ARLINGTON COUNTY, VIRGINIA
OFFICE OF THE PURCHASING AGENT
2100 CLARENDON BOULEVARD, SUITE 500
ARLINGTON, VIRGINIA 22201

CONTRACT AWARD COVERPAGE

TO:	FHP TECTONICS CORP	DATE ISSUED:	FEBRUARY 18, 2023
	5515 N EAST RIVER ROAD	CONTRACT NO:	23-DES-ITBPW-341
	CHICAGO, IL 60656	CONTRACT TITLE:	GENERATOR REPLACMENT FOR ETHAN ALLEN

THIS IS A NOTICE OF AWARD OF CONTRACT AND NOT AN ORDER. NO WORK IS AUTHORIZED UNTIL THE VENDOR RECEIVES A VALID COUNTY PURCHASE ORDER ENCUMBERING CONTRACT FUNDS.

The contract documents consist of the terms and conditions of AGREEMENT No. 23-DES-ITBPW-341 including any attachments or amendments thereto.

EFFECTIVE DATE: MARCH 3, 2023
EXPIRES: JUNE 30, 2024
RENEWALS: NONE
COMMODITY CODE(S): 91230,93639,69045,94163,94172,90977
LIVING WAGE: N

ATTACHMENTS:
AGREEMENT No. 23-DES-ITBPW-341

EMPLOYEES NOT TO BENEFIT:
NO COUNTY EMPLOYEE SHALL RECEIVE ANY SHARE OR BENEFIT OF THIS CONTRACT NOT AVAILABLE TO THE GENERAL PUBLIC.

VENDOR CONTACT: BILL ROCHA VENDOR TEL. NO.: (703) 245-0280

EMAIL ADDRESS: WROCHA@FHPASCHEN.COM

COUNTY CONTACT: REGAN CARVER (DES-WSS) COUNTY TEL. NO.: (703) 228-3602

COUNTY CONTACT EMAIL: RCARVER@ARLINGTONVA.US

PURCHASING DIVISION AUTHORIZATION

Sy Gezachew Title Procurement Officer Date 03/03/23

ARLINGTON COUNTY, VIRGINIA
OFFICE OF THE PURCHASING AGENT
SUITE 500, 2100 CLARENDON BOULEVARD
ARLINGTON, VA 22201

AGREEMENT NO. 23-DES-ITBPW-341

THIS AGREEMENT is made, on 3/3/2023, between **FHP Tectonics Corp., 5515 N East River Road, Chicago, Illinois 60656** ("Contractor") an Illinois corporation authorized to do business in the Commonwealth of Virginia, and the **County Board of Arlington County, Virginia** ("County"). The County and the Contractor, for the consideration hereinafter specified, agree as follows:

1. CONTRACT DOCUMENTS

The Contract Documents consist of:

- Agreement No. 23-DES-ITBPW-341, and all modifications properly incorporated into the Agreement
- Exhibit A – Arlington County Invitation to Bid No. 22-DES-ITBPW-341, including DES General Conditions and Special Conditions (incorporated herein by reference)
- Exhibit B – Specifications, Drawings and Construction Notes
- Exhibit C – Virginia Department Of Labor And Industry Wage Determination Decision
- Exhibit D – Price Bid of Contractor
- Exhibit E – Contractor Performance Evaluation Form

Where the terms and provisions of this Agreement vary from the terms and provisions of the other Contract Documents, the terms and provisions of this Agreement will prevail over the other Contract Documents, and the remaining Contract Documents will be complementary to each other. If there are any conflicts, the most stringent terms or provisions will prevail.

The Contract Documents set forth the entire agreement between the County and the Contractor. The County and the Contractor agree that no representative or agent of either party has made any representation or promise with respect to the parties' agreement that is not contained in the Contract Documents. The Contract Documents may be referred to below as the "Contract" or the "Agreement".

2. SCOPE OF WORK

The Contractor will furnish all labor, materials, and equipment for the construction of generator replacement for Ethan Allen (the "Project") and all other work shown, described, and required by the Contract Documents (hereinafter "the Work").

The Work shall be performed according to the standards established by the Contract Documents read together as a single specification. It shall be the Contractor's responsibility, at solely the Contractor's cost, to provide sufficient services to fulfill the purposes of the Work. Nothing in the Contract Documents shall be construed to limit the Contractor's responsibility to manage the details and execution of its Work.

3. PROJECT OFFICER

The performance of the Contractor is subject to the review and approval of the County Project Officer identified in Section 53, Notices, unless the Contractor is otherwise notified in writing.

4. TIME FOR COMPLETION

Work under this Agreement shall achieve Substantial Completion no later than Four Hundred Thirteen (413) consecutive calendar days after the commencement date given in a Notice to Proceed provided by the County to the Contractor, subject to any modifications made as provided for in the Contract Documents. This Four Hundred Thirteen (413) day period shall be the Period of Performance for Substantial Completion. No Work shall be deemed Substantially Complete until it meets the requirements of Substantial Completion set forth in the General Conditions. Final Completion of the Work shall be completed no later than thirty (30) calendar days after the date of acceptance of Substantial Completion by the County Project Officer. Work will not reach Final Completion until it meets the requirements set forth in the General Conditions.

Unless otherwise provided, no claims for early completion are allowed.

5. CONTRACT AMOUNT

The County will pay the Contractor in accordance with the terms of the Progress Payments and Retainage and Payment Terms sections below and at the prices shown in Exhibit D, for the Contractor's completion of the Work as required by the Contract Documents provided the Work is performed to the satisfaction of and is accepted by the Project Officer. The Contractor will complete the Work for the total amount specified in this section ("Contract Amount") unless such amount is modified as provided in this Agreement. The Contract Amount includes all of the Contractor's costs and fees (profit) and is inclusive of all anticipated or known site conditions, anticipated or known materials, labor, and equipment costs, or any other costs which should reasonably have been expected by the Contract Documents.

6. PROGRESS PAYMENTS AND RETAINAGE

The County will make monthly progress payments to the Contractor upon written application by the Contractor, on the basis of a written estimate of the work performed during the preceding calendar month as approved by the Project Officer. However, 5% of each progress payment will be retained by the County until Final Completion and acceptance of all Work covered by the Agreement.

All material and work covered by partial payments will become the property solely of the County at the time the partial payment is made. However, the Contractor will have the sole responsibility, care and custody for all materials and work upon which payments have been made until Substantial Completion.

When calculating payment for materials on-site, the County shall not pay for materials which are not scheduled for incorporation into the Work within sixty (60) days from the date of application for payment.

7. PAYMENT TERMS

The Contractor must submit invoices to the County's Project Officer, who will either approve the invoice or require corrections. The County will pay the Contractor within 45 days after approval of an invoice for completed work which is reasonable and allocable to the Contract. All payments will be made from the County to the Contractor via ACH. The number of the County Purchase Order pursuant to work has been performed must appear on all invoices.

8. PAYMENT OF SUBCONTRACTORS

The Contractor is wholly responsible for the entire amount owed to any subcontractor with which the Contractor contracts in the performance of this Agreement, regardless of whether the Contractor has received payment from the County. The Contractor is not liable for amounts that are not owed as a result of the subcontractor's breach of its agreement with the Contractor, in which case the Contractor must notify the subcontractor in writing of its intention to withhold payment, in full or in part, and the reason for doing so.

The Contractor is obligated to take one of the two following actions within seven days after receipt of payment by the County for work performed by any subcontractor under this Contract:

a. Pay the subcontractor for the proportionate share of the total payment received from the County attributable to the work performed by the subcontractor under this Contract; or

b. Notify the County and the subcontractor, in writing, of the Contractor's intention to withhold all or a part of the subcontractor's payment with the reason for nonpayment.

The Contractor is obligated to pay interest to the subcontractor on all amounts owed by the Contractor to the subcontractor that remain unpaid after seven days following receipt by the Contractor of payment from the County for work performed by the subcontractor under this Contract, except for amounts withheld as allowed in subsection b., above. Unless otherwise provided under the terms of this Contract, interest will accrue at the rate of 1% per month.

The Contractor must include in each of its subcontracts, if any are permitted, a provision requiring each subcontractor to include or otherwise be subject to the same payment and interest requirements with respect to each lower-tier subcontractor.

The Contractor's obligation to pay an interest charge to a subcontractor pursuant to this section may not be construed to be an obligation of the County. A Contract modification may not be made for the purpose of providing reimbursement for such interest charge. A cost reimbursement claim may not include any amount for reimbursement for such interest charge.

9. PREVAILING WAGE CONTRACT REQUIREMENTS

A. Section 4-104 of the Arlington County Purchasing Resolution (regarding "Prevailing Wage) applies to this Contract. All employees of the Contractor and any subcontractors shall be paid wages, salaries, benefits, and other remuneration at or above the craft or trade category prevailing wage rate indicated by Virginia Commissioner of Labor and Industry (DOLI) and as listed in the contract.

The Contractor and its subcontractors shall submit all certified payrolls and statements of compliance weekly through the eComply website. If the Contractor or any subcontractor does not have an eComply profile, a one-time registration process immediately following the Notice of Award or Notice of Intent to Award and training on system functionality are required for each non-registered entity. The Contractor shall also be responsible for reviewing subcontractor payrolls and ensuring that contract requirements are met.

In addition to applying the prevailing wage rates to its own employees, the Contractor shall include the provisions of this Article 4-104 in every subcontract so that such provisions will be binding upon each subcontractor. The Contractor agrees to assume the obligation that the wage requirements will be observed in fulfilling the requirements of the Contract. The appropriate enforcement sanctions will be invoked against the Contractor and any such subcontractor in the event of such subcontractor's failure to comply with any of the provisions of this Article 4-104.

All wage rates to be used are listed in this Contract in Exhibit C. While DOLI maintains a list of wage determinations online for reference purposes, only the wage determinations made in an official Wage Determination Decision, sent by DOLI to Arlington County, can be used to ascertain the exact rates to be paid for this Contract.

All rates are determined by DOLI and any appeals of specific classification may be made through the Wage Determination Appeal form available at http://www.doli.virginia.gov/wp-content/uploads/2021/04/Appeal-for-Wage-Determination-Clarification.pdf.

B. Upon award of the Contract, the Contractor shall certify, under oath, to the Virginia Commissioner of Labor and Industry and to the County Prevailing Wage Compliance Manager, the pay scale for each craft and trade to be employed for, or to provide labor for, in the Work by the Contractor and any subcontractors. The Contractor's certification shall include all information required by the Code of Virginia § 2.2-4321.3G.

C. The Contractor shall ensure that each individual providing labor as a mechanic, laborer, worker or equivalent shall be accurately classified in confirmation with the Wage Determination.

D. The Contractor shall post the prevailing wage rate for each craft and classification involved as determined by DOLI, including the effective date, in a prominent and easily accessible place at the work site during the time work is being performed. The posting must be in English and any other language that is primarily spoken by the individuals at the work site. Within 10 days of such posting the Contractor shall certify to the County Prevailing Wage Compliance Manager and DOLI its compliance with this subsection at https://www.doli.virginia.gov/wp-content/uploads/2021/04/PW_Posting_Compliance_Form.pdf;

E. The Contractor must fully cooperate with the County Prevailing Wage Compliance Manager to ensure contract compliance requirements ,including but not limited to site visits, wage rate signage, contractor employee interviews, and the submission of certified payroll records.

F. The Contractor must submit to the County Prevailing Wage Compliance Manager and DOLI, within five (5) working days of the end of each month, certification for each craft or trade employed on the project, specifying the total hourly amount paid to employees, including wages

and applicable fringe benefits using the Pay Scale Certification Form at https://www.doli.virginia.gov/wp-content/uploads/2021/04/DOLI-Pay-Scale-Certification-for-Public-Works-Projects.pdf. The certification must itemize the amount paid in wages and each applicable benefit and list the names and addresses of any third party fund, plan or program to which benefit payments will be made on behalf of employees.

G. The Contractor shall indemnify and hold harmless the County from any fines, demands, claims, suits, and damages, including attorney's fees, resulting from the Contractor's or any subcontractor's failure to pay the Prevailing Wage.

H. The Contractor and its subcontractors shall keep, maintain, and preserve (i) records relating to the wages paid to and hours worked by each individual performing the work of any mechanic, laborer, or worker; and (ii) a schedule of the occupation or work classification at which each individual performing the work of any mechanic, laborer, or worker on the construction project is employed each work day and week. The Contractor and its subcontractors shall make such records available to the Prevailing Wage Compliance Manager within 10 days of a request or per a regular schedule established in the Contract, and shall certify that records reflect the actual hours worked and the amount paid to its workers for whatever time period is requested. The Contractor and its subcontractors must preserve these records for a period of six (6) years after the expiration or earlier termination of the applicable contract.

I. Any Contractor or subcontractor who pays any mechanic, laborer, or worker for services under this Contract less than the Prevailing Wage shall be liable to such individuals for the payment of all wages due, plus interest at an annual rate of eight percent (8%) from the dates wages were due; and shall be disqualified from bidding on public contracts with any public body until the Contractor or subcontractor has made full restitution. A willful violation of Article 4-104 is a Class I misdemeanor.

J. For questions regarding Prevailing Wage, please email prevailingwage@arlingtonva.us.

10. RELEASE AND REQUEST FOR FINAL PAYMENT

In order to receive final payment upon Final Completion of the Project and before Final Acceptance, the Contractor must submit to the Project Officer a signed original notarized copy of the Arlington County Release and Request for Final Payment form per the General Conditions.

11. LIQUIDATED DAMAGES

Time is of the essence under this Contract. The Work must be completed within the Time for Completion. The County and the Contractor agree that damages for failure to achieve Substantial Completion of the Work by the date specified under Time for Completion are not susceptible to exact determination but that $1,038.00 per calendar day is in proportion to the actual loss that the County would suffer from such delay. Therefore, the Contractor will pay the County as liquidated damages $1,038.00 per day for each and every day beyond the time for Substantial Completion that the County determines Substantial Completion has not achieved. The County and the Contractor also agree that damages for failure to achieve Final Completion of the Work by the date specified under Time for Completion are not susceptible to exact determination but that $1,038.00 per calendar day is in proportion to the actual loss the County would suffer from such delay. Therefore, the Contractor will pay the County as liquidated damages $1,038.00 per day for each and every day beyond the time for Final Completion until Final Completion is achieved.

The County will be entitled to deduct liquidated damages against any sums owed by the County to the Contractor under this Contract. The Contractor hereby waives any defense as to the validity of any liquidated damages on grounds that such liquidated damages are void as penalties or are not reasonably related to actual damages.

12. NON-APPROPRIATION

All payments by the County to the Contractor pursuant to this Contract are subject to the availability of an annual appropriation for this purpose by the County Board of Arlington County, Virginia ("Board"). In the event that the Board does not appropriate funds for the goods or services provided under this Contract, the County will terminate the Contract, without termination charge or other liability to the County, on the last day of the fiscal year or when the previous appropriation has been spent, whichever occurs first.

13. ESTIMATED QUANTITIES/NON-EXCLUSIVITY OF CONTRACTOR

This Contract does not obligate the County to purchase a specific quantity of items or services during Contract Term. Any quantities that are included in the Contract Documents are the present expectations of the County for the period of the Contract; and the County is under no obligation to buy that or any amount as a result of having provided this estimate or of having had any normal or otherwise measurable requirement in the past. The County may require more goods and/or services than the estimated annual quantities, and any such additional quantities will not give rise to any claim for compensation other than at the unit prices and/or rates in the Contract.

The County does not guarantee that the Contractor will be the exclusive provider of the goods or services covered by this Contract. The items or services covered by this Contract may be or become available under other County contract(s), and the County may determine that it is in its best interest to procure the items or services through those contract(s).

14. COUNTY PURCHASE ORDER REQUIREMENT

County purchases are authorized only if the County issues a Purchase Order in advance of the transaction, indicating that the ordering County agency has sufficient funds available to pay for the purchase. If the Contractor provides goods or services without a signed County Purchase Order, it does so at its own risk and expense. The County will not be liable for payment for any purchases made by its employees that are not authorized by the County Purchasing Agent.

15. LIEN

It is expressly agreed that after any payment has been made by the County either to the Contractor for work done, or labor or material supplied under the Contract, the County will have a lien upon all material delivered to the site either by the Contractor, or for the Contractor, which is to be used in the performance of the Contract.

16. VALUE ENGINEERING PROPOSAL (VEP)

Unless otherwise provided, the Contractor may submit to the County a written VEP for modifying the plans, specifications, or other requirements of the Agreement covering the work (Contract) for the purpose of reducing the total cost of the Contract without reducing the design capacity or quality of the finished product. If the VEP is accepted by the County, the net savings will be equally divided by the County and the Contractor.

Each VEP shall result in a net savings over the Contract cost without impairing essential functions and characteristics of the item(s) or of any other part of the project, including, but not limited to, service life, reliability, economy of operation, ease of maintenance, aesthetics, and safety. At least the following information shall be submitted with each VEP:

(a) a statement that the proposal is submitted as a VEP;

(b) a statement concerning the basis for the VEP, benefits to the County, and an itemization of the Contract items and requirements affected by the VEP;

(c) a detailed estimate of the cost under the existing Contract and under the VEP;

(d) proposed specifications and recommendations as to the manner in which the VEP changes are to be accomplished; and

(e) a statement as to the time by which a Contract Amendment adopting the VEP must be issued so as to obtain the maximum cost-effectiveness.

The County will process the VEP in the same manner as prescribed for any other proposal that would necessitate issuance of an Amendment. The County may accept a VEP in whole or part by issuing an Amendment that will identify the VEP on which it is based. The County will not be liable to the Contractor for failure to accept or act on any VEP submitted pursuant to these requirements or for delays in the work attributable to any VEP. Until a VEP is put into effect by an Amendment, the Contractor shall remain obligated to the terms and conditions of the existing Agreement. If an executed Amendment has not been issued by the date on which the Contractor's proposal specifies that a decision should be made or such other date as the Contractor may subsequently have specified in writing, the VEP shall be deemed rejected.

The Amendment effecting the necessary modification of the Contract will establish the net savings agreed on, provide for adjustment of the contract prices, and indicate the net savings. The Contractor shall absorb all costs incurred in preparing a VEP. Reasonably incurred costs for reviewing and administering a VEP will be borne by the County. The County may establish any reasonable conditions it deems appropriate for consideration, approval, and implementation of the VEP. The Contractor's 50 percent share of the net savings shall constitute full compensation to it, including by way of illustration and not limitation compensation for time, for effecting all changes pursuant to the Amendment.
Unless specifically provided for in the Amendment authorizing the VEP, acceptance of the VEP and performance of the work thereunder will not change the Contract Term limit.

The County may adopt a VEP for general use in contracts administered by the County if it determines that the VEP is suitable for application to other contracts. A VEP identical with or similar to a previously submitted VEP will be eligible for consideration and compensation under these provisions if it has not been previously adopted for general application to other contracts administered by the County. When a VEP is adopted for general use, compensation pursuant to these requirements will be applied only to those awarded contracts for which the VEP was submitted prior to the date of adoption of the VEP.

If a VEP is based on or is similar to a change in the plans, specifications, or special provisions adopted by the County prior to submission of the VEP, as determined by the County, the County will not accept the VEP.

The County will be the sole judge of the acceptability of a VEP. The requirements herein apply to each VEP initiated, developed, and identified as such by the Contractor at the time of its submission to the County. However, nothing herein shall be construed as requiring the County to consider or approve a VEP, and the decision to enter into an Amendment to the contract to accommodate a VEP shall be in the County's sole discretion.

Subject to the provisions contained herein, the County, or any other public agency with the County's permission, shall have the right to use all or part of an accepted VEP without obligation or compensation of any kind to the Contractor.

If a VEP is accepted by the County, any provisions herein that pertain to the adjustment of contract unit prices attributable to alterations of contract quantities will not apply to the items adjusted or deleted as a result of putting the VEP into effect by an Amendment.

17. EMPLOYMENT DISCRIMINATION BY CONTRACTOR PROHIBITED

During the performance of its work pursuant to this Contract:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, sexual orientation, gender identity, national origin, age, disability or on any other basis prohibited by state law. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

B. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation will be deemed sufficient for meeting the requirements of this section.

C. The Contractor will state in all solicitations or advertisements for employees that it places or causes to be placed that such Contractor is an Equal Opportunity Employer.

D. The Contractor will comply with the provisions of the Americans with Disabilities Act of 1990 (“ADA”), which prohibits discrimination against individuals with disabilities in employment and mandates that disabled individuals be provided access to publicly and privately provided services and activities.

E. The Contractor must include the provisions of the foregoing paragraphs in every subcontract or purchase order of more than $10,000.00 relating to this Contract so that the provisions will be binding upon each subcontractor or vendor.

18. EMPLOYMENT OF UNAUTHORIZED ALIENS PROHIBITED

In accordance with §2.2-4311.1 of the Code of Virginia, as amended, the Contractor must not during the performance of this Contract knowingly employ an unauthorized alien, as that term is defined in the federal Immigration Reform and Control Act of 1986.

19. DRUG-FREE WORKPLACE TO BE MAINTAINED BY CONTRACTOR

During the performance of this Contract, the Contractor must: (i) provide a drug-free workplace for its employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor's workplace and

specifying the actions that will be taken against employees for violating such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of more than $10,000.00 relating to this Contract so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "workplace" means the site(s) for the performance of the work required by this Contract.

20. *SEXUAL HARASSMENT POLICY

If the Contractor employs more than five employees, the Contractor shall (i) provide annual training on the Contractor's sexual harassment policy to all supervisors and employees providing services in the Commonwealth, except such supervisors or employees that are required to complete sexual harassment training provided by the Department of Human Resource Management, and (ii) post the Contractor's sexual harassment policy in (a) a conspicuous public place in each building located in the Commonwealth that the Contractor owns or leases for business purposes and (b) the Contractor's employee handbook.

21. COVID-19 VACCINATION POLICY FOR CONTRACTORS

Due to the ongoing COVID-19 pandemic, the County has taken various steps to protect the welfare, health, safety, and comfort of the workforce and public at large. As part of these steps, the County has implemented various requirements with respect to health and safety including policies with respect to social distancing, the use of face-coverings and vaccine mandates. To protect the County's workforce and the public at large, all employees and subcontractors of the Contractor who are assigned to this Contract, should be fully vaccinated against COVID-19. Any contractor employee or subcontractor who is not fully vaccinated should be following a weekly testing protocol as established by the Contractor, unless exempt pursuant to a valid reasonable accommodation under state or federal law.

22. PROJECT STAFF

The County has the right to reasonably reject staff or subcontractors whom the Contractor assigns to the Project. The Contractor must then provide replacement staff or subcontractors satisfactory to the County in a timely manner and at no additional cost to the County. The day-to-day supervision and control of the Contractor's employees and its subcontractors is the sole responsibility of the Contractor.

23. FAILURE TO DELIVER

If the Contractor fails to deliver goods or services in accordance with the Contract terms and conditions, the County, after notice to the Contractor, may procure the goods or services from other sources and hold the Contractor responsible for any resulting additional purchase and administrative costs. The County shall be entitled to offset such costs against any sums owed by the County to the Contractor. However, if public necessity requires the use of nonconforming materials or supplies, they may be accepted at a reduction in price to be determined solely by the County.

24. UNSATISFACTORY WORK

If any of the work done, or material, goods, or equipment provided by the Contractor, is unsatisfactory to the County the Contractor must, upon notice from the County, immediately remove at the Contractor's expense such unsatisfactory work, material, goods, or equipment and replace the same with work, material, goods, or equipment satisfactory to the County. If the Contractor fails to do so after fifteen (15) days the County shall have the right to remove or replace the rejected work, material, goods, or equipment at the expense of the Contractor and offset the expense and administrative costs against any

sums owed to the Contractor. This provision applies during the Contract term and during any warranty or guarantee period. At the Project Officer's discretion, rather than correction or replacement of the work, an appropriate adjustment to the Contract Amount may be made.

25. TERMINATION

The County may terminate this Contract at any time as follows: (1) for cause, if, as determined by the County, the Contractor is in breach or default or has failed to perform the Work satisfactorily; or (2) for the convenience of the County.

Upon receipt of a notice of termination, the Contractor must not place any further orders or subcontracts for materials, services or facilities; must terminate all vendors and subcontracts, except as are necessary for the completion of any portion of the Work that the County did not terminate; and must immediately deliver all documents related to the terminated Work to the County.
Any purchases that the Contractor makes after the notice of termination will be the sole responsibility of the Contractor, unless the County has approved the purchases in writing as necessary for completion of any portion of the Work that the County did not terminate.

If any court of competent jurisdiction finds a termination for cause by the County to be improper, then the termination will be deemed a termination for convenience.

A. TERMINATION FOR CAUSE, INCLUDING BREACH AND DEFAULT; CURE

1. Termination for Unsatisfactory Performance. If the County determines that the Contractor has failed to perform satisfactorily, then the County will give the Contractor written notice of such failure(s) and the opportunity to cure them within 15 days or any other period specified by the County ("Cure Period"). If the Contractor fails to cure within the Cure Period, the County may terminate the Contract for failure to provide satisfactory performance by providing written notice with a termination date. Upon such termination, the Contractor may apply for compensation for Contract services that the County previously accepted ("Termination Costs"), unless payment is otherwise barred by the Contract. The Contractor must submit any request for Termination Costs, with all supporting documentation, to the County Project Officer within 30 days after the expiration of the Cure Period. The County may accept or reject the request for Termination Costs, in whole or in part, and may notify the Contractor of its decision within a reasonable time.

   In the event of termination by the County for failure to perform satisfactorily, the Contractor must continue to provide its services as previously scheduled through the termination date, and the County must continue to pay all fees and charges incurred through the termination date.

2. Termination for Breach or Default. If the County terminates the Contract for default or breach of any Contract provision or condition, then the termination will be immediate after notice of termination to the Contractor (unless the County provides for an opportunity to cure), and the Contractor will not be permitted to seek Termination Costs.

   Upon any termination pursuant to this section, the Contractor will be liable to the County for costs that the County must expend to complete the Work, including costs resulting from any related delays and from unsatisfactory or non-compliant work performed by the

Contractor or its subcontractors. The County will deduct such costs from any amount due to the Contractor; or if the County does not owe the Contractor, the Contractor must promptly pay the costs within 15 days of a demand by the County. This section does not limit the County's recovery of any other damages to which it is entitled by law.

Except as otherwise directed by the County, the Contractor must stop work on the date of receipt the notice of the termination.

B. TERMINATION FOR THE CONVENIENCE OF THE COUNTY

The County may terminate this Contract in whole or in part whenever the Purchasing Agent determines that termination is in the County's best interest. The County will give the Contractor at least 15 days' notice in writing. The notice must specify the extent to which the Contract is terminated and the effective termination date. The Contractor will be entitled to Termination Costs, as defined above, plus any other reasonable amounts that the parties might negotiate; but no amount will be allowed for anticipatory profits.

Except as otherwise directed by the County, the Contractor must stop work on the date of receipt of the notice of the termination.

26. INDEMNIFICATION

The Contractor covenants for itself, its employees and its subcontractors to save, defend, hold harmless and indemnify the County and all of its elected and appointed officials, officers, current and former employees, agents, departments, agencies, boards and commissions (collectively the "County Indemnitees") from and against any and all claims made by third parties for any and all losses, damages, injuries, fines, penalties, costs (including court costs and attorneys' fees), charges, liability, demands or exposure resulting from, arising out of or in any way connected with the Contractor's acts or omissions, including the acts or omissions of its employees, vendors, delivery drivers and/or subcontractors, in performance or nonperformance of the Contract. This duty to save, defend, hold harmless and indemnify will survive the termination of this Contract. If the Contractor fails or refuses to fulfill its obligations contained in this section, the Contractor must reimburse the County for any and all resulting payments and expenses, including reasonable attorneys' fees. The Contractor must pay such expenses upon demand by the County, and failure to do so may result in the County withholding such amounts from any payments to the Contractor under this Contract.

27. INTELLECTUAL PROPERTY INDEMNIFICATION

The Contractor warrants and guarantees that in providing services under this Contract neither the Contractor nor any subcontractor is infringing on the intellectual property rights (including, but not limited to, copyright, patent, mask and trademark) of third parties.

If the Contractor or any of its employees or subcontractors uses any design, device, work or material that is covered by patent or copyright, it is understood that the Contract Amount includes all royalties, licensing fees, and any other costs arising from such use in connection with the Work under this Contract.

The Contractor covenants for itself, its employees and its subcontractors to save, defend, hold harmless, and indemnify the County Indemnitees, as defined above, from and against any and all claims, losses, damages, injuries, fines, penalties, costs (including court costs and attorneys' fees), charges, liability or exposure for infringement of or on account of any trademark, copyright, patented or unpatented invention, process or article manufactured or used in the performance of this Contract. This duty to save,

defend, hold harmless and indemnify will survive the termination of this Contract. If the Contractor fails or refuses to fulfill its obligations contained in this section, the Contractor must reimburse the County for any and all resulting payments and expenses, including reasonable attorneys' fees. The Contractor must pay such expenses upon demand by the County, and failure to do so may result in the County withholding such amounts from any payments to the Contractor under this Contract.

28. COPYRIGHT

By this Contract, the Contractor irrevocably transfers, assigns, sets over and conveys to the County all rights, title and interest, including the sole exclusive and complete copyright interest, in any and all copyrightable works created pursuant to this Contract. The Contractor will execute any documents that the County requests to formalize such transfer or assignment.

The rights granted to the County by this section are irrevocable and may not be rescinded or modified, including in connection with or as a result of the termination of or a dispute concerning this Contract.
The Contractor may not use subcontractors or third parties to develop or provide input into any copyrightable materials produced pursuant to this Contract without the County's advance written approval and unless the Contractor includes this Copyright provision in any contract or agreement with such subcontractors or third parties related to this Contract.

29. OWNERSHIP AND RETURN OF RECORDS

This Contract does not confer on the Contractor any ownership rights or rights to use or disclose the County's data or inputs.

All drawings, specifications, blueprints, data, information, findings, memoranda, correspondence, documents or records of any type, whether written, oral or electronic, and all documents generated by the Contractor or its subcontractors as a result of this Contract (collectively "Records") are the exclusive property of the County and must be provided or returned to the County upon completion, termination, or cancellation of this Contract. The Contractor will not use or willingly cause or allow such materials to be used for any purpose other than performance of this Contract without the written consent of the County.

The Records are confidential, and the Contractor will neither release the Records nor share their contents. The Contractor will refer all inquiries regarding the status of any Record to the Project Officer or to his or her designee. At the County's request, the Contractor will deliver all Records, including hard copies of electronic records, to the Project Officer and will destroy all electronic Records.

The Contractor agrees to include the provisions of this section as part of any contract or agreement related to this Contract into which it enters with subcontractors or other third parties.
The provisions of this section will survive any termination or cancellation of this Contract.

30. CONFIDENTIAL INFORMATION

The Contractor and its employees, agents and subcontractors will hold as confidential all County information obtained under this Contract. Confidential information includes, but is not limited to, nonpublic personal information; personal health information (PHI); social security numbers; addresses; dates of birth; other contact information or medical information about a person; and information pertaining to products, operations, systems, customers, prospective customers, techniques, intentions, processes, plans and expertise. The Contractor must take reasonable measures to ensure that all of its employees, agents and subcontractors are informed of and abide by this requirement.

31. ETHICS IN PUBLIC CONTRACTING

This Contract incorporates by reference Article 9 of the Arlington County Purchasing Resolution, as well as all state and federal laws related to ethics, conflicts of interest or bribery, including the State and Local Government Conflict of Interests Act (Code of Virginia § 2.2-3100 et seq.), the Virginia Governmental Frauds Act (Code of Virginia § 18.2-498.1 et seq.) and Articles 2 and 3 of Chapter 10 of Title 18.2 of the Code of Virginia, as amended (§ 18.2-438 et seq.). The Contractor certifies that its bid was made without

collusion or fraud; that it has not offered or received any kickbacks or inducements from any other offeror, supplier, manufacturer or subcontractor; and that it has not conferred on any public employee having official responsibility for this procurement any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.

32. COUNTY EMPLOYEES

No Arlington County employee may share in any part of this Contract or receive any benefit from the Contract that is not available to the general public.

33. FORCE MAJEURE

Neither party will be held responsible for failure to perform the duties and responsibilities imposed by this Contract if such failure is due to a fire, riot, rebellion, natural disaster, war, act of terrorism or act of God that is beyond the control of the party and that makes performance impossible or illegal, unless otherwise specified in the Contract, provided that the affected party gives notice to the other party as soon as practicable after the force majeure event, including reasonable detail and the expected duration of the event's effect on the party.

34. AUTHORITY TO TRANSACT BUSINESS

The Contractor must, pursuant to Code of Virginia § 2.2-4311.2, be and remain authorized to transact business in the Commonwealth of Virginia during the entire term of this Contract. Otherwise, the Contract is voidable at the sole option of and with no expense to the County.

35. RELATION TO THE COUNTY

The Contractor is an independent contractor, and neither the Contractor nor its employees or subcontractors will be considered employees, servants or agents of the County. The County will not be responsible for any negligence or other wrongdoing by the Contractor or its employees, servants or agents. The County will not withhold payments to the Contractor for any federal or state unemployment taxes, federal or state income taxes or Social Security tax or for any other benefits. The County will not provide to the Contractor any insurance coverage or other benefits, including workers' compensation.

36. ANTITRUST

The Contractor conveys, sells, assigns and transfers to the County all rights, title and interest in and to all causes of action under state or federal antitrust laws that the Contractor may have relating to this Contract.

37. REPORT STANDARDS

The Contractor must submit all written reports required by this Contract for advance review in a format approved by the Project Officer. Reports must be accurate and grammatically correct and should not contain spelling errors. The Contractor will bear the cost of correcting grammatical or spelling errors and

inaccurate report data and of other revisions that are required to bring the report(s) into compliance with this section.

Whenever possible, proposals must comply with the following guidelines:

- printed double-sided on at least 30% recycled-content and/or tree-free paper
- recyclable and/or easily removable covers or binders made from recycled materials (proposals with glued bindings that meet all other requirements are acceptable)
- avoid use of plastic covers or dividers
- avoid unnecessary attachments or documents or superfluous use of paper (e.g. separate title sheets or chapter dividers)

38. AUDIT

The Contractor must retain all books, records and other documents related to this Contract for at least five (5) years, unless otherwise specified in the Contract, or such period of time required by the County's funding partner(s), if any, whichever is greater, after the final payment and must allow the County or its authorized agents to examine the documents during this period and during the Contract Term. The Contractor must provide any requested documents to the County for examination within 15 days of the request, at the Contractor's expense. Should the County's examination reveal any overcharging by the Contractor, the Contractor must, within 30 days of County's request, reimburse the County for the overcharges and for the reasonable costs of the County's examination, including, but not limited to, the services of external audit firm and attorney's fees; or the County may deduct the overcharges and examination costs from any amount that the County owes to the Contractor. If the Contractor wishes to destroy or dispose of any records related to this Contract (including confidential records to which the County does not have ready access) within five (5) years after the final payment, unless otherwise specified in the Contract, or such period of time required by the County's funding partner(s), if any, whichever is greater, the Contractor must give the County at least 30 days' notice and must not dispose of the documents if the County objects.

The Purchasing Agent may require the Contractor to demonstrate that it has the necessary facilities, ability, and financial resources to comply with the Contract and furnish the service, material or goods specified herein in a satisfactory manner at any time during the term of this Contract.

39. ASSIGNMENT

The Contractor may not assign, transfer, convey or otherwise dispose of any award or any of its rights, obligations or interests under this Contract without the prior written consent of the County.

40. AMENDMENTS

This Contract may not be modified except by written amendment executed by persons duly authorized to bind the Contractor and the County.

41. ARLINGTON COUNTY PURCHASING RESOLUTION AND COUNTY POLICIES

Nothing in this Contract waives any provision of the Arlington County Purchasing Resolution, which is incorporated herein by reference, or any applicable County policy.

42. DISPUTE RESOLUTION

All disputes arising under this Agreement or concerning its interpretation, whether involving law or fact and including but not limited to claims for additional work, compensation or time, and all claims for

alleged breach of contract must be submitted in writing to the Project Officer as soon as the basis for the claim arises. In accordance with the Arlington County Purchasing Resolution, claims denied by the Project Officer may be submitted to the County Manager in writing no later than 60 days after the final payment. The time limit for a final written decision by the County Manager is 30 days. Procedures concerning contractual claims, disputes, administrative appeals and protests are contained in the Arlington County Purchasing Resolution. The Contractor must continue to work as scheduled pending a decision of the Project Officer, County Manager, County Board or a court of law.

43. APPLICABLE LAW, FORUM, VENUE, AND JURISDICTION

This Contract is governed in all respects by the laws of the Commonwealth of Virginia; and the jurisdiction, forum and venue for any litigation concerning the Contract or the Work is in the Circuit Court for Arlington County, Virginia, and in no other court.

44. ARBITRATION

No claim arising under or related to this Contract may be subject to arbitration.

45. NONEXCLUSIVITY OF REMEDIES

All remedies available to the County under this Contract are cumulative, and no remedy will be exclusive of any other at law or in equity.

46. NO WAIVER

The failure to exercise a right provided for in this Contract will not be a subsequent waiver of the same right or of any other right.

47. SEVERABILITY

The sections, paragraphs, clauses, sentences, and phrases of this Contract are severable; and if any section, paragraph, clause, sentence or phrase of this Contract is declared invalid by a court of competent jurisdiction, the rest of the Contract will remain in effect.

48. ATTORNEY'S FEES

In the event that the County prevails in any legal action or proceeding brought by the County to enforce any provision of this Contract, the Contractor will pay the County's reasonable attorney's fees and expenses.

49. SURVIVAL OF TERMS

In addition to any statement that a specific term or paragraph survives the expiration or termination of this Contract, the following sections also survive: INDEMNIFICATION; INTELLECTUAL PROPERTY INDEMNIFICATION; RELATION TO COUNTY; OWNERSHIP AND RETURN OF RECORDS; AUDIT; COPYRIGHT; DISPUTE RESOLUTION; APPLICABLE LAW AND JURISDICTION; ATTORNEY'S FEES, AND CONFIDENTIAL INFORMATION.

50. HEADINGS

The section headings in this Contract are inserted only for convenience and do not affect the substance of the Contract or limit the sections' scope.

51. AMBIGUITIES

The parties and their counsel have participated fully in the drafting of this Agreement; and any rule that ambiguities are to be resolved against the drafting party does not apply. The language in this Agreement is to be interpreted as to its plain meaning and not strictly for or against any party.

52. NOTICES

Unless otherwise provided in writing, all legal notices and other formal communications required by this Contract are deemed to have been given when either (a) delivered in person; (b) delivered by an agent, such as a delivery service; or (c) deposited in the United States mail, postage prepaid, certified or registered and addressed as follows:

TO THE CONTRACTOR:
Bill Rocha
FH Pashen
2010 Corporate Rodge, Suite 400
McLean, Virginia 22102
Phone: (703) 245-0280
Email: wrocha@fhpaschen.com

TO THE COUNTY:

Regan Carver, Project Officer
DES – Water, Sewer and Streets Bureau
4200 28th St S
Arlington, Virginia 22206
Phone: (703) 228-3602
Email: rcarver@arlingtonva.us

AND

Dr. Sharon T. Lewis, LL.M, MPS, VCO, CPPB
Purchasing Agent
Arlington County, Virginia
2100 Clarendon Boulevard, Suite 500
Arlington, Virginia 22201
Phone: (703) 228-3294
Email: slewis1@arlingtonva.us

TO COUNTY MANAGER'S OFFICE (FOR PROJECT CLAIMS):

County Manager
Arlington County, Virginia
2100 Clarendon Boulevard, Suite 318
Arlington, Virginia 22201

53. NON-DISCRIMINATION NOTICE

Arlington County does not discriminate against faith-based organizations.

54. INSURANCE, PAYMENT AND PERFORMANCE BONDS

The Contractor shall maintain the required insurance coverage and payment and performance bonds as set forth in the Invitation to Bid through completion of the Contract, including all warranty and guarantee periods.

55. MATERIAL CHANGES

The Contractor shall notify Purchasing Agent within seven days of any material changes in its operation that relate to any matter attested regarding certifications on its bid form.

56. CONTRACTOR PERFORMANCE EVALUATION

Arlington County will perform written evaluations of the Contractor's performance at various intervals throughout the term of this Contract. The evaluations will address, at a minimum, the Contractor's work/performance, quality, cost controls, schedule, timeliness and sub-contractor management. The Project Officer shall be responsible for completing the evaluations and providing a copy to the Contractor and County Procurement Officer.

57. COUNTERPARTS

This Agreement may be executed in one or more counterparts and all of such counterparts shall together constitute one and the same instrument. Original signatures transmitted and received via facsimile or other electronic transmission (e.g., PDF or similar format) are true and valid signatures for all purposes hereunder and shall be effective as delivery of a manually executed original counterpart.

WITNESS these signatures:

THE COUNTY BOARD OF ARLINGTON COUNTY, VIRGINIA	FHP TECTONICS CORP.
AUTHORIZED SIGNATURE: DocuSigned by: Sy Gezachew 27FC198F4A6D475...	AUTHORIZED SIGNATURE: DocuSigned by: William Rocha 1F41DCDF3B254A6...
NAME Sy Gezachew	NAME: William Rocha
TITLE: PROCUREMENT OFFICER	TITLE: Vice President
DATE: 3/3/2023	DATE: 2/27/2023

ARLINGTON
VIRGINIA

NEW GENERATOR AND TEMPORARY GENERATOR CONNECTION FOR PUMPING STATIONS FT. ETHAN ALLEN

FINAL CONSTRUCTION DOCUMENTS
MAY 17, 2019

GES
Global Engineering Solutions®

ENGINEERING
PROGRAM MANAGEMENT
CONSTRUCTION MANAGEMENT

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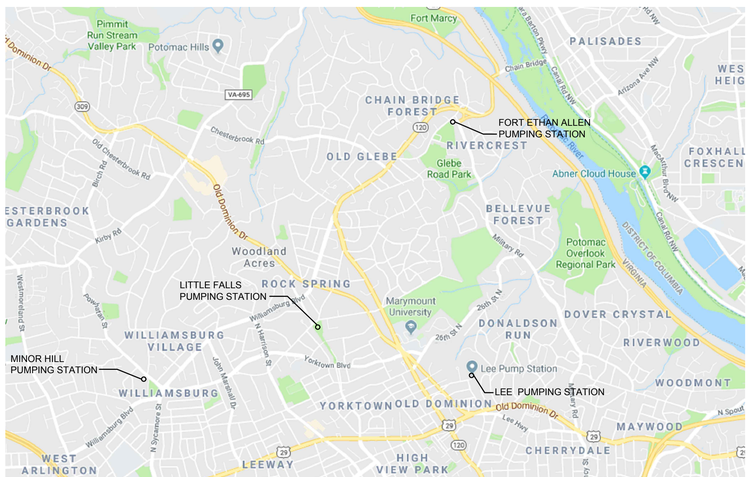
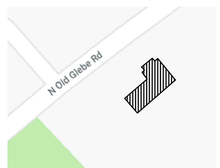
BETHESDA, MARYLAND 20817
(T) 301-216-2871 (F) 301-216-9671
www.THEGES.com

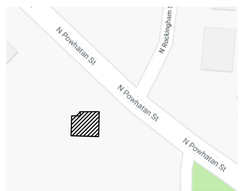
VICINITY MAP



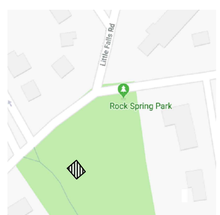
KEY PLAN



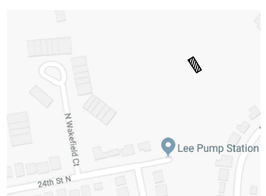
FORT ETHAN ALLEN PUMPING STATION
4401 N. Old Glebe Road
Arlington, VA 22207



MINOR HILL PUMPING STATION
3600 N. Powhatan Street
Arlington, VA 22213



LITTLE FALLS PUMPING STATION
5012 Little Falls Road
Arlington, VA 22207



LEE PUMPING STATION
2400 N. Wakefield Street
Arlington, VA 22207

DRAWING INDEX

DRAWING	TITLE	SHEET
G001	COVER SHEET	1
E001	ELECTRICAL COVER SHEET	2
ED120EA	FLOOR PLAN AND SINGLE LINE DIAGRAM - EXISTING/DEMOLITION (ETHAN ALLEN)	3
E120EA	FLOOR PLAN AND SINGLE LINE DIAGRAM - EXISTING/NEW (ETHAN ALLEN)	4
M001	MECHANCIAL COVER SHEET	5
M110EA	MECHANCIAL PLANS & SCHEMATICS (ETHAN ALLEN)	6
S120EA	FT ETHAN ALLEN PUMPING STATION EQUIPMENT PADS	7

ARLINGTON
VIRGINIA

DEPARTMENT OF
ENVIRONMENTAL SERVICES

Engineering & Capital Projects Division
Engineering Bureau
2100 Clarendon Boulevard, Suite 813
Arlington, VA 22201
Phone: 703.228.3629
Fax: 703.228.3606

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6700A ROCKLEDGE DRIVE, SUITE 301
BETHESDA, MARYLAND 20817
(T) 301-216-2871 (F) 301-216-9671

www.THEGES.com

PROJECT:

NEW GENERATOR AND TEMPORARY GENERATOR CONNECTION FOR PUMPING STATIONS

REVISIONS:

-	-

REGISTRATION:

COMMONWEALTH OF VIRGINIA
FARSHAD MAJIDIAN
No. 0402 029158
PROFESSIONAL ENGINEER

DRAWN BY:	CS
DATE:	05-17-2019
PROJECT NO.:	F18-14

DRAWING TITLE:

COVER SHEET

DRAWING NUMBER

G001

ELECTRICAL NOTES

GENERAL NOTES

1. ALL WORK SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER.
2. INSTALL A FIRE STOP OF ROCKWOOL FIBER OR SILICON FOAM SEALANT TO PROVIDE AN EFFECTIVE BARRIER AGAINST THE SPREAD OF FIRE AND SMOKE WHERE CONDUITS, WIREWAYS, AND OTHER ELECTRICAL RACEWAYS PASS THROUGH FIRE RATED PARTITIONS AND/OR SLABS.
3. ALL CERTIFICATES OF APPROVAL SHALL BE IN TRIPLICATE, DELIVERED TO THE ENGINEER, AND BECOME THE PROPERTY OF THE OWNER.
4. CONTRACTOR SHALL VERIFY ALL EQUIPMENT REQUIREMENTS BEFORE INSTALLING CONDUIT OR CONDUCTORS FROM POWER SOURCE TO EQUIPMENT TERMINATION.
5. ALL ELECTRICAL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE LATEST ADOPTED NATIONAL ELECTRICAL CODE AND ALL OTHER LOCAL CODES AND AUTHORITIES HAVING JURISDICTION.
6. THE DRAWINGS, WHICH CONSTITUTE A PART OF THIS CONTRACT, INDICATE THE GENERAL ARRANGEMENT EQUIPMENT, CONDUIT AND OTHER WORK. ALL ITEMS NOT SPECIFICALLY MENTIONED HEREIN, WHICH ARE NECESSARY TO MAKE A COMPLETE WORKING INSTALLATION, SHALL BE INCLUDED AT NO EXTRA COST.
7. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO EXAMINE AND TO COORDINATE WITH THE STRUCTURAL, AND MECHANICAL DRAWINGS IN ORDER TO BECOME FAMILIAR WITH ALL ASPECTS OF THE DESIGN AFFECTING THE ELECTRICAL WORK.
8. CONTRACTOR SHALL COORDINATE MOUNTING LOCATIONS OF ALL NEW ELECTRICAL DEVICES AND EQUIPMENT PRIOR TO COMMENCEMENT OF WORK.
9. ALL ELECTRICAL MATERIALS SHALL BE NEW EXCEPT WHERE SPECIFICALLY NOTED AS EXISTING TO BE REUSED. ALL MATERIAL SHALL BE LISTED BY THE UNDERWRITERS LABORATORIES, INC. (UL). DEFECTIVE EQUIPMENT AND/OR EQUIPMENT DAMAGED DURING INSTALLATION AND/OR TESTING SHALL BE REPLACED OR REPAIRED IN A MANNER MEETING THE APPROVAL OF THE ENGINEER.
10. ALL WORK SHALL BE SUBJECT TO THE APPROVAL OF THE OWNER OR OWNER'S AUTHORIZED REPRESENTATIVE.
11. MODIFICATIONS TO EXISTING PANELBOARDS AND SWITCHBOARDS: THE CONTRACTOR SHALL PROVIDE NEW CIRCUIT BREAKERS AND/OR FUSED SWITCHES AS REQUIRED. NEW EQUIPMENT SHALL MATCH EXISTING INSTALLED EQUIPMENT AND SHALL BE OF THE SAME MANUFACTURER AND TYPE AS SIMILAR EXISTING EQUIPMENT. INTERRUPTING RATING OF EQUIPMENT SHALL BE THE SAME AS OF THE EXISTING EQUIPMENT.
12. INTERRUPTION OF ELECTRICAL POWER: THE CONTRACTOR SHALL COORDINATE ALL WORK REQUIRING INTERRUPTION OF ELECTRICAL POWER WITH ARLINGTON COUNTY AND SHALL OBTAIN WRITTEN PERMISSION. PRIOR TO SHUTTING DOWN POWER TO ANY SWITCHBOARD.
13. SITE VISIT: PRIOR TO SUBMITTING HIS BID, THE CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH ALL EXISTING CONDITIONS. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN ADVANCE OF ANY CONDITIONS THAT EXIST THAT WOULD PREVENT THE WORK HEREIN SPECIFIED OR SHOWN ON THE DRAWINGS FROM BEING PERFORMED. FAILURE TO SURVEY THE SITE PRIOR TO BID AND START OF CONSTRUCTION WILL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY TO INSTALL DESIGN WITHIN THE CONFINES OF THE EXISTING CONDITIONS.
14. GUARANTEE: THE CONTRACTOR SHALL LEAVE THE ENTIRE ELECTRICAL SYSTEM INSTALLED UNDER THIS CONTRACT IN PROPER WORKING ORDER AND SHALL, WITHOUT CHARGE, REPLACE ANY WORK OR MATERIALS WHICH DEVELOP DEFECTS, EXCEPT FROM ORDINARY WEAR AND TEAR, WITHIN ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE. BENEFICIAL USE SHALL NOT BE CONSTRUED AS FINAL ACCEPTANCE. THE CONTRACTOR SHALL, DURING THE ONE YEAR GUARANTEE PERIOD, BE RESPONSIBLE FOR THE PROPER REPAIR AND ADJUSTMENTS OF ALL ELECTRICAL SYSTEMS AND EQUIPMENT, APPARATUS, DEVICES, ETC. INSTALLED BY HIM, AND DO ALL WORK NECESSARY TO ENSURE EFFICIENT AND PROPER FUNCTIONING. PRIOR TO THE EXPIRATION OF THE GUARANTEE PERIOD, APPROXIMATELY 11 MONTHS AFTER FINAL ACCEPTANCE OF THIS PROJECT, A POST CONSTRUCTION REVIEW OF THE PROJECT WILL BE MADE.
15. THE CONTRACTOR SHALL FURNISH PERSONNEL TO ASSIST THE COUNTY IN THIS REVIEW. ANY ADJUSTMENTS, REPAIRS OR REPLACEMENTS FOUND NECESSARY DURING REVIEW SHALL BE DONE BY THE CONTRACTOR, AT NO ADDITIONAL COST TO THE COUNTY.
16. THE CONTRACTOR SHALL BE RESPONSIBLE FOR, AND SHALL INCUR FINANCIAL RESPONSIBILITY FOR ANY DAMAGES CAUSED BY, OR RESULTING FROM, DEFECTS IN HIS WORK.
17. THE CONTRACTOR SHALL MAINTAIN AT THE SITE, FOR THE COUNTY, ONE COPY OF ALL DRAWINGS, ADDENDA, APPROVED SHOP DRAWINGS, REVISIONS AND OTHER MODIFICATIONS, IN GOOD ORDER AND MARKED TO RECORD ALL CHANGES MADE DURING CONSTRUCTION. THE REST OF DRAWINGS AND OTHER INFORMATION SHALL BE DELIVERED TO THE COUNTY AND ONE COPY GIVEN TO THE ENGINEER UPON COMPLETION OF WORK.

ELECTRICAL NOTES

DEMOLITION NOTES

D1. ALL EXISTING INSTALLATIONS WHICH ARE TO BE REMOVED, ABANDONED, RELOCATED, AND/OR CAPPED SHALL BE ABANDONED IN PLACE WITHOUT WRITTEN AUTHORIZATION FROM THE COUNTY.

D2. IN ALL AREAS WHERE DEMOLITION WORK OCCUR, PATCH AND REPAIR TO MATCH NEW FINISH OR EXISTING FINISHES WHICH ARE TO REMAIN.

D3. ALL DEMOLITION WORK SHALL BE COORDINATED WITH ARLINGTON COUNTY AND OTHER SECTIONS OF THE CONTRACT DOCUMENTS.

D4. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN WRITING OF ANY DISCOVERED CONFLICTS BETWEEN EXISTING INSTALLATIONS WHICH ARE NOT SCHEDULED FOR DEMOLITION AND THE NEW WORK INDICATED WITHIN THE CONTRACT DOCUMENTS. SUCH NOTIFICATION SHALL BE ACCOMPANIED WITH A DRAWING DELINEATING THE PROPOSED SOLUTION PRIOR TO STARTING ANY WORK IN THE AFFECTED AREA.

D5. THE CONTRACTOR SHALL PROVIDE A PROPOSED SCHEDULE OF DEMOLITION WORK FOR REVIEW BY THE COUNTY.

D6. ANY ADDITIONAL DEMOLITION WORK DEEMED NECESSARY AND NOT INCLUDED WITHIN THE SCOPE OF THE CONTRACT DOCUMENTS SHALL BE EXECUTED ONLY UPON RECEIPT OF WRITTEN AUTHORIZATION FROM THE COUNTY.

D7. CONTRACTOR IS TO ASSURE THE CONTINUITY OF POWER TO REMAINING LIGHTING FIXTURES AND POWER EQUIPMENT AFFECTED BY THE DEMOLITION.

DEMOLITION

NOTE: REFER TO DEMOLITION DRAWINGS & NOTES FOR REQUIREMENTS.

(R): EXISTING TO BE REMOVED.

(E): EXISTING TO REMAIN.

(ER): EXISTING TO BE RELOCATED.

(RE) RELOCATED EXISTING DEVICE IN NEW LOCATION.

ITEMS SHOWN DASHED INDICATE EXISTING TO BE REMOVED.

LIGHT LINES INDICATE EXISTING TO REMAIN.

ELECTRICAL LEGEND

POWER

NOTES: REFER TO ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR EXACT LOCATION AND MOUNTING HEIGHTS.

WP: WEATHER PROOF (NEMA 3R)

GFI: GROUND FAULT INTERRUPTER.

WALL MOUNTED 20A SIMPLEX RECEPTACLE (18" AFF UON).

WALL MOUNTED 20A DUPLEX RECEPTACLE. (18" AFF UON).

WALL 20A QUADRUPLEX RECEPTACLE. (18" AFF UON).

4 POLE PIN AND SLEEVE PLUG. REFER TO PLANS FOR RATING.

CEILING MOUNTED JUNCTION BOX.

WALL MOUNTED JUNCTION BOX.

DISCONNECT SWITCH - NON-FUSED.

FUSED DISCONNECT SWITCH. FUSE SIZE PER PLANS.

COMBINATION STARTER/DISCONNECT SWITCH.

VFD — VARIABLE FREQUENCY DRIVE.

VFD — VARIABLE FREQUENCY DRIVE WITH INTEGRAL DISCONENCT.

M/G — M = MOTOR, G = GENERATOR

208/120V SURFACE MOUNTED PANEL.

480/277V SURFACE MOUNTED PANEL.

CB — ENCLOSED CIRCUIT BREAKER.

PB — PULL BOX.

BRANCH CIRCUIT HOMERUN, 2#12 + 1#12G, 3/4" C.

CONDUIT TURNING UP

CONDUIT TURNING DOWN

GROUND

OR T — TRANSFORMER

N E LOAD — AUTOMATIC TRANSFER SWITCH

MOLDED CASE CIRCUIT BREAKER

ELECTRICAL LEGEND

GENERAL

(#) INDICATES PLAN NOTE.

(#) INDICATES REVISION. CLOUDED AREA CONTAINS THE REVISION.

[#] INDICATES ROOM NUMBER.

ABBREVIATIONS

A, AMP	AMPERES	G, GND	GROUND
AB	ABOVE	GC	GENERAL CONTRACTOR
AC	ALTERNATE CURRENT	GFI	GROUND FAULT INRERRUPTER
AFF	ABOVE FINISHED FLOOR	IG	ISOLATED GROUND
ARCH	ARCHITECTURAL, ARCHITECT	INCAND	INCANDESCENT
BEL	BELOW	KAIC	KILOAMP INTERRUPTING CURRENT
BKR	BREAKER	KVA	KILOVOLT AMPERES
	CONDUIT	KW	KILOWATTS
CEIL	CEILING	LT(S)	LIGHT(S)
CKT	CIRCUIT	M	METER
CM	CENTIMETER	MECH	MECHANICAL
DC	DIRECT CURRENT	MH	MOUNTING HEIGHT
D/S	DISCONNECT SWITCH	MLO	MAIN LUGS ONLY
DISC	DISCONNECT SWITCH	MM	MILLIMETER
DWG	DRAWING	MTD	MOUNTED
EC	ELECTRICAL CONTRACTOR	NEC	NATIONAL ELECTRICAL CODE
EF	EXHAUST FAN	NO.,#	NUMBER
ELEC	ELECTRICAL	NTS	NOT TO SCALE
EM	EMERGENCY	P	POLE
EQUIP	EQUIPMENT	PH, Ø	PHASE
EXIST	EXISTING	PNL	PANEL
FA	FIRE ALARM	RECEP	RECEPTACLE
FACP	FIRE ALARM CONTROL PANEL	RM	ROOM
FAAP	FIRE ALARM ANNUNCIATOR PANEL	TELE	TELEPHONE
FIXT	FIXTURE	TYP	TYPICAL
FLA	FULL LOAD AMPERES	UON	UNLESS OTHERWISE NOTED
FLUOR	FLUORESCENT	V	VOLTS
		W	WATTS
		W/	WITH
		WP	WEATHERPROOF

SHEET NAMING LEGEND

E111A

- DISCIPLINE: "E0" DEMO, "E" NEW WORK
- SECTOR
- PLAN TYPE: "1" FLOOR PLAN, "2" ENLARGED FLOOR ETC.
- FLOOR LEVEL: "0" LOWEST FLOOR, "1" NEXT FLOOR LEVEL ETC.
- SYSTEM TYPE: "0" SITE, "1" LIGHTING, "2" POWER, "3" FIRE ALARM

ARLINGTON VIRGINIA

DEPARTMENT OF ENVIRONMENTAL SERVICES

Engineering & Capital Projects Division
Engineering Bureau
2100 Clarendon Boulevard, Suite 813
Arlington, VA 22201
Phone: 703.228.3629
Fax: 703.228.3606

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PROJECT:

NEW GENERATOR AND TEMPORARY GENERATOR CONNECTION FOR PUMPING STATIONS
ETHAN ALLEN

REVISIONS:

-	-

REGISTRATION:

COMMONWEALTH OF VIRGINIA
FARSHAD MAJIDIAN
No. 0402 029158
PROFESSIONAL ENGINEER

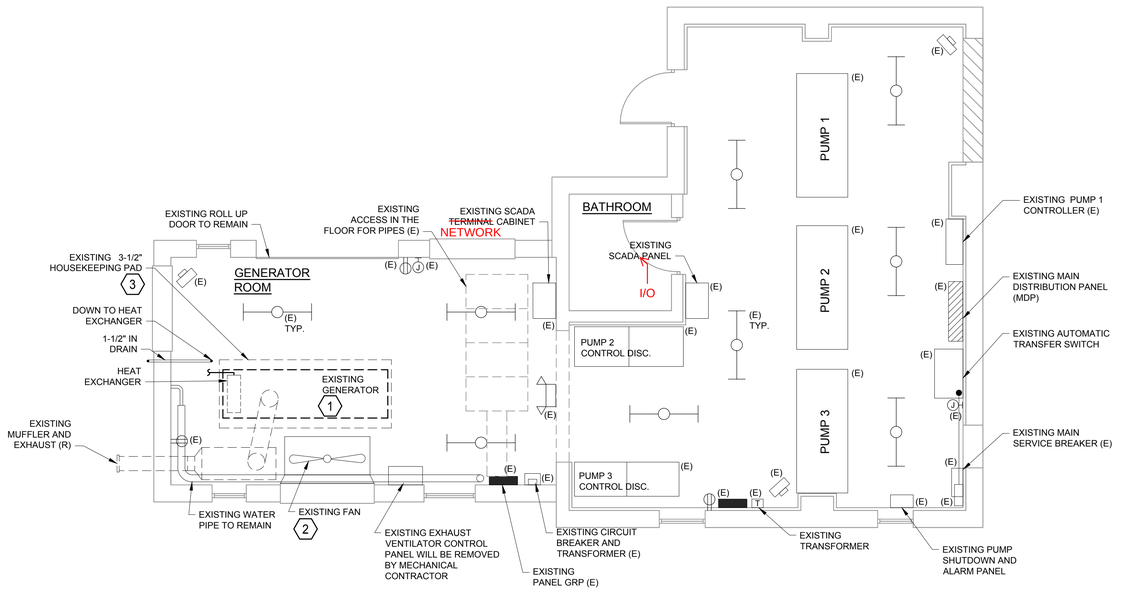
DRAWN BY:	CS
DATE:	05-17-2019
PROJECT NO.:	F18-14

DRAWING TITLE:

ELECTRICAL COVER SHEET

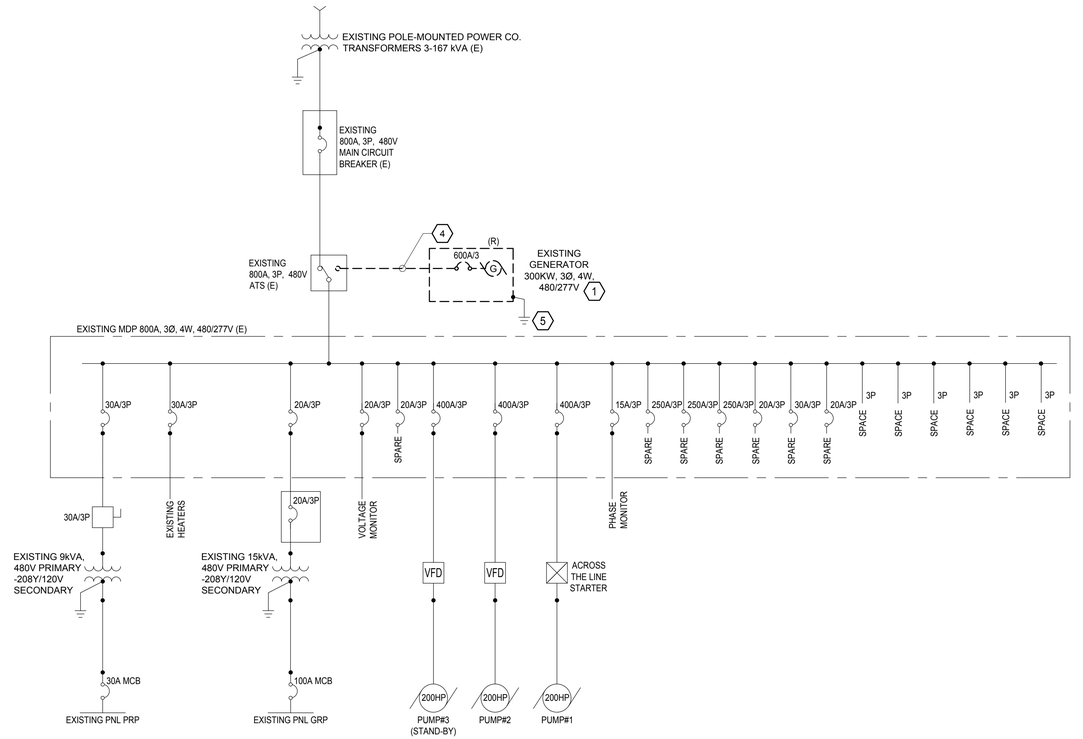
DRAWING NUMBER

E001



1 FT. ETHAN ALLEN - FLOOR PLAN - DEMOLITION

SCALE: 1/4" = - 1'-0"



2 FT. ETHAN ALLEN - SINGLE LINE DIAGRAM - EXISTING/DEMOLITION

SCALE:NOT TO SCALE

GENERAL NOTES

1. REFER TO E001 FOR GENERAL NOTES, SYMBOL LEGEND AND LIST OF ABBREVIATIONS.
2. UNLESS OTHERWISE INDICATED ALL EXISTING DEVICES, EQUIPMENT, PUMPS, PUMP CONTROLLERS, LIGHT FIXTURES, RECEPTACLES AND LIGHTING TO REMAIN.
3. CONTRACTOR SHALL BE CAREFUL NOT TO DAMAGE THE EXISTING RATED CEILING TILES OR WALL PANELS DURING DEMOLITION AND/OR NEW WORK.
4. CONTRACTOR SHALL PROVIDE A CONTINUOUS TEMPORARY EMERGENCY GENERATOR WHILE WORKING IN THE STATION FOR THE DURATION OF CONSTRUCTION. THE STATION SHALL NOT BE WITHOUT NORMAL AND OR EMERGENCY POWER. COORDINATE THE SIZE OF THE TEMPORARY GENERATOR WITH EACH STATION.

(#) KEYED NOTES

1. DISCONNECT AND REMOVE EXISTING EMERGENCY GENERATOR. REFER TO E120EA FOR EXTEND OF NEW WORK. REFER TO MD120EA FOR EXTEND OF MECHANICAL DEMOLITION WORK.
2. DISCONNECT AND REMOVE EXISTING CIRCUIT WIRING AND CONDUIT BACK TO ITS SOURCE AFTER THE FANS ARE REMOVED. REFER TO E120EA AND M120EA FOR EXTEND OF NEW WORK.
3. REFER TO S120EA FOR EXTEND OF NEW WORK.
4. DISCONNECT AND REMOVE EXISTING NOTED FEEDERS. SALVAGE EXISTING CONDUITS ABOVE CEILING. REFER TO E120EA FOR EXTEND OF NEW WORK.
5. DISCONNECT THE EXISTING GENERATOR FROM THE EXISTING GROUNDING. REFER TO E120EA FOR EXTEND OF NEW WORK.

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PROJECT:

NEW GENERATOR AND TEMPORARY GENERATOR CONNECTION FOR PUMPING STATIONS ETHAN ALLEN

REVISIONS:

-	-

REGISTRATION:

COMMONWEALTH OF VIRGINIA
FARSHAD MAJIDIAN
No. 0402 029158
PROFESSIONAL ENGINEER

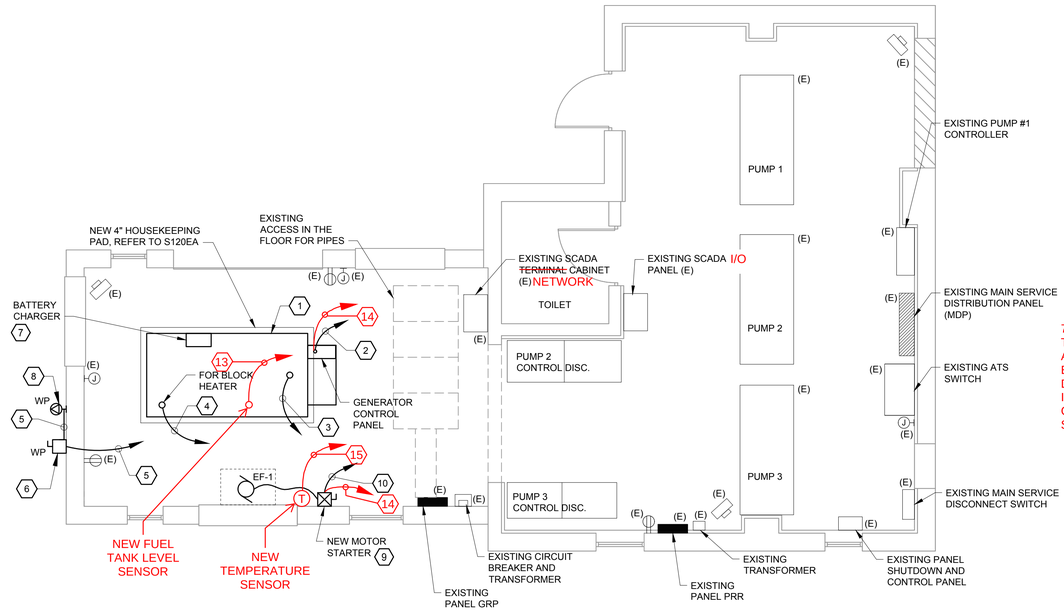
DRAWN BY:	CS
DATE:	05-17-2019
PROJECT NO.:	F18-14

DRAWING TITLE:

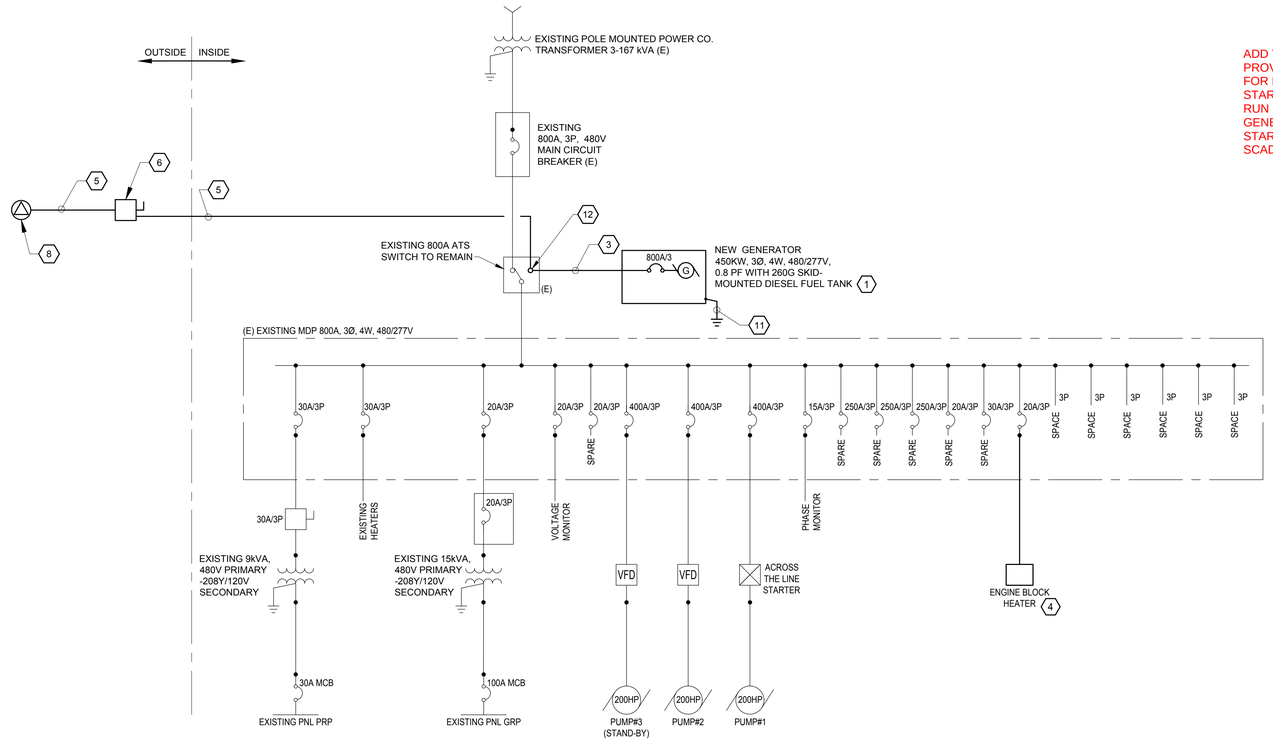
FLOOR PLAN & SINGLE LINE DIAGRAM - EXIST./ DEMOLITION

DRAWING NUMBER

ED120EA



1 FT. ETHAN ALLEN FLOOR PLAN - NEW WORK
SCALE: 1/4" = - 1'-0"



2 FT. ETHAN ALLEN - SINGLE LINE DIAGRAM - EXISTING/NEW
SCALE:NOT TO SCALE

GENERAL NOTES

1. REFER TO E001 FOR GENERAL NOTES, SYMBOL LEGEND AND LIST OF ABBREVIATIONS.
2. UNLESS OTHERWISE INDICATED, ALL EXISTING DEVICES, EQUIPMENT, PUMPS, PUMP CONTROLLERS, LIGHT FIXTURES, RECEPTACLES AND LIGHTING TO REMAIN.
3. GENERATOR LAYOUT IS BASED ON MTU GENERATOR MANUFACTURER DIMENSIONS (BASIS OF DESIGN). DUE TO LIMITED SPACES IN THE ROOM, THE PHYSICAL DIMENSION OF THE NEW GENERATOR SHALL NOT EXCEED FROM WHAT IS SHOWN ON THE PLAN. THE OVERALL HEIGHT OF EQUIPMENT SHALL NOT EXCEED 128" THAT WOULD INCLUDE; 4" CONCRETE PAD, FUEL TANK, ENGINE GENERATOR, MUFFLERS AND EXHAUST PIPES.
4. CONTRACTOR SHALL BE CAREFUL NOT TO DAMAGE THE EXISTING RATED CEILING TILES OR WALL PANELS DURING DEMOLITION AND/OR NEW WORK.
5. REFER TO M120EA FOR EXTEND OF MECHANICAL NEW WORK.
6. CONTRACTOR SHALL PROVIDE A CONTINUOUS TEMPORARY EMERGENCY GENERATOR WHILE WORKING IN THE STATION FOR THE DURATION OF CONSTRUCTION. THE STATION SHALL NOT BE WITHOUT NORMAL AND OR EMERGENCY POWER. COORDINATE THE SIZE OF THE TEMPORARY GENERATOR WITH EACH STATION.

7. ALL TERMINATIONS OF WIRES AT THE SCADA I/O PANEL AND ASSOCIATED FIELD POINTS SHALL BE COMPLETED BY THE COUNTY'S DESIGNATED SCADA SYSTEM INTEGRATOR. CONTRACTOR SHALL COORDINATE SCHEDULE FOR SCADA WORK WITH THE COUNTY.

KEYED NOTES

1. INSTALL NEW 450kW EMERGENCY GENERATOR WITH 250 G (8HRS) SKID-MOUNTED FUEL TANK ON A NEW 4" CONCRETE PAD AS SHOWN.
2. UTILIZE EXISTING CONDUIT AND INSTALL NEW #14 CONTROL WIRING (GENERATOR START) FROM THE NEW GENERATOR TO EXISTING ATS SWITCH. EXTEND CONDUIT IF NEEDED.
3. INSTALL THREE SETS OF 4-350KCMIL + 1 #1/0G IN 3" CONDUIT. EXISTING TWO CONDUIT SHOULD BE UTILIZED. THE THIRD CONDUIT CAN BE INSTALLED EXPOSED (NOT TO DISTURB THE CEILING TILES) WITH PROPER SUPPORTS.
4. ENGINE BLOCK HEATER CIRCUIT. PROVIDE 3#12 + 1#12 G, 3/4" C TO AN EXISTING 20A, 3P SPARE CIRCUIT BREAKER IN MDP. COORDINATE POWER REQUIREMENTS WITH EQUIPMENT MANUFACTURER.
5. INSTALL ONE SET OF 4-500KCMIL + 1 #3 G IN 4" C AS SHOWN. USE RGS CONDUIT OUTSIDE.
6. PROVIDE A 400A, 3P, 480V DISCONNECT SWITCH IN A LOCKABLE NEMA 4X STAINLESS STEEL ENCLOSURE.
7. UTILIZE EXISTING CIRCUIT CONDUIT FOR THE BATTERY CHARGER. PROVIDE NEW 2#10 + 1#10 G FROM THE CHARGER TO EXISTING CIRCUIT BREAKER IN PANEL. EXTEND THE CIRCUIT TO THE CHARGER ON THE GENERATOR SKID. COORDINATE EXACT LOCATION IN FIELD.
8. INSTALL A NEW NEMA 3R 400A, 480V, 3W, 4POLE PIN AND SLEEVE TYPE RECEPTACLE (PLUG) WITH ANGLE AND BACK BOX (JUNCTION BOX). THE RECEPTACLE SHALL BE SIMILAR TO CATALOG NUMBER AJA40034400RS, STYLE 2. MANUFACTURED BY APPLETON.
9. PROVIDE A FACTORY-ASSEMBLED COMBINATION OF MAGNETIC MOTOR STARTER WITH DISCONNECT SWITCH, OVERLOAD RELAYS AND RED LED PILOT LIGHTS FOR THE NEW EXHAUST FAN AS SHOWN. THE STARTER SHALL BE SURFACE MOUNTED, UL 489, NEMA AB 1, NEMA AB 3, WITH AUXILIARY CONTACTS "A" & "B" ARRANGED TO ACTIVATE WITH MCP HANDLE. INTERLOCK THE STARTER WITH THE GENERATOR AND THE EXISTING LOUVERS SO THAT WHEN THE GENERATOR STARTS, THE FAN SHALL TURN ON AND THE LOUVERS TO OPEN. REFER TO M120EA FOR ADDITIONAL INFORMATION. COORDINATE THE STARTER SIