARCHITECT'S PROJECT NUMBER: CONTRACT FOR: General Construction	OWNER: <input type="checkbox"/> ARCHITECT: <input type="checkbox"/> CONTRACTOR: <input type="checkbox"/> SURETY: <input type="checkbox"/> OTHER: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)



, SURETY,

on bond of
(Insert name and address of Contractor)



, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)



, OWNER,

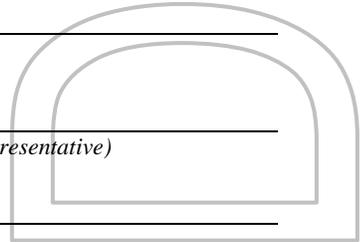
as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)



Attest:
(Seal):

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**SECTION 00 73 13
SUPPLEMENTARY GENERAL CONDITIONS A201-2017**

The following supplements modify the "General Conditions of the Contract for Construction," AIA Document A201-2017. Where a portion of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

TABLE OF ARTICLES

1. GENERAL PROVISIONS
2. OWNER
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11. INSURANCE AND BONDS
12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT

ARTICLE 1: GENERAL PROVISIONS

- 1.1 BASIC DEFINITIONS
- 1.1.1 THE CONTRACT DOCUMENTS

Strike the last sentence of Section 1.1.1 in its entirety and replace with the following:

"The Contract Documents also include Advertisement for Bid, Instructions to Bidder, sample forms, the Bid Form, the Contractor's completed Bid and the Award Letter."

Add the following Section:

"1.1.1.1 In the event of conflict or discrepancies among the Contract Documents, the Documents prepared by the State of Delaware, Division of Facilities Management shall take precedence over all other documents."

1.1.8 INITIAL DECISION MAKER

Strike the last sentence of Section 1.1.8 in its entirety and add the following to the end of the remaining sentence:

" and certify termination of the Agreement under Section 14.2.2."

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1.1 Insert "if possible" at the end of the second sentence.

Add the following Sections:

"1.2.4 In the case of an inconsistency between the Drawings and the Specifications, or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect's interpretation."

"1.2.5 The word "PROVIDE" as used in the Contract Documents shall mean "FURNISH AND INSTALL" and shall include, without limitation, all labor, materials, equipment, transportation, services and other items required to complete the Work."

"1.2.6 The word "PRODUCT" as used in the Contract Documents means all materials, systems and equipment."

1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

Strike Section 1.5.1 in its entirety and replace with the following:

"All pre-design studies, drawings, specifications and other documents, including those in electronic form, prepared by the Architect under this Agreement are, and shall remain, the property of the Owner whether the Project for which they are made is executed or not. Such documents may be used by the Owner to construct one or more like Projects without the approval of, or additional compensation to, the Architect. The Contractor, Subcontractors, Sub-subcontractors, and Material or Equipment Suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or Material and Equipment Supplier on other Projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and Architect's consultants.

The Architect shall not be liable for injury or damage resulting from the re-use of drawings and specifications if the Architect is not involved in the re-use Project. Prior to re-use of construction documents for a Project in which the Architect is not also involved, the Owner will remove from such documents all identification of the original Architect, including name, address and professional seal or stamp."

Strike Section 1.5.2 in its entirety.

1.7 DIGITAL DATA USE AND TRANSMISSION

Strike Section 1.7 in its entirety and replace with the following:

“The parties shall agree upon protocols governing transmission and use of Instruments of Service or any other information or documentation in digital form.”

1.8 BUILDING INFORMATION MODELS USE AND RELIANCE

Strike Section 1.8 in its entirety.

ARTICLE 2: OWNER

2.2 EVIDENCE OF THE OWNERS FINANCIAL ARRANGEMENTS

Strike Section 2.2 in its entirety.

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.3.3 Strike 2.3.3 in its entirety.

2.3.4 Add the following sentence at the end of the paragraph:

“The Contractor, at their expense shall bear the costs to accurately identify the location of all underground utilities in the area of their excavation and shall bear all cost for any repairs required, out of failure to accurately identify said utilities.”

Strike Section 2.3.6 in its entirety and replace with the following:

“2.3.6 The Contractor shall be furnished free of charge (1) electronic set of the Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage and handling.”

2.5 OWNER'S RIGHT TO CARRY OUT THE WORK

Add “, except as outlined in Section 3.15” after the reference to “Article 15” at the end of the last sentence of the Section.

ARTICLE 3: CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.2 Add “and Owner” after “report to the Architect” in the second sentence.

3.2.4 Strike “subject to Section 15.1.7” in the second sentence.

3.2.4 Strike the third sentence.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add the following Sections:

"3.3.2.1 The Contractor shall immediately remove from the Work, whenever requested to do so by the Owner, any person who is considered by the Owner or Architect to be incompetent or disposed to be so disorderly, or who for any reason is not satisfactory to the Owner, and that person shall not again be employed on the Work without the consent of the Owner or the Architect."

"3.3.4 The Contractor must provide suitable storage facilities at the Site for the proper protection and safe storage of their materials, or as otherwise identified by the specifications. Consult the Owner and the Architect before storing any materials."

"3.3.5 When any room is used as a shop, storeroom, office, etc., by the Contractor or Subcontractor(s) during the construction of the Work, the Contractor making use of these areas will be held responsible for any repairs, patching or cleaning arising from such use."

3.4 LABOR AND MATERIALS

Add the Following Sections:

"3.4.4 Before starting the Work, each Contractor shall carefully examine all preparatory Work that has been executed to receive their Work. Check carefully, by whatever means are required, to insure that its Work and adjacent, related Work, will finish to proper contours, planes and levels. Promptly notify the Architect & Owner of any defects or imperfections in preparatory Work which will in any way affect satisfactory completion of its Work. Absence of such notification will be construed as an acceptance of preparatory Work and later claims of defects will not be recognized."

"3.4.5 Under no circumstances shall the Contractor's Work proceed prior to preparatory Work having been completely cured, dried and/or otherwise made satisfactory to receive this Work. Responsibility for timely installation of all materials rests solely with the Contractor responsible for that Work, who shall maintain coordination at all times."

3.5 WARRANTY

Add the following Sections:

"3.5.3 The Contractor will guarantee all materials and workmanship against original defects, except injury from proper and usual wear when used for the purpose intended, for two years after Acceptance by the Owner, and will maintain all items in perfect condition during the period of warranty."

"3.5.4 Defects appearing during the period of warranty will be made good by the Contractor at his expense upon demand of the Owner, it being required that all work will be in perfect condition when the period of warranty will have elapsed."

"3.5.5 Upon notification by the Owner of a defect covered by the Contractor's warranty, the Contractor shall respond within 4 hours of the notification."

"3.5.6 In addition to the General Warranty there are other warranties required for certain items for different periods of time than the two years as above, and are particularly so

stated in that part of the specifications referring to same. The said warranties will commence at the same time as the General Warranty.”

“3.5.7 If the Contractor fails to remedy any failure, defect or damage within a reasonable time after receipt of notice, the Owner will have the right to replace, repair, or otherwise remedy the failure, defect or damage at the Contractor’s expense.”

3.8 ALLOWANCES

Add the following Section:

“3.8.1.1 For costs to be covered under a project allowance, (included in the schedule of values) the Contractor shall submit a summary of those costs anticipated and an Allowance Access Authorization Form to the Architect and Owner, reflecting the projected costs. The Allowance Access Authorization Form must be signed by the Owner prior to initiating any work associated with the allowance.”

3.10 CONTRACTOR’S CONSTRUCTION AND SUBMITTAL SCHEDULES

3.10.1 Add “estimated” after “and the” and before “date of” in the second sentence.

3.10.2 Strike “and thereafter as necessary to maintain a current submittal schedule” in the first sentence.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following Sections:

“3.11.1 During the course of the Work, the Contractor shall maintain a record set of drawings on which the Contractor shall mark the actual physical location of all piping, valves, equipment, conduit, outlets, access panels, controls, actuators, including all appurtenances that will be concealed once construction is complete, etc., including all invert elevations.”

“3.11.2 At the completion of the project, the Contractor shall obtain a set of the conformed contract drawings from the Architect, and neatly transfer all information outlined in 3.11.1 to provide a complete record of the as-built conditions.”

“3.11.3 Upon completion of the work noted in 3.11.2 the contractor shall schedule a meeting with the Architect/Engineer and Owner to review the final record drawings and closeout documents prior to submission. After this meeting the Contractor shall make adjustments per the review, and submit one (1) original markup and (2) copies of the red line drawings (as-built conditions, to the Owner and one (1) print to the Architect. In addition, attach one complete set of the as-built documents to each of the Operating and Maintenance Instructions/Manuals. The Contractor will include (2) USB drives, each containing all “red line drawings (as-built) and Closeout Documents properly tabbed in accordance with closeout requirements as defined elsewhere in the contract documents.”

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.10.2 Strike “If the Contract Documents require” from the beginning of the sentence.

3.12.10.2 Strike “to” between “professional” and certify” and replace with “shall”.

3.17 Insert “indemnify and” between “shall” and “hold” in the second sentence.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.2 ADMINISTRATION OF THE CONTRACT

4.2.7 Strike the first sentence and replace with the following:

“The Architect will review and approve or take other appropriate action upon the Contractor’s submittals such as Shop Drawings, Product Data and Samples for the purpose of checking for conformance with the Contract Documents.”

4.2.7 Strike the second sentence and replace with the following:

“The Architect’s action will be taken with such reasonable promptness as to cause no delay in the Work in the activities of the Owner, Contractor or separate Contractors, while allowing sufficient time in the Owner’s professional judgment to permit adequate review.”

Add the following Section:

“4.2.10.1 There will be no full-time Project Representative provided by the Owner or Architect on this project.”

“4.2.13 Add “and in compliance with all local requirements.” to the end of the sentence.”

ARTICLE 5: SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.3 Strike Section 5.2.3 in its entirety and replace with the following:

“If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection, subject to the statutory requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4.”

5.2.4 Strike Section 5.2.4 in its entirety and replace with the following:

“The Contractor may not substitute any Subcontractor listed in its Bid unless the Contractor complies with the requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4. Failure to comply with this requirement shall subject the Contractor to a penalty as outlined in Section 5.2 of the Owner’s General Requirements.”

Add the following Section:

“5.2.5 The Contractor shall comply and shall ensure all Subcontractors comply with all requirements for drug testing as set forth in TITLE 19 LABOR DELAWARE ADMINISTRATIVE CODE 4000 Office of Management and Budget 4100 Division of Facilities Management **4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects.**”

ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

- 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS
 - 6.1.1 Strike "and waiver of subrogation" from the end of the second sentence.
 - 6.1.4 Strike Section 6.1.4 in its entirety.
- 6.2 MUTUAL RESPONSIBILITY
 - 6.2.3 Strike "shall" and replace with "may" in the second sentence.

ARTICLE 7: CHANGES IN THE WORK

(SEE ARTICLE 7: CHANGES IN WORK IN THE STATE OF DELAWARE DIVISION OF FACILITIES MANAGEMENT GENERAL REQUIREMENTS)

- 7.3.4.1 Strike "and other employee costs approved by the Architect" after "worker's compensation insurance,"
- 7.3.4.4 Add "work attributable to the" before "change" at the end of the sentence.
- 7.4 MINOR CHANGES IN WORK
 - Add "unless such changes are approved" at the end of the third sentence.

ARTICLE 8: TIME

- 8.2 PROGRESS AND COMPLETION
 - 8.2.1 Add the following Section:
 - "8.2.1.1 Refer to Project Specifications Section SUMMARY OF WORK for Contract time requirements."
 - 8.2.2 After "by the Contractor" strike "and" and insert "to".
 - 8.2.4 Add the following Section:
 - "8.2.4 If the Work falls behind the Progress Schedule as submitted by the Contractor, the Contractor shall employ additional labor and/or equipment necessary to bring the Work into compliance with the Progress Schedule at no additional cost to the Owner."
- 8.3 DELAYS AND EXTENSION OF TIME
 - 8.3.1 Strike "binding dispute resolution" and insert "any and all remedies at law or in equity".
 - Add the following Section:
 - "8.3.2.1 The Contractor shall update the status of the suspension, delay, or interruption of the Work with each Application for Payment. (The Contractor shall report the termination of such cause immediately upon the termination thereof.) Failure to

comply with this procedure shall constitute a waiver for any claim for adjustment of time or price based upon said cause.”

Strike Section 8.3.3 in its entirety and replace with the following:

8.3.3 “Except in the case of a suspension of the Work directed by the Owner, an extension of time under the provisions of Section 8.3.1 shall be the Contractor’s sole remedy in the progress of the Work and there shall be no payment or compensation to the Contractor for any expense or damage resulting from the delay.”

Add the following Section:

“8.3.4 By permitting the Contractor to work after the expired time for completion of the project, the Owner does not waive their rights under the Contract.”

ARTICLE 9: PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following Sections:

“9.2.1 The Schedule of Values shall be submitted using AIA Document G703, Continuation Sheet to G702.”

“9.2.2 The Schedule of Values is to include a line item for Project Closeout Document Submittal. The value of this item is to be no less than 1.5% of the initial contract amount.”

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Strike Section 9.3.1 in its entirety and replace with the following:

“At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values for completed portions of the Work. The application shall be notarized, and supported by all data substantiating the Contractor’s right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage.”

Add the following Sections:

“9.3.1.3 Application for Payment shall be submitted on AIA Document G702 “Application and Certificate for Payment”, supported by AIA Document G703 “Continuation Sheet”. Said Applications shall be fully executed and notarized.”

“9.3.4 Until Closeout Documents have been received and outstanding items completed the Owner will pay 95% (ninety-five percent) of the amount due the Contractor on account of progress payments.”

“9.3.5 The Contractor shall provide a current and updated Progress Schedule to the Architect with each Application for Payment. Failure to provide Schedule will be just cause for rejection of Application for Payment.”

9.5 DECISIONS TO WITHHOLD CERTIFICATION

Add the following Subsections to 9.5.1:

- .8 failure to provide a current Progress Schedule;
- .9 a lien or attachment is filed;
- .10 failure to comply with mandatory requirements for maintaining Record Documents.

9.6 PROGRESS PAYMENTS

9.6.1 Strike Section 9.6.1 in its entirety and replace with the following:

“9.6.1 After the Architect has approved and issued a Certificate for Payment, payment shall be made by the Owner within 30 days after Owner’s receipt of the Certificate for Payment.”

9.6.8 Strike “Provided the Owner has fulfilled its payment obligations under the Contract Documents,” in the first sentence.

9.7 FAILURE OF PAYMENT

Strike Section 9.7 in its entirety and replace with the following:

“If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within fourteen days after receipt of the Contractor’s Application for Payment, or if the Owner does not pay the Contractor within thirty days after the date established in the Contract Documents, the amount certified by the Architect, then the Contractor may, upon thirty additional days’ notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.”

9.8 SUBSTANTIAL COMPLETION

9.8.3 At the end of Section 9.8.3, add the following sentence:

“If the Architect is required to make more than 2 inspections of the same portion of work, the Contractor shall be responsible for all costs associated with subsequent inspections including but not limited to any Architect’s fees.”

9.8.5 Strike “shall” and insert “may” in the second sentence.

9.8.5 Insert “1/2 of the” after “make payment of” in the second sentence.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 Strike the the first sentence and replace with the following (the remainder of the Section remains as written):

“The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use authorized by public authorities having jurisdiction over the Project.”

9.10.2 Strike “to remain in force after final payment is currently in effect” after “required by the Contract Documents” and replace with “shall remain in force until final payment is completed” in the first sentence.

9.10.4.4 Strike “if permitted by the Contract Documents,”

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

Add the following Sections:

10.1.1 Each Contractor shall develop a safety program in accordance with the Occupational Safety and Health Act of 1970. A copy of said plan shall be furnished to the Owner and Architect prior to the commencement of that Contractor's Work.

10.1.2 Each Contractor shall appoint a Safety Representative. Safety Representatives shall be someone who is on site on a full time basis. If deemed necessary by the Owner or Architect, Contractor Safety meetings will be scheduled. The attendance of all Safety Representatives will be required. Minutes will be recorded of said meetings by the Contractor and will be distributed to all parties as well as posted in all job offices/trailers etc.

10.2 SAFETY OF PERSONS AND PROPERTY

Add the following Section:

10.2.4.1 As required in the Hazardous Chemical Act of June 1984, all vendors supplying any material that may be defined as hazardous must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a caution warning on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in foreseeable emergency situations. Material Safety Data Sheets shall be provided directly to the Owner, along with the shipping slips that include those products.

10.2.5 Strike the second sentence in its entirety.

10.3 HAZARDOUS MATERIALS AND SUBSTANCES

10.3.3 Strike Section 10.3.3 in its entirety.

10.3.4 Insert “hazardous” in the last sentence after “handling of such” .

10.3.6 Strike Section 10.3.6 in its entirety.

ARTICLE 11: INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE AND BONDS

11.1.1 Strike “Owner” from the the third sentence .

11.2 OWNER'S LIABILITY INSURANCE

Strike 11.2 in its entirety, except that in the case of school projects in which case Section 11.2 shall remain.

11.3 WAIVERS OF SUBROGATION

Delete Section 11.3 in its entirety

11.4 LOSS OF USE, BUSINESS INTERRUPTION, AND DELAY IN COMPLETION
INSURANCE

Delete Section 11.4 in its entirety

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.2.2 AFTER SUBSTANTIAL COMPLETION

Add the following Section:

“12.2.2.1.1 At any time during the progress of the Work, or in any case where the nature of the defects will be such that it is not expedient to have corrected, the Owner, at its option, will have the right to deduct such sum, or sums, of money from the amount of the Contract as it considers justified to adjust the difference in value between the non-conforming work and that required under contract including any damage to the structure.”

12.2.2.1 Strike all references to “one year” or “one-year” and replace with “two years”.

12.2.2.2 Strike “one-year” and replace with “two years”.

12.2.2.3 Strike “one-year” and replace with “two years”.

12.2.5 Strike “one-year” and replaced with “two years”.

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Strike the last sentence.

13.4 TESTS AND INSPECTIONS

13.4.1 Strike the last sentence and replace with the following:

“The Owner shall pay for tests, inspections, or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.”

13.5 INTEREST

Strike “the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located” and replace with “30 days of presentment of the authorized Certificate of Payment at the annual rate of 12% or 1% per month.”

Insert the following Section:

“13.6 CONFLICTS WITH FEDERAL STATUTES OR REGULATIONS

13.6.1 If any provision, specifications or requirement of the Contract Documents conflict or is inconsistent with any statute, law or regulation of the government of the United State of America, the Contractor shall notify the Architect and Owner immediately upon discovery.”

ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1.4 Insert “, upon the Contractors’ request,” after “furnish to the Contractor” .

14.1.3 Strike “and profit on Work not executed, and” after “as well as reasonable overhead” and replace with “, profit, and reasonable”

14.3 SUSPENSION BY OWNER FOR CONVENIENCE

14.3.2 Strike “Adjustment of the Contract Sum shall include profit”.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.3 Strike Section 14.4.3 in its entirety and replace with the following:

“In case of such termination for the Owner’s convenience, the Contractor shall be entitled to receive payment for Work executed, and reasonable costs incurred by reason of such termination along with reasonable overhead.”

ARTICLE 15: CLAIMS AND DISPUTES

15.1 CLAIMS

15.1.2 TIME LIMITS ON CLAIMS

Strike the last sentence.

15.1.3 NOTICE OF CLAIM

Strike all references to “21” and replace with “45”.

15.1.5 CLAIMS FOR ADDITIONAL COSTS

Strike the first sentence and replace with the following:

“Contractor shall not proceed to execute any portion of the Work that is subject to the Claim without prior approval of the costs or method of payment for the costs associated with the Claim as determined by the Architect and approved by the Owner.”

15.1.7 WAIVER OF CLAIMS FOR CONSEQUENTIAL DAMAGES

Strike Section 15.1.7 in its entirety.

15.2 INITIAL DECISION

15.2.1 Strike "and binding dispute resolution" in the fourth sentence and replace with "or any and all remedies at law or in equity".

15.2.5 Strike Section 15.2.5 in its entirety and replace with the following:

"The Architect will approve or reject Claims by written decision, which shall state the reasons therefore and shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be subject to mediation and any or all remedies at law or in equity."

15.2.6 Strike Section 15.2.6 and its subSections in their entirety.

15.3 MEDIATION

15.3.1 Strike "binding dispute resolution" and replace with "any or all remedies at law or in equity".

15.3.2 Strike ", shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedure in effect on the date of the Agreement," in the first sentence.

15.3.2 Strike all references to "binding dispute resolution" and replace with "any or all remedies at law and in equity".

15.3.3 Strike Section 15.3.3 in its entirety.

15.4 ARBITRATION

Strike Section 15.4 and its Subsections in their entirety.

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**SECTION 00 81 13
GENERAL REQUIREMENTS**

TABLE OF ARTICLES

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12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT

ARTICLE 1: GENERAL

1.1 CONTRACT DOCUMENTS

1.1.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to an extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

1.1.2 Work including material purchases shall not begin until the Contractor is in receipt of a bonafide State of Delaware Purchase Order. Any work performed or material purchases prior to the issuance of the Purchase Order is done at the Contractor's own risk and cost.

1.2 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

1.2.1 For Public Works Projects financed in whole or in part by state appropriation the Contractor agrees that during the performance of this contract:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, sex, color, sexual orientation, gender identity or national origin. The Contractor will take positive steps to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, sex, color, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.
2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

ARTICLE 2: OWNER

(NO ADDITIONAL GENERAL REQUIREMENTS – SEE SUPPLEMENTARY GENERAL CONDITIONS)

ARTICLE 3: CONTRACTOR

- 3.1 Schedule of Values: The successful Bidder shall within twenty (20) days after receiving notice to proceed with the work, furnish to the Owner a complete schedule of values on the various items comprising the work.
- 3.2 Subcontracts: Upon approval of Subcontractors, the Contractor shall award their Subcontracts as soon as possible after the signing of their own contract and see that all material, their own and those of their Subcontractors, are promptly ordered so that the work will not be delayed by failure of materials to arrive on time.
- 3.3 Before commencing any work or construction, the General Contractor is to consult with the Owner as to matters in connection with access to the site and the allocation of Ground Areas for the various features of hauling, storage, etc.
- 3.4 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions.
- 3.5 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.
- 3.6 The Contractor warrants to the Owner that materials and equipment furnished will be new and of good quality, unless otherwise permitted, and that the work will be free from defects and in conformance with the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved, may be considered defective. If required by the Owner, the Contractor shall furnish evidence as to the kind and quality of materials and equipment provided.

- 3.7 Unless otherwise provided, the Contractor shall pay all sales, consumer, use and other similar taxes, and shall secure and pay for required permits, fees, licenses, and inspections necessary for proper execution of the Work.
- 3.8 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on performance of the Work. The Contractor shall promptly notify the Owner if the Drawings and Specifications are observed to be at variance therewith.
- 3.9 The Contractor shall be responsible to the Owner for the acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under contract with the Contractor.
- 3.10 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project all waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials. The Contractor shall be responsible for returning all damaged areas to their original conditions.
- 3.11 STATE LICENSE AND TAX REQUIREMENTS
- 3.11.1 Each Contractor and Subcontractor shall be licensed to do business in the State of Delaware and shall pay all fees and taxes due under State laws. In conformance with Section 2503, Chapter 25, Title 30, Delaware Code, "the Contractor shall furnish the Delaware Department of Finance within ten (10) days after entering into any contract with a contractor or subcontractor not a resident of this State, a statement of total value of such contract or contracts together with the names and addresses of the contracting parties."
- 3.12 The Contractor shall comply with all requirements set forth in Section 6962, Chapter 69, Title 29 of the Delaware Code.
- 3.13 During the contract Work, the Contractor and each Subcontractor, shall implement an Employee Drug Testing Program in accordance with OMB Regulation 4104 - "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on "Large Public Works Projects". "Large Public Works" is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

- 4.1 CONTRACT SURETY
- 4.1.1 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND
- 4.1.2 All bonds will be required as follows unless specifically waived elsewhere in the Bidding Documents.
- 4.1.3 Contents of Performance Bonds – The bond shall be in the form approved by the Office of Management and Budget. The bond shall be conditioned upon the faithful compliance and performance by the successful bidder of each and every term and condition of the contract and the proposal, plans, specifications, and bid documents thereof. Each term and condition shall be met at the time and in the manner prescribed by the Contract, Bid documents and the specifications, including the payment in full to every person furnishing

materiel or performing labor in the performance of the Contract, of all sums of money due the person for such labor and materiel. (The bond shall also contain the successful bidder's guarantee to indemnify and save harmless the State and the agency from all costs, damages and expenses growing out of or by reason of the Contract in accordance with the Contract.)

4.1.4 Invoking a Performance Bond – The agency may, when it considers that the interest of the State so requires, cause judgement to be confessed upon the bond.

4.1.5 Within twenty (20) days after the date of notice of award of contract, the Bidder to whom the award is made shall furnish a Performance Bond and Labor and Material Payment Bond, each equal to the full amount of the Contract price to guarantee the faithful performance of all terms, covenants and conditions of the same. The bonds are to be issued by an acceptable Bonding Company licensed to do business in the State of Delaware and shall be issued in duplicate.

4.1.6 Performance and Payment Bonds shall be maintained in full force (warranty bond) for a period of two (2) years after the date of the Certificate for Final Payment. The Performance Bond shall guarantee the satisfactory completion of the Project and that the Contractor will make good any faults or defects in his work which may develop during the period of said guarantees as a result of improper or defective workmanship, material or apparatus, whether furnished by themselves or their Sub-Contractors. The Payment Bond shall guarantee that the Contractor shall pay in full all persons, firms or corporations who furnish labor or material or both labor and material for, or on account of, the work included herein. The bonds shall be paid for by this Contractor. The Owner shall have the right to demand that the proof parties signing the bonds are duly authorized to do so.

4.2 FAILURE TO COMPLY WITH CONTRACT

4.2.1 If any firm entering into a contract with the State, or Agency that neglects or refuses to perform or fails to comply with the terms thereof, the Agency which signed the Contract may terminate the Contract and proceed to award a new contract in accordance with this Chapter 69, Title 29 of the Delaware Code or may require the Surety on the Performance Bond to complete the Contract in accordance with the terms of the Performance Bond. Nothing herein shall preclude the Agency from pursuing additional remedies as otherwise provided by law.

4.3 CONTRACT INSURANCE AND CONTRACT LIABILITY

4.3.1 In addition to the bond requirements stated in the Bid Documents, each successful Bidder shall purchase adequate insurance for the performance of the Contract and, by submission of a Bid, agrees to indemnify and save harmless and to defend all legal or equitable actions brought against the State, any Agency, officer and/or employee of the State, for and from all claims of liability which is or may be the result of the successful Bidder's actions during the performance of the Contract.

4.3.2 The purchase or nonpurchase of such insurance or the involvement of the successful Bidder in any legal or equitable defense of any action brought against the successful Bidder based upon work performed pursuant to the Contract will not waive any defense which the State, its agencies and their respective officers, employees and agents might otherwise have against such claims, specifically including the defense of sovereign immunity, where applicable, and by the terms of this section, the State and all agencies, officers and employees thereof shall not be financially responsible for the consequences of work performed, pursuant to said contract.

4.4 RIGHT TO AUDIT RECORDS

4.4.1 The Owner shall have the right to audit the books and records of a Contractor or any Subcontractor under any Contract or Subcontract to the extent that the books and records relate to the performance of the Contract or Subcontract.

4.4.2 Said books and records shall be maintained by the Contractor for a period of seven (7) years from the date of final payment under the Prime Contract and by the Subcontractor for a period of seven (7) years from the date of final payment under the Subcontract.

ARTICLE 5: SUBCONTRACTORS

5.1 SUBCONTRACTING REQUIREMENTS

5.1.1 All contracts for the construction, reconstruction, alteration or repair of any public building (not a road, street or highway) shall be subject to the following provisions:

1. A contract shall be awarded only to a Bidder whose Bid is accompanied by a statement containing, for each Subcontractor category, the name and address (city or town and State only – street number and P.O. Box addresses not required) of the subcontractor whose services the Bidder intends to use in performing the Work and providing the material for such Subcontractor category.
2. A Bid will not be accepted nor will an award of any Contract be made to any Bidder which, as the Prime Contractor, has listed itself as the Subcontractor for any Subcontractor unless:
 - A. It has been established to the satisfaction of the awarding Agency that the Bidder has customarily performed the specialty work of such Subcontractor category by artisans regularly employed by the Bidder's firm;
 - B. That the Bidder is duly licensed by the State to engage in such specialty work, if the State requires licenses; and
 - C. That the Bidder is recognized in the industry as a bona fide Subcontractor or Contractor in such specialty work and Subcontractor category.

5.1.2 The decision of the awarding Agency as to whether a Bidder who list itself as the Subcontractor for a Subcontractor category shall be final and binding upon all Bidders, and no action of any nature shall lie against any awarding agency or its employees or officers because of its decision in this regard.

5.1.3 After such a Contract has been awarded, the successful Bidder shall not substitute another Subcontractor for any Subcontractor whose name was set forth in the statement which accompanied the Bid without the written consent of the awarding Agency.

5.1.4 No Agency shall consent to any substitution of Subcontractors unless the Agency is satisfied that the Subcontractor whose name is on the Bidders accompanying statement:

- A. Is unqualified to perform the work required;
- B. Has failed to execute a timely reasonable Subcontract;

- C. Has defaulted in the performance on the portion of the work covered by the Subcontract; or
- D. Is no longer engaged in such business.

5.1.5 Should a Bidder be awarded a contract, such successful Bidder shall provide to the agency the taxpayer identification license numbers of such subcontractors. Such numbers shall be provided on the later of the date on which such subcontractor is required to be identified or the time the contract is executed. The successful Bidder shall provide to the agency to which it is contracting, within 30 days of entering into such public works contract, copies of all Delaware Business licenses of subcontractors and/or independent contractors that will perform work for such public works contract. However, if a subcontractor or independent contractor is hired or contracted more than 20 days after the Bidder entered the public works contract the Delaware Business license of such subcontractor or independent contractor shall be provided to the agency within 10 days of being contracted or hired.

5.1.6 The Contractor may employ additional Subcontractors on the jobsite only after submitting a copy of the Subcontractor's Employee Drug Testing Program to the Owner for approval. A Contractor or Subcontractor shall not commence work until the Owner has concluded its review and determined that the submitted Employee Drug Testing Program complies with OMB Regulation 4104.

5.2 PENALTY FOR SUBSTITUTION OF SUBCONTRACTORS

5.2.1 Should the Contractor fail to utilize any or all of the Subcontractors in the Contractor's Bid statement in the performance of the Work on the public bidding, the Contractor shall be penalized in the amount of (project specific amount*). The Agency may determine to deduct payments of the penalty from the Contractor or have the amount paid directly to the Agency. Any penalty amount assessed against the Contractor may be remitted or refunded, in whole or in part, by the Agency awarding the Contract, only if it is established to the satisfaction of the Agency that the Subcontractor in question has defaulted or is no longer engaged in such business. No claim for the remission or refund of any penalty shall be granted unless an application is filed within one year after the liability of the successful Bidder accrues. All penalty amounts assessed and not refunded or remitted to the contractor shall be reverted to the State.

*one (1) percent of contract amount not to exceed \$10,000

5.3 ASBESTOS ABATEMENT

5.3.1 The selection of any Contractor to perform asbestos abatement for State-funded projects shall be approved by the Office of Management and Budget, Division of Facilities Management pursuant to Chapter 78 of Title 16.

5.4 STANDARDS OF CONSTRUCTION FOR THE PROTECTION OF THE PHYSICALLY HANDICAPPED

5.4.1 All Contracts shall conform with the standard established by the Delaware Architectural Accessibility Board unless otherwise exempted by the Board.

5.5 CONTRACT PERFORMANCE

5.5.1 Any firm entering into a Public Works Contract that neglects or refuses to perform or fails to comply with its terms, the Agency may terminate the Contract and proceed to award a new Contract or may require the Surety on the Performance Bond to complete the Contract in accordance with the terms of the Performance Bond.

ARTICLE 6: CONSTRUCTION BY OWNER OR SEPARATE CONTRACTORS

- 6.1 The Owner reserves the right to simultaneously perform other construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other Projects at the same site.
- 6.2 The Contractor shall afford the Owner and other Contractors reasonable opportunity for access and storage of materials and equipment, and for the performance of their activities, and shall connect and coordinate their activities with other forces as required by the Contract Documents.

ARTICLE 7: CHANGES IN THE WORK

- 7.1 The Owner, without invalidating the Contract, may order changes in the Work consisting of Additions, Deletions, Modifications or Substitutions, with the Contract Sum and Contract completion date being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Professional, as the duly authorized agent, the Contractor and the Owner.
- 7.2 The Contract Sum and Contract Completion Date shall be adjusted only by a fully executed Change Order.
- 7.3 The additional cost, or credit to the Owner resulting from a change in the Work shall be by mutual agreement of the Owner, Contractor and the Architect. In all cases, this cost or credit shall be based on the 'DPE' wages required and the "invoice price" of the materials/equipment needed.
- 7.3.1 "DPE" shall be defined to mean "direct personnel expense". Direct payroll expense includes prevailing wage rates plus a maximum multiplier of 1.35 times DPE. For example, if the prevailing wage rate is \$50/hour, the DPE would be \$67.50/hour (50 x 1.35).
- 7.3.2 "Invoice price" of materials/equipment shall be defined to mean the actual cost of materials and/or equipment that is paid by the Contractor, (or subcontractor), to a material distributor, direct factory vendor, store, material provider, or equipment leasing entity. Rates for equipment that is leased and/or owned by the Contractor or subcontractor(s) shall not exceed those listed in the latest version of the "Means Building Construction Cost Data" publication.
- 7.3.3 In addition to the above, the General Contractor is allowed a fifteen percent (15%) markup for overhead and profit for additional work performed by the General Contractor's own forces. For additional subcontractor work, the Subcontractor is allowed a fifteen (15) percent overhead and profit on change order work above and beyond the direct costs stated previously. To this amount, the General Contractor will be allowed a mark-up not exceeding seven and one half percent (7.5%) on the subcontractors work. These mark-ups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, supervision, etc. No markup is permitted on the work of the subcontractors subcontractor. No additional costs shall be allowed for changes related to the Contractor's onsite superintendent/staff, or project manager, unless a change in the work changes the project duration and is identified by the CPM schedule. There will be no other costs associated with the change order.

ARTICLE 8: TIME

- 8.1 Time limits, if any, are as stated in the Project Manual. By executing the Agreement, the Contractor confirms that the stipulated limits are reasonable, and that the Work will be completed within the anticipated time frame.
- 8.2 If progress of the Work is delayed at any time by changes ordered by the Owner, by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions, unavoidable casualties or other causes beyond the Contractor's control, the Contract Time shall be extended for such reasonable time as the Owner may determine.
- 8.3 Any extension of time beyond the date fixed for completion of the construction and acceptance of any part of the Work called for by the Contract, or the occupancy of the building by the Owner, in whole or in part, previous to the completion shall not be deemed a waiver by the Owner of his right to annul or terminate the Contract for abandonment or delay in the matter provided for, nor relieve the Contractor of full responsibility.
- 8.4 SUSPENSION AND DEBARMENT
- 8.4.1 Per Section 6962(d)(14), Title 29, Delaware Code, "Any Contractor who fails to perform a public works contract or complete a public works project within the time schedule established by the Agency in the Invitation To Bid, may be subject to Suspension or Debarment for one or more of the following reasons: a) failure to supply the adequate labor supply ratio for the project; b) inadequate financial resources; or, c) poor performance on the Project."
- 8.4.2 "Upon such failure for any of the above stated reasons, the Agency that contracted for the public works project may petition the Director of the Office of Management and Budget for Suspension or Debarment of the Contractor. The Agency shall send a copy of the petition to the Contractor within three (3) working days of filing with the Director. If the Director concludes that the petition has merit, the Director shall schedule and hold a hearing to determine whether to suspend the Contractor, debar the Contractor or deny the petition. The Agency shall have the burden of proving, by a preponderance of the evidence, that the Contractor failed to perform or complete the public works project within the time schedule established by the Agency and failed to do so for one or more of the following reasons: a) failure to supply the adequate labor supply ratio for the project; b) inadequate financial resources; or, c) poor performance on the project. Upon a finding in favor of the Agency, the Director may suspend a Contractor from Bidding on any project funded, in whole or in part, with public funds for up to 1 year for a first offense, up to 3 years for a second offense and permanently debar the Contractor for a third offense. The Director shall issue a written decision and shall send a copy to the Contractor and the Agency. Such decision may be appealed to the Superior Court within thirty (30) days for a review on the record."
- 8.5 RETAINAGE
- 8.5.1 Per Section 6962(d)(5) a.3, Title 29, Delaware Code: The Agency may at the beginning of each public works project establish a time schedule for the completion of the project. If the project is delayed beyond the completion date due to the Contractor's failure to meet their responsibilities, the Agency may forfeit, at its discretion, all or part of the Contractor's retainage.
- 8.5.2 This forfeiture of retainage also applies to the timely completion of the punchlist. A punchlist will only be prepared upon the mutual agreement of the Owner, Architect and Contractor. Once the punchlist is prepared, all three parties will by mutual agreement, establish a schedule for its completion. Should completion of the punchlist be delayed beyond the established date due to the Contractor's failure to meet their responsibilities, the Agency may hold permanently, at its discretion, all or part of the Contractor's retainage.

ARTICLE 9: PAYMENTS AND COMPLETION

9.1 APPLICATION FOR PAYMENT

9.1.1 Applications for payment shall be made upon AIA Document G702. There will be a five percent (5%) retainage on all Contractor's monthly invoices until completion of the project. This retainage may become payable upon receipt of all required closeout documentation, provided all other requirements of the Contract Documents have been met.

9.1.2 A date will be fixed for the taking of the monthly account of work done. Upon receipt of Contractor's itemized application for payment, such application will be audited, modified, if found necessary, and approved for the amount. Statement shall be submitted to the Owner.

9.1.3 Section 6516, Title 29 of the Delaware Code annualized interest is not to exceed 12% per annum beginning thirty (30) days after the "presentment" (as opposed to the date) of the invoice.

9.2 PARTIAL PAYMENTS

9.2.1 Any public works Contract executed by any Agency may provide for partial payments at the option of the Owner with respect to materials placed along or upon the sites or stored at secured locations, which are suitable for use in the performance of the contract.

9.2.2 When approved by the agency, partial payment may include the values of tested and acceptable materials of a nonperishable or noncontaminative nature which have been produced or furnished for incorporation as a permanent part of the work yet to be completed, provided acceptable provisions have been made for storage.

9.2.2.1 Any allowance made for materials on hand will not exceed the delivered cost of the materials as verified by invoices furnished by the Contractor, nor will it exceed the contract bid price for the material complete in place.

9.2.3 If requested by the Agency, receipted bills from all Contractors, Subcontractors, and material, men, etc., for the previous payment must accompany each application for payment. Following such a request, no payment will be made until these receipted bills have been received by the Owner.

9.3 SUBSTANTIAL COMPLETION

9.3.1 When the building has been made suitable for occupancy, but still requires small items of miscellaneous work, the Owner will determine the date when the project has been substantially completed.

9.3.2 If, after the Work has been substantially completed, full completion thereof is materially delayed through no fault of the Contractor, and without terminating the Contract, the Owner may make payment of the balance due for the portion of the Work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment that it shall not constitute a waiver of claims.

9.3.3 On projects where commissioning is included, the commissioning work as defined in the specifications must be complete prior to the issuance of substantial completion.

9.4 FINAL PAYMENT

- 9.4.1 Final payment, including the five percent (5%) retainage if determined appropriate, shall be made within thirty (30) days after the Work is fully completed and the Contract fully performed and provided that the Contractor has submitted the following closeout documentation (in addition to any other documentation required elsewhere in the Contract Documents):
- 9.4.1.1 Evidence satisfactory to the Owner that all payrolls, material bills, and other indebtedness connected with the work have been paid,
 - 9.4.1.2 An acceptable RELEASE OF LIENS,
 - 9.4.1.3 Copies of all applicable warranties,
 - 9.4.1.4 As-built drawings,
 - 9.4.1.5 Operations and Maintenance Manuals,
 - 9.4.1.6 Instruction Manuals,
 - 9.4.1.7 Consent of Surety to final payment.
 - 9.4.1.8 The Owner reserves the right to retain payments, or parts thereof, for its protection until the foregoing conditions have been complied with, defective work corrected and all unsatisfactory conditions remedied.

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

- 10.1 The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take all reasonable precautions to prevent damage, injury or loss to: workers, persons nearby who may be affected, the Work, materials and equipment to be incorporated, and existing property at the site or adjacent thereto. The Contractor shall give notices and comply with applicable laws ordinances, rules regulations, and lawful orders of public authorities bearing on the safety of persons and property and their protection from injury, damage, or loss. The Contractor shall promptly remedy damage and loss to property at the site caused in whole or in part by the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable.
- 10.2 The Contractor shall notify the Owner in the event any existing hazardous material such as lead, PCBs, asbestos, etc. is encountered on the project. The Owner will arrange with a qualified specialist for the identification, testing, removal, handling and protection against exposure or environmental pollution, to comply with applicable regulation laws and ordinances. The Contractor and Architect will not be required to participate in or to perform this operation. Upon completion of this work, the Owner will notify the Contractor and Architect in writing the area has been cleared and approved by the authorities in order for the work to proceed. The Contractor shall attach documentation from the authorities of said approval.
- 10.3 As required in the Hazardous Chemical Information Act of June 1984, all vendors supplying any materials that may be defined as hazardous, must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a warning caution on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in any foreseeable emergency situation. Material Safety Data Sheets must be provided directly to the Owner along with the shipping slips that include those products.

10.4 The Contractor shall certify to the Owner that materials incorporated into the Work are free of all asbestos. This certification may be in the form of Material Safety Data Sheet (MSDS) provided by the product manufacturer for the materials used in construction, as specified or as provided by the Contractor.

ARTICLE 11: INSURANCE AND BONDS

11.1 The Contractor shall carry all insurance required by law, such as Unemployment Insurance, etc. The Contractor shall carry such insurance coverage as they desire on their own property such as a field office, storage sheds or other structures erected upon the project site that belong to them and for their own use. The Subcontractors involved with this project shall carry whatever insurance protection they consider necessary to cover the loss of any of their personal property, etc.

11.2 Upon being awarded the Contract, the Contractor shall obtain a minimum of two (2) copies of all required insurance certificates called for herein, and submit one (1) copy of each certificate, to the Owner, within 20 days of contract award.

11.3 Bodily Injury Liability and Property Damage Liability Insurance shall, in addition to the coverage included herein, include coverage for injury to or destruction of any property arising out of the collapse of or structural injury to any building or structure due to demolition work and evidence of these coverages shall be filed with and approved by the Owner.

11.4 The Contractor's Property Damage Liability Insurance shall, in addition to the coverage noted herein, include coverage on all real and personal property in their care, custody and control damaged in any way by the Contractor or their Subcontractors during the entire construction period on this project.

11.5 Builders Risk (including Standard Extended Coverage Insurance) on the existing building during the entire construction period, may be provided by the Contractor under this contract. The Owner shall insure the existing building and all of its contents and all this new alteration work under this contract during entire construction period for the full insurable value of the entire work at the site. Note, however, that the Contractor and their Subcontractors shall be responsible for insuring building materials (installed and stored) and their tools and equipment whenever in use on the project, against fire damage, theft, vandalism, etc.

11.6 Certificates of the insurance company or companies stating the amount and type of coverage, terms of policies, etc., shall be furnished to the Owner, within 20 days of contract award.

11.7 The Contractor shall, at their own expense, (in addition to the above) carry the following forms of insurance:

11.7.1 Contractor's Contractual Liability Insurance

Minimum coverage to be:

Bodily Injury	\$500,000	for each person
	\$1,000,000	for each occurrence
	\$1,000,000	aggregate
Property Damage	\$500,000	for each occurrence
	\$1,000,000	aggregate

11.7.2 Contractor's Protective Liability Insurance

Minimum coverage to be:

Bodily Injury	\$500,000 \$1,000,000 \$1,000,000	for each person for each occurrence aggregate
Property Damage	\$500,000 \$500,000	for each occurrence aggregate

11.7.3 Automobile Liability Insurance

Minimum coverage to be:

Bodily Injury	\$1,000,000 \$1,000,000	for each person for each occurrence
Property Damage	\$500,000	per accident

11.7.4 Prime Contractor's and Subcontractors' policies shall include contingent and contractual liability coverage in the same minimum amounts as 11.7.1 above.

11.7.5 Workmen's Compensation (including Employer's Liability):

11.7.5.1 Minimum Limit on employer's liability to be as required by law.

11.7.5.2 Minimum Limit for all employees working at one site.

11.7.6 Certificates of Insurance must be filed with the Owner guaranteeing fifteen (15) days prior notice of cancellation, non-renewal, or any change in coverages and limits of liability shown as included on certificates.

11.7.7 Social Security Liability

11.7.7.1 With respect to all persons at any time employed by or on the payroll of the Contractor or performing any work for or on their behalf, or in connection with or arising out of the Contractor's business, the Contractor shall accept full and exclusive liability for the payment of any and all contributions or taxes or unemployment insurance, or old age retirement benefits, pensions or annuities now or hereafter imposed by the Government of the United States and the State or political subdivision thereof, whether the same be measured by wages, salaries or other remuneration paid to such persons or otherwise.

11.7.7.2 Upon request, the Contractor shall furnish Owner such information on payrolls or employment records as may be necessary to enable it to fully comply with the law imposing the aforesaid contributions or taxes.

11.7.7.3 If the Owner is required by law to and does pay any and/or all of the aforesaid contributions or taxes, the Contractor shall forthwith reimburse the Owner for the entire amount so paid by the Owner.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1 The Contractor shall promptly correct Work rejected by the Owner or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed, and shall correct any Work found to be not in accordance with the requirements of the Contract Documents within a period of two years from the date of Substantial Completion, or by terms of an applicable

special warranty required by the Contract Documents. The provisions of this Article apply to work done by Subcontractors as well as to Work done by direct employees of the Contractor.

- 12.2 At any time during the progress of the work, or in any case where the nature of the defects shall be such that it is not expedient to have them corrected, the Owner, at their option, shall have the right to deduct such sum, or sums, of money from the amount of the contract as they consider justified to adjust the difference in value between the defective work and that required under contract including any damage to the structure.

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 CUTTING AND PATCHING

- 13.1.1 The Contractor shall be responsible for all cutting and patching. The Contractor shall coordinate the work of the various trades involved.

13.2 DIMENSIONS

- 13.2.1 All dimensions shown shall be verified by the Contractor by actual measurements at the project site. Any discrepancies between the drawings and specifications and the existing conditions shall be referred to the Owner for adjustment before any work affected thereby has been performed.

13.3 LABORATORY TESTS

- 13.3.1 Any specified laboratory tests of material and finished articles to be incorporated in the work shall be made by bureaus, laboratories or agencies approved by the Owner and reports of such tests shall be submitted to the Owner. The cost of the testing shall be paid for by the Contractor.

- 13.3.2 The Contractor shall furnish all sample materials required for these tests and shall deliver same without charge to the testing laboratory or other designated agency when and where directed by the Owner.

13.4 ARCHAEOLOGICAL EVIDENCE

- 13.4.1 Whenever, in the course of construction, any archaeological evidence is encountered on the surface or below the surface of the ground, the Contractor shall notify the authorities of the State Historic Preservation Office and suspend work in the immediate area for a reasonable time to permit those authorities, or persons designated by them, to examine the area and ensure the proper removal of the archaeological evidence for suitable preservation by the Division of Historical and Cultural Affairs.

13.5 GLASS REPLACEMENT AND CLEANING

- 13.5.1 The General Contractor shall replace without expense to the Owner all glass broken during the construction of the project. If job conditions warrant, at completion of the job the General Contractor shall have all glass cleaned and polished.

13.6 WARRANTY

- 13.6.1 For a period of two (2) years from the date of substantial completion, as evidenced by the date of final acceptance of the work, the contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect of equipment, material or workmanship performed by the contractor or any of his subcontractors or

suppliers. However, manufacturer's warranties and guarantees, if for a period longer than two (2) years, shall take precedence over the above warranties. The contractor shall remedy, at his own expense, any such failure to conform or any such defect. The protection of this warranty shall be included in the Contractor's Performance Bond.

ARTICLE 14: TERMINATION OF CONTRACT

- 14.1 If the Contractor defaults or persistently fails or neglects to carry out the Work in accordance with the Contract Documents or fails to perform a provision of the Contract, the Owner, after seven days written notice to the Contractor, may make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor. Alternatively, at the Owner's option, and the Owner may terminate the Contract and take possession of the site and of all materials, equipment, tools, and machinery thereon owned by the Contractor and may finish the Work by whatever method the Owner may deem expedient. If the costs of finishing the Work exceed any unpaid compensation due the Contractor, the Contractor shall pay the difference to the Owner.
- 14.2 "If the continuation of this Agreement is contingent upon the appropriation of adequate state, or federal funds, this Agreement may be terminated on the date beginning on the first fiscal year for which funds are not appropriated or at the exhaustion of the appropriation. The Owner may terminate this Agreement by providing written notice to the parties of such non-appropriation. All payment obligations of the Owner will cease upon the date of termination. Notwithstanding the foregoing, the Owner agrees that it will use its best efforts to obtain approval of necessary funds to continue the Agreement by taking appropriate action to request adequate funds to continue the Agreement."

END OF SECTION

DRUG TESTING FORM

The Office of Management and Budget (OMB) has developed the 4014 regulations as part of the Delaware Code that requires Contractors and Subcontractors to implement a program of mandatory drug testing for Employees who work on Large Public Works Contracts funded all or in part with public funds pursuant to 29 **Del.C.** 6908(a)6). The regulations establish the mechanism, standards and requirements of a Mandatory Drug Testing Program that will be incorporated by reference into this Contract awarded pursuant to 29 **Del.C.** 6962. Sample copies of Testing report Forms maintained and/or submitted pursuant to the requirements of 4104 regulations for this Project are included herewith.

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EMPLOYEE DRUG TESTING REPORT FORM

Period Ending: _____

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds maintain testing data that includes but is not limited to the data elements below.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Number of employees who worked on the jobsite during the report period: _____

Number of employees subject to random testing during the report period: _____

Number of Negative Results _____ Number of Positive Results _____

Action taken on employee(s) in response to a failed or positive random test:

Date: _____

This form is not required to be submitted to the Owner. Included as a reference to show information required to be maintained by the Contractor. The Owner shall have the right to periodically audit all Contractor and Subcontractor test results at the Contractor's or Subcontractor's offices (or by other means to make the data available for inspection by the Owner).

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**EMPLOYEE DRUG TESTING
REPORT OF POSITIVE RESULTS**

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds to notify the Owner in writing of a positive random drug test.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Name of employee with positive test result: _____

Last 4 digits of employee SSN: _____

Date test results received: _____

Action taken on employee in response to a positive test result:

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

This form shall be sent by mail to the Owner within 24 hours of receipt of test results.

Enclose this test results form in a sealed envelope with the notation "Drug Testing Form – DO NOT OPEN" on the face thereof and place in a separate mailing envelope.

END OF SECTION

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SECTION 04 05 11
MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for unit masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.
- B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International.
- C. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- F. ASTM C150/C150M - Standard Specification for Portland Cement.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
- I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
- J. ASTM C476 - Standard Specification for Grout for Masonry.
- K. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- L. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
- M. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength.
- N. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
- O. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry.
- P. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.
- Q. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix based on the Proportion specification of ASTM C 270 is to be used.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer's Instructions: Comply with material manufacturer's instructions for use of products (including surface preparation, mixing, applying, drying, etc.). In case of conflict with requirements of this Section, the more stringent requirements shall govern.

B. STONE MATERIALS

- a. Stone: Provide natural building stone of variety, color, finish, size, and shape to match existing stone.
 - i. For existing stone that exhibits a range of colors, finishes, sizes, or shapes, provide stone that matches that range rather than stone that matches an individual color, finish, size, or shape within that range.
 - ii. Limestone shall be Indiana limestone to match existing original limestone on the building, including grade, color, texture and tooling.

2.2 MORTAR MATERIALS

- A. Engage independent third party testing and analysis laboratory to perform mortar analysis on material found in existing masonry mortar joints. Subsequent to performance of mortar analysis and following review of results of analysis report by Historic Preservation Architect, submit for review proposed portland cement, hydrated lime, mortar sand and mortar pigments as determined to be required to match existing masonry mortar installations.
- B. Masonry cement will not be permitted.
- C. Water: Potable, clean, free from deleterious amounts of oils, acids, alkalis, salts and organic matter.

2.3 MORTAR MIX

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - a. Mixing Pointing Mortar: Thoroughly mix cementitious materials, sand and pigments together before adding any water. Then mix again adding only enough water to produce a damp, workable mix that will retain its form when pressed into a ball. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 2 1/2 hours of final mixing; do not retemper or use partially cured material.
- B. Colored Mortar: Provide mortar of color required by using selected ingredients. Do not alter specified proportions without Architect's approval.
 - a. Mortar Pigments: Mortar pigments shall not exceed 10% of total weight of cement and lime.
- C. Do not use admixtures of any kind in mortar, unless otherwise approved.
- D. Mortar Proportions: Mortar is to comply with referenced standards for exterior, above-grade loadbearing and non-loadbearing construction, ASTM C270 Type N mortar. Mix mortar materials in the following proportions:
 - a. Pointing and Rebuilding (Setting) Mortar for Stone and Backup Brick: 1 part Portland cement, 1 part lime, and 4.5 to 6 parts sand.

E. Testing

- a. The right to require further or additional testing of masonry mortar or mortar materials is reserved by the Owner.
- b. Testing shall be conducted in accordance with the provisions of the ASTM Specifications C-270 for masonry mortars, ASTM C-109, or the applicable ASTM Specifications covering the individual mortar materials.
- c. Certified test reports by an independent testing laboratory will be furnished by the Contractor upon request of the Architect. The costs of tests shall be borne as follows:
 - i. If the results of the test show that the mortar does not conform to the ASTM specifications, the cost shall be borne by the Contractor.
 - ii. If the results of the test show that the mortar does conform to the ASTM Specifications, the cost will be borne by the Owner.

2.4 CLEANING MATERIALS

- A. Water for Rinsing: Potable.

2.5 MISCELLANEOUS MATERIALS

- A. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone, is vapor- and water permeable, exhibits low shrinkage, frost and salt resistant, and physically compatible with the substrate, including, but not limited to porosity, tensile and compressive strength. Formulate in colors and textures to match stone being patched. Provide three colors for each type of stone (limestone) to enable matching the range of colors of the existing original stone. Supplier: Cathedral Stone Products Inc., Hanover, Maryland, tel. 410-782-9150 or approved equal.
- a. Limestone patching compound (3 custom color formulations to match range of original limestone):
 - i. Jahn M-70 Restoration Mortar (custom formulation); the choice of custom formulations to be used is subject to approval of samples and mockups during Submittals:
- B. Grout Products:
- a. Dispersed Hydrated Lime (DHL) Putty for buttering the sides of Dutchman, capping disaggregated surfaces, or patching, as distributed by US Heritage Group in Chicago, telephone no. 773-286-2100.
 - b. Dispersed Hydrated Lime (DHL) Injection Mortar for cracks between approximately 0.030" to 0.125" wide, as distributed by US Heritage Group in Chicago, telephone no. 773-286-2100.
 - c. Pigments for Dispersed Hydrated Lime (Bayferrox Pigments), as distributed by Bayer Corporation, Pittsburgh, PA tel. 800-662-2927.
 - d. Crack Filler: Mineral-Based Jahn Injection Grouts distributed by Cathedral Stone Products Inc., Hanover, MD, tel. 410-782-9150, that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
 - ii. Grout "A": Jahn M32 for cracks .126" to .19" wide.
 - iii. Grout "B": Jahn M40 Crack and Void Injection Grout for cracks approximately .20" wide and larger.
- C. Tape for DHL Protection
- a. Polyken 888 PE Coated Cloth Stucco Masking Tape (Tyco Adhesives): available from Taperoll.com INC, P.O. Box 781390, Sebastian, FL 32958 Tel: 772-388-1007. Note that it is not recommended for use for a longer period than 2 weeks.

- D. All stone anchors, patch anchors, new pieces of stone, new patch materials and all grouts, epoxy adhesives, lime putty's, etc. shall be labeled on the shop drawings.

2.6 TOOLS

- A. Hand Tools: Chisels, hammers and mallets.
 - a. Thickness of Chisels: All chisels used to remove mortar from or prepare joints shall have a maximum thickness of 5/8 times joint width extending back from tip of chisel a minimum of one-and-one-half times depth at which chisel will be inserted into joint.
 - b. Special Tools: Provide special knives or special thin cutter blades for use in joints less than 1/8" in width.
- B. Power Tools: Small, hand-held electric grinders with diamond or abrasive blades no greater than 3/32" thick and a maximum of 4-1/2" in diameter may be used to cut joints only under certain conditions as described in Part 3 below, and if specifically approved by Architect.
- C. Brushes: Stiff, natural bristle brushes.
- D. Trowels for Pointing: Long, thin pointing trowels that are narrower than joints being pointed.
- E. Fabricate special trowels for pointing if necessary to provide for proper insertion and compaction of mortar.

PART 3 EXECUTION

3.01 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.
 - a. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
- B. Prevent mortar from staining face of surrounding masonry and other surfaces. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
 - a. Cover sills, ledges, and projections to protect from mortar droppings.
 - b. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - c. Immediately remove mortar in contact with exposed masonry and other surfaces.
 - d. Clean mortar splatters from scaffolding at end of each day.

3.02 INSPECTION

- A. The Contractor shall examine all substrates, supports, and conditions under which this work is to be performed and notify the Architect, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected.
- B. Each piece of new masonry shall be examined for visible defects or damage. No cracked, warped or physically damaged pieces shall be installed.

3.03 GROUT FOR CRACKS BETWEEN 0.03" - 0.125" WIDE: DISPERSED HYDRATED LIME (DHL)

- A. Sieve dry pigments, and mix the pigments with dispersed hydrated lime (DHL) and clean, potable water using a high speed mixer according to the following volumetric ratios:
 - a. For limestone:

Limestone DHL formulation A

1 1/4 part DHL
1/64 part #318 Bayferrox pigment
1/48 part #820 Bayferrox pigment

Limestone DHL Formulation B

1 1/4 part DHL
1/64 part #318 Bayferrox pigment
1/48 part #820 Bayferrox pigment
1/128 part #663/4 Bayferrox pigment

Limestone DHL Formulation C

1 part formulation A
1 part formulation B

- B. Clean out cracks with compressed air.
- C. Flush out cracks with water to prepare masonry to accept the pigmented Dispersed Hydrated Lime crack filler.
- D. Pre-wet the crack. Ensure that the crack is still wet with minor amount of standing water, but not enough to allow water to drip. If stone is only damp, re-wet and let sit until some water is absorbed into the stone.
- E. Inject DHL Grout into cracks with a plastic hypodermic needle with removable, replaceable stainless steel needles; select needle of an adequate size to allow material to flow freely without separating. Water may be added to DHL grout to increase flow, allowable % by volume as per manufacturer's recommendations. Pre-wetting the crack with a 50% denatured alcohol solution can contribute to suction of the grout into the crack. Grout can be smoothed with a wet finger or a natural sponge. At thumbprint hardness, edges of cracks may be cleaned with a natural sponge. At 12-24 hour set, edges may be further cleaned off, if necessary, with a stiff natural bristle brush. Manufacturer's recommendations do not include misting; however, frequent misting of the fills over the first 48 hours seems to lower the percentage of failures.
- F. Protect repairs from direct rain and direct sunlight for 1 week, and protect from frost for 4 weeks.
- G. Do not work in temperatures below 40 degrees F or above 90 degrees F, or when the temperature is expected to fall below 40 degrees F or above 90 degrees F for 48 hours after installation of crack repair.

3.04 GROUT INJECTION FOR CRACKS 0.126" TO 0.19" WIDE (JAHN M32) AND 0.20" WIDE AND LARGER (JAHN M40)

- A. Preparation:
 - 1. Transverse Cracks: For cracks across the face of the masonry unit, drill a series of injection ports in the center of the crack. These ports should be drilled in a downward direction. Between the ports, the crack should be sealed with removable, non-staining clay or repaired with the appropriate Jahn Mortar.
 - 2. Wash the surface and interior of the crack using clean water to remove all dust, loose or deleterious material which could prevent proper flow and / or adhesion, compromising the integrity of the cured injection grout.
- B. Strictly adhere to Manufacturer's written instructions and recommendations regarding preparation, installation, finishing and curing.

- C. Safety goggles, gloves and a dust mask should be worn for protection. Do not mix more material than can be used within approximately 30 minutes.
- D. Grout "A": Jahn M32 for cracks between approximately 0.126" to 0.19:
 - 1. Mixing Ratio: The mixing ratio is approximately 2 to 5 parts powder to 1 part water by volume.
 - 2. Mixing: Mix mechanically using a high speed drill (3,000 rpm or higher) equipped with a Jiffler-type mixing paddle. After mixing, the mortar should be poured into another clean container using a sieve. Continued agitation is necessary if the mortar is allowed to sit prior to use.
- E. Grout "B": Jahn M40 for cracks approximately 0.20" wide and larger
 - 1. Mixing Ratio: The mixing ratio is approximately 2 to 2 ½ parts powder to 1 part water by volume.
 - 2. Mixing: Mix manually or mechanically, using a slow speed drill (400-600 rpm) equipped with a Jiffler-type mixing paddle. The material should be mixed for a minimum of three minutes, with continued agitation should the product be allowed to sit prior to use.
- F. Do not mix more material than can be used within approximately 30 minutes. Discard any mixed material that has been unused for 30 minutes or more.
- G. Wash the interior of the crack immediately before injection by flushing with clean water. If the crack is allowed to dry out before grout is injected, this step must be repeated.
- H. Treatment of Transverse Cracks across the face of the masonry unit: Inject grout into lowest port and continue until it flows freely from this port and other ports at the same level. Seal ports using non-staining clay, sealant, or caulk and proceed in identical fashion until the crack is filled. Clean up overflow immediately.
- I. Finishing: Remove plugs after 24 to 48 hours and repair the ports and the crack surface, if not previously performed, using an appropriate Jahn Mortar to match color and type of existing masonry.
- J. Clean up: Remove uncured mortar from substrate before it dries using clean water and a rubber sponge. Cured mortar may only be removed chemically or mechanically.
- K. Do not work in temperatures below 40 degrees F or above 90 degrees F, or when the temperature is expected to fall below 40 degrees F or above 90 degrees F for 48 hours after installation of crack repair.

3.05 REPAIR FOR PREVIOUSLY REPAIRED CRACKS & FISSURES

- A. Remove all existing mortar or patching material from the crack with hand held chisels: use properly sized and shaped carbide tipped sandstone chisels set in small, finger-grip pneumatic stone-carving heads, or 4" circular diamond-tipped masonry blades. The chisels should be used where the configuration of the crack repair is more intricate, and the masonry blades for less complex repairs. Only skilled restoration masons should carry out this work so that no damage to the surrounding stone should occur.
- B. Remove all sealant residue.

- C. Cut along the full length of the crack using the appropriate tool to remove all of the repair material and any unsound stone. Where possible, the cut should be interior “dovetailed” or back-cut to provide for positive keying for the patch repair compound. The feathering of edges is not allowed. Coordinate with drawings for depth.
- D. Clean out residual dust along the full length of the crack with compressed air, clean water and a non-ferrous soft bristle brush.
- E. Mix and install the appropriate Jahn repair mortar following procedure indicated in item 3.6 Stone Patching below. Strictly adhere to manufacturer’s written instructions and recommendations regarding preparation, installation, finishing and curing.

3.06 PATCHING

- A. Patch the following units:
 - 1. Units indicated to be patched.
 - 2. Units with holes.
 - 3. Units with chipped edges or corners.
 - 4. Units with small areas of deep deterioration.
 - 5. Remove and replace existing patches, unless otherwise indicated or approved by Architect.
- B. Strictly adhere to Manufacturer’s written instructions and recommendations regarding preparation, installation, finishing and curing.
- C. Do not work in temperatures below 40 degrees F or above 90 degrees F, or when the temperature is expected to fall below 40 degrees F or above 90 degrees F for 48 hours after installation of crack repair. Protect repair mortar from direct sunlight and wind when the ambient air temperature exceeds 70 degrees F.
- D. Surface Preparation:
 - 1. Cut out unsound stone and old patch repairs. Remove additional material so patch will not have feathered edges and will be at least 1/2 inch (12 mm) thick (squared shoulder), but not less than recommended by patching compound manufacturer. Remove all sealant residue. Cut pocket into masonry with hand tools only, unless otherwise approved via submittals. Do not leave thin slivers of masonry at surface. Roughen surface to provide key for patch material.
 - 2. Exercise care that sound masonry is not damaged or disturbed.
 - 3. For locations where removed substrate is configured in such a way that detachment of the patch from the substrate would render the patch prone to falling, reinforce with stainless steel threaded rods.
 - a. Drill holes in substrate to depth indicated on Contract Drawing.
 - b. Locate holes minimum 2” from edge of stone.
 - c. Clean holes using compressed, oil-free air, and bristle brushes, until no dust cloud is produced when a brush, inserted the full depth of the hole, is pulled out of the hole.
 - d. Anchor stainless steel threaded rods to backup by means of a two-part moisture tolerant structural adhesive, such as Sikadur 31, Hi-Mod Gel. Rods to be installed at an angle.
 - e. Anchors should be covered with a minimum of 1” repair material.
 - f. No armature wires for the patch shall be used.

4. Remove loose particles, soil, debris, oil, and other contaminants from existing stone units at locations to be patched by cleaning with clean water and a non-ferrous soft bristle brush.
5. Pre-wet the surface ahead of time to prevent the substrate from drawing moisture out of the repair too quickly. Re-wet the surface immediately before applying the repair material: surfaces to be patched shall be damp, but without standing water.

E. Mixing of the Repair Material:

1. It is recommended that safety goggles, gloves and a dust mask be worn for protection. Do not mix more material than can be used within approximately 30 minutes.
2. Mixing ratios:
 - a. Jahn M70 (for Limestone) Mixing ratio shall be as follows: approximately 5 to 5 ½ parts dry material to 1 part water.
3. Add water to dry ingredients and mix well. Adjust amount of water according to the weather and the porosity of the substrate.
4. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.

F. Application of Repair Material:

1. Moisten the substrate using clean water. Jahn mortar should be applied to a glistening wet surface on vertical applications and a well-dampened surface (with no pooling water) on horizontal applications. If the surface is allowed to dry out before application of the repair mortar, this step must be repeated.
2. Apply the mortar mix using a trowel in a series of lifts with no waiting period or scratch coat necessary between layers, up to a total maximum thickness of 3". The first coat is to be consistency of wet putty 1/8" thick. For patches thicker than 3", apply mortar in two layers, allowing the first layer to cure for a while before applying the second layer. If applied in layers, scrape off any cement skin that forms and continue application. Dampen the surface before applying the next layer. Work mortar firmly into the surface of the masonry, including the corners, and under and around all mechanical anchors.
3. Build up patching material so that it is slightly above the adjacent masonry surface. Allow mortar 15 to 30 minutes to set slightly (wait time will vary with temperature and humidity – longer in cool weather), then scrape off excess material using a straight edge. Do not press down or "float" the patch. Where patches occur at panel edges or corners, form mortar to match the profile of the surrounding masonry. In all cases, finish patch so that it is as indistinguishable as possible from the adjacent masonry, matching existing appearance, including profile(s).

G. Finishing:

1. Finish surface of patch in accordance with manufacturer's printed instructions.
2. Trowel, scrape, or carve surface of patch to match texture and surface plane of surrounding stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
3. Build patch up **1/4 inch (6 mm)** above surrounding stone and carve surface to match adjoining stone before patch fully sets.

H. Curing:

1. Lightly mist the repair with water to wet the entire surface of the finished patch approximately 30 minutes to 1 hour after completion on hot sunny days, and approximately 2 hours, or longer, on cool or cloudy days. Time will vary with temperature and humidity. Mist several times a day on the three days following the patch

installation. Should access to the patches be impossible for a period of time, plastic may be used to cover them temporarily. The application of plastic, however, does not remove the need for normal curing techniques. Never cover patches with plastic immediately after finishing – the water in the repair will be trapped on the surface causing it to lighten.

I. Adjustment and Cleaning:

1. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.
2. Remove uncured mortar from the perimeter of the repair before it dries using clean water and a rubber sponge. Repeat several times with clean water to prevent a halo effect (staining of adjacent masonry). Cured mortar may only be removed chemically or mechanically.

3.07 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
 1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.
- B. Wash adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt, and stains.

3.08 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Prior to and during application, inspections shall be made by a representative of the Material Manufacturer for patches and grout injection repairs at cracks. Inspections shall be made at such times and frequency as required to determine that:
 1. Substrate surface preparation is acceptable.
 2. Materials, equipment and application methods are in accordance with the Manufacturer's written instructions.
 3. Completed work is in accordance with Contract Documents and qualifies for warranty coverage as specified.

END OF SECTION

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

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems. Related to duct leak testing.
 - 1. The State of Delaware has a separate contract with Noresco Sustainability Services to perform final testing, adjusting, and balancing of this project. The successful contractor shall engage the services of a balancer to perform duct leak testing as specified in 23 31 00.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: Employment of testing agency and payment for services.
- B. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
- C. Section 23 31 00 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- B. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, Eighth Edition.
- C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Duct Leak Test Plan:
 - 1. The Duct Leak Test Plan shall include the following:
 - a. Marked up drawing identifying what ductwork will be leak tested.
 - b. Procedure for testing the identified ductwork. (How will this ductwork be temporarily sealed, etc)
 - c. Rating of the ductwork and what pressure this test will be conducted at.
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
 - 2. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 3. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 4. Units of Measure: Units of measure should include Inches of Water Column (In w.c.)
 - 5. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Engineer.
 - g. Project Contractor.
 - h. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. TAB contractor shall perform ductwork leak tests prior to installation of ceiling. TAB contractor shall schedule this work thru the mechanical contractor.
- B. Perform total system balance in accordance with one of the following:
 - 1. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
 - 2. SMACNA (TAB).
- C. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- D. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- E. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Certified by one of the following:
 - a. NEBB, National Environmental Balancing Bureau: www.nebb.org.
 - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.
- F. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Submit an explanation of the duct leakage test to the engineer.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - 1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 SCOPE

- A. Produce a Duct Leak Test Plan, Perform Duct Leak Testing, and report findings.

3.07 MINIMUM DATA TO BE REPORTED

- A. Duct Leak Tests:
1. Description of ductwork under test
 2. Duct design operating pressure
 3. Duct design test static pressure
 4. Duct capacity, air flow
 5. Maximum allowable leakage duct capacity times leak factor
 6. Test apparatus
 - a. Blower
 - b. Orifice, tube size
 - c. Orifice size
 - d. Calibrated
 7. Test static pressure
 8. Test orifice differential pressure
 9. Leakage

END OF SECTION

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SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass Fiber, Flexible.
- B. Glass Fiber, Rigid
- C. Jackets.
- D. Duct insulation.
- E. Insulation jackets.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- B. Section 23 31 00 - HVAC Ducts and Casings

1.03 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville: www.jm.com.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 4. CertainTeed Corporation; : www.certainteed.com/#sle.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Minimum Density of 1.0 PCF.
- C. Vapor Barrier Jacket:
 - 1. 0.0032 inch vinyl.
 - 2. Moisture Vapor Permeability: 1.3 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure sensitive tape.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. Knauf Insulation: www.knaufusa.com.
 - 2. Johns Manville: www.jm.com.
 - 3. Owens Corning Corp: www.owenscorning.com.
 - 4. CertainTeed Corporation: www.certainteed.com.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent.
 - 4. Maximum Density: 8.0 lb/cu ft.
- C. Vapor Barrier Jacket:
 - 1. 0.0032 inch vinyl.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

2.04 JACKETS

- A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
 - 1. Lagging Adhesive:
 - a. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
 - 1. For rigid polyisocyanurate, installation shall only be completed by manufacturer licensed contractors.
- B. Insulated ducts conveying air below ambient temperature:
 - 1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ducts conveying air above ambient temperature:
1. Provide with or without standard vapor barrier jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

3.03 SCHEDULES

- A. Outside Air Intake Ducts: 2 inches thick, flexible glass fiber or rigid board.
- B. Supply Ducts within insulated building envelope (R-6 min.): 2 inches thick, flexible glass fiber
- C. Return Ducts: 1 inch thick, flexible glass fiber or rigid board.
- D. Ducts exposed in mechanical room or non public spaces: shall be provided with rigid board and jacket if below 10 feet above finished floor.

END OF SECTION

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SECTION 23 07 16
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment insulation.
- B. Covering.

1.02 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturers:
 - 1. Johns Manville Corporation: www.jm.com/#sle.
 - 2. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 3. Owens Corning Corp: www.owenscorning.com/#sle.
- B. Insulation: ASTM C553; flexible, noncombustible.
 - 1. 'K' Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
- C. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 JACKETS

- A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.016 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- D. Insulated equipment containing fluids below ambient temperature; insulate entire system.
- E. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
- F. Exterior Applications:
 - 1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
 - 2. Cover with aluminum or stainless steel.
- G. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.
- H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.02 SCHEDULE

- A. Cooling Systems:
 - 1. Pump Bodies outside the building envelope.
 - 2. Heat Exchangers outside the building envelope.
 - 3. Equipment Exposed to Freezing with Heat Tracing.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.
- E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. Johns Manville Corporation: www.jm.com.
 - 3. Knauf Insulation: www.knaufinsulation.com.
 - 4. Owens Corning Corp: www.owenscorning.com.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. Maximum Service Temperature: 650 degrees F.
 - 2. Maximum Moisture Absorption: 0.2 percent by volume.
- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 - 1. Armacell LLC: www.armacell.us.
 - 2. K-Flex USA LLC: www.kflexusa.com.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

- A. PVC Plastic.
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
- B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
 - 1. Lagging Adhesive: Compatible with insulation.
- C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.016 inch sheet.
 - 2. Finish: Embossed.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- K. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.
- L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

- A. Heating Systems:
 - 1. Heating Water Supply and Return: 2" Glass Fiber with PVC fitting covers
- B. Cooling Systems:
 - 1. Condenser Water Interior: No insulation
 - 2. Condensate Drains from Cooling Coils: 1/2" Flexible Elastomeric Cellular Insulation

C. Other Systems:

1. Piping Exposed to Freezing with Heat Tracing: 2" glass fiber with aluminum jacketing

END OF SECTION

SECTION 23 65 33
LIQUID COOLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid cooler.
- B. Controls.
- C. Ladder and Handrails.
- D. Inside Sump.
- E. Discharge hood.

1.02 RELATED REQUIREMENTS

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- C. Section 23 21 13 - Hydronic Piping.
- D. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- E. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ASME PTC 23 - Atmospheric Water-Cooling Equipment; The American Society of Mechanical Engineers; 2003.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2013.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.
- C. Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.
- D. The thermal performance shall be certified by the Cooling Technology Institute in accordance with CTI Certification Standard STD-201.
- E. Certificates: Certify that liquid cooler performance, based on ASME PTC 23 meet or exceed specified requirements and submit performance curve plotting leaving water temperature against wet bulb temperature.
- F. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.
- G. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include cleaning methods and cleaning materials recommended.
- H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in State of Delaware OMB - Division of Facilities Management's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for State of Delaware OMB - Division of Facilities Management's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Fan Belts: Two sets, matched, of each type and size.
 - 3. Extra Spray Nozzles: Two.
 - 4. Extra Float Valves: One.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Factory assemble entire unit. For shipping, disassemble into as large as practical sub-assemblies so that minimum amount of field work is required for re-assembly.
- B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for liquid cooler package, labor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Baltimore Aircoil Company: www.baltimoreaircoil.com. Model (PT2)
- B. EVAPCO, Inc: www.evapco.com. Basis of design (Model AT)
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURED UNITS

- A. Description: Factory assembled and tested, induced draft counter flow closed circuit cooler complete with fan, coil, fill, louvers, accessories and rigging supports
- B. The unit structure shall be designed, analyzed, and constructed in accordance with the latest edition of International Building Code (IBC) Regulations for seismic loads up to 1.0 g or wind loads up to 145 psf.

2.03 COMPONENTS

- A. Pan and Casing:
 - 1. All cold water basin components including vertical supports, air inlet louver frames and panels up to rigging seam shall be constructed of 316 stainless steel.
 - 2. Upper Casing, channels and angle supports shall be constructed of heavy gauge mill hot-dip galvanized steel. Fan cowl and guard shall be constructed of galvanized steel. All galvanized steel shall be coated with a minimum of 2.35 ounces of zinc per square foot area (G-235 Hot-Dip Galvanized Steel designation). During fabrication, all galvanized steel panel edges shall be coated with a 95% pure zinc-rich compound.
- B. Fill Media: Fill media shall be constructed of Polyvinyl Chloride (PVC) of cross-fluted design and suitable for inlet water temperatures up to 130 F. The bonded block fill shall be bottom supported and suitable as an internal working platform. Fill shall be self-extinguishing, have a flame spread of 5 under A.S.T.M. designation E-84-81a, and shall be resistant to rot, decay and biological attack.
- C. Distribution Section: Spray nozzles shall be precision molded ABS, large orifice spray nozzles utilizing fluidic technology for superior water distribution over the fill media and to minimize water distribution system maintenance. Spray header, branches, and riser shall be Schedule 40 Polyvinyl Chloride (PVC) for corrosion resistance. Branches shall have threaded end caps to facilitate debris removal.
- D. Drift Eliminators: The eliminators shall be constructed entirely of Polyvinyl Chloride (PVC) in easily handled sections. Design shall incorporate three changes in air direction and limit the water carryover to a maximum of 0.001% of the recirculating water rate.
- E. Bleed-off Valve: Unit shall have a waste water bleed line with adjustable valve provided.

- F. Air Inlet Louvers: The air inlet louvers shall be constructed from UV inhibited polyvinyl chloride (PVC) and incorporate a framed interlocking design that allows for easy removal of louvers for access to the entire basin area for maintenance. The louvers shall have a minimum of two changes in air direction and shall be of a non-planar design to prevent splash-out, block direct sunlight and debris from entering the basin.
- G. Electronic water level control package shall have five (5) stainless steel water level sensors (one (1) high level, one (1) high level alarm, one (1) low level, one (1) low level alarm and one (1) ground) with a NEMA 4X enclosure mounted in a cleanable Schedule 40 PVC external standpipe with slow closing solenoid valve(s) and "y" strainer(s). Components must be field mounted. Valves shall be sized for 25 psig (172 kPa) minimum to 125 psig (862 kPa) maximum pressure. Standpipe requires heat tracing in cold weather applications.
- H. Pan strainer: Pan Strainer shall be all type 304 stainless steel construction with large area removable perforated screens.
- I. Discharge Damper w/ Insulation (If applicable): Coolers shall utilize integral water re-distribution basin as heat loss protection. All coolers that utilize a discharge hood with dampers shall be provided with factory supplied insulation the discharge hood. These dampers shall be coordinated with the building automation systems (BAS) contractor for actuator compatibility. Actuators are to be supplied by the BAS contractor.

2.04 MOTORS AND DRIVES

- A. Fans: Shall be high efficiency axial propeller type with aluminum wide chord blade construction. Each fan shall be statically balanced and installed in a closely fitted cowl with venturi air inlet for maximum fan efficiency.
- B. Fan Motors: Fan motor(s) shall be totally enclosed, ball bearing type electric motor(s) suitable for moist air service. Motor(s) are Premium Efficient, Class F insulated, 1.15 service factor design. Inverter rated per NEMA MG1 Part 31.4.4.2 and suitable for variable torque applications and constant torque speed range with properly sized and adjusted variable frequency drives.
- C. Fan Drive: The fan drive shall be multigroove, solid back V-belt type with taper lock bushings designed for 150% of the motor nameplate horsepower. The belt material shall be neoprene reinforced with polyester cord and specifically designed for evaporative equipment service. Fan and motor sheave shall be aluminum alloy construction. Belt adjustment shall be accomplished from the exterior of the unit.
- D. Fan Shaft: Shaft shall be Solid, ground and polished steel. Exposed surface coated with rust preventative.
- E. Shaft Bearings: Fan Shaft Bearings shall be heavy-duty, self-aligning ball type bearings with extended lubrication lines to grease fittings located on access door frame. Bearings shall be designed for a minimum L-10 life of 100,000 hours.

2.05 INSIDE SUMP

- A. Pan and Casing: Shall be constructed with 316 Stainless steel and reinforcing angles and channels with lift out steel strainer.

2.06 COOLING TOWER CONTROL PANEL

- A. The cooling tower control panel shall include complete Variable Frequency Drive (VFD) fan control and incorporate control of spray pumps and basin heaters when applicable. The NEMA-3R cooling tower Starter/VFD panel shall be provided by unit manufacturer to include complete Variable Frequency Drive (VFD) for fan and incorporate spray pump motor starter and basin heater contactors. The Variable Frequency Drive shall be provided by ATC Contractor and in conformance to section 23 09 69. ATC vendor shall provide VFD to Unit Manufacturer for Mounting & Wiring into Single Point Power Panel Supplied by Vendor. The Variable Frequency Drive shall be in conformance to section 23 09 69.
- B. A single point power connection for all controlled motors will be included. UL 489 breaker shall include thermal and magnetic trip mechanisms.

- C. The control panel shall include manual bypass functionality which isolates the VFD.
- D. VFD operator controls shall include a VFD/Off/Bypass switch and HOA switch mounted on the enclosure door.'
- E. The control panel shall include all necessary terminal inputs to control the sequence of operations from a Building Management System including at a minimum: VFD start command, VFD reference speed, spray pump operation, basin heater operation.
- F. The control panel must also include a Full Voltage Non-Reversing Starter for a Spray Pump if present. HOA switch to be included and mounted on the enclosure door.
- G. If Basin Heater is Present, the control panel shall also include a basin heater contactor with Off/Auto switch installed and mounted on the enclosure door.
- H. Terminal inputs shall be provided for Vibration Cut Out Switch.
- I. All internal power and control wiring to be installed and tested in the factory.
- J. A Five Year Warranty shall be provided as standard by panel manufacturer.

2.07 MAINTENANCE ACCESS

- A. Fan Section: Access door shall be hinged and located in the upper casing for fan drive and water distribution system access.
- B. Basin Section: Framed removable louver panels shall be on all four sides of the unit for pan and sump access.
- C. Internal Working Platform: Internal working platform shall provide for easy access to the fans, belts, motor, sheaves, bearings, all mechanical equipment and complete water distribution system. The fill shall be an acceptable means of accessing these components.
- D. An OSHA approved external service platform shall be provided at the motor access door of the tower extending the full length of the of the access door. Each platform shall have at least a 36" walking surface. The platforms shall be galvanized steel grating, supported by galvanized steel framework attached to the tower and surrounded by a sturdy handrail, knee rail and kick plate system. Mounting channels shall be the same material as the casing section (galvanized or stainless steel). A vertical ladder shall be provided to the platform. This ladder shall extend down to the roof.
- E. This tower will be mounted on steel, ladder extension to be coordinated with final installation height.
- F. The unit shall be equipped with a mechanical equipment removal davit. The motor shall be lowered from the mechanical equipment supports down to grade.

2.08 ACCESSORIES

- A. Electric Immersion Heaters: Cold water basin shall be fitted with copper-element, electric immersion heater(s) with a separate thermostat and low water protection device. Heaters selected to maintain +40 F pan water at 0 F ambient temperature.
- B. Time Delay Relay: Limits fan motor starts to not more than six per hour.
- C. Control Box Enclosure: The closed circuit cooler shall be provided with a NEMA 3R weatherproof and ventilated control box enclosure that will house all of the electronics for the closed circuit cooler.
 - 1. NEMA 1 extended enclosure, to house additional equipment within the VFD enclosure.
 - 2. NEMA 12 FVFF (Forced Ventilation inlet Filter and outlet Filter) enclosures with filters and blower.
 - 3. NEMA 3R enclosures for outdoor installations. For installation in ambient temperature environment above 104°F, de-rate VFD 20% to increase ambient temperature rating to 122°F. For installation in sustained ambient temperature environment below 14°F, include panel space heater.
- D. Sump Sweeper Piping

1. Cold water basin shall be fitted with schedule 80 PVC sump sweeper piping complete with high-flow eductor nozzles to facilitate basin cleaning. The system shall contain one inlet connection and one outlet connecting per basin.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings are ready to receive work.
- B. Verify that required utilities are available, in proper location, and ready to use.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cooler on structural steel beams as instructed by manufacturer.
- C. Connect cooler water piping with flanged connections to cooler.
- D. Connect make-up water piping with flanged or union connections to cooler. Pitch to cooler. Pipe drain, overflow drain, and bleed lint to nearest grade.

3.03 FIELD QUALITY CONTROL

- A. Provide the services of the manufacturer's field representative to inspect each tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

3.04 SYSTEM STARTUP

- A. Prepare and start systems.
- B. Allow one eight hour day per cooler for start-up and instructions of State of Delaware OMB - Division of Facilities Management's operating personnel.

3.05 ADJUSTING

- A. Adjust water level float valves and float controls for proper operating level.
- B. Adjust temperature controls and verify operation.

END OF SECTION

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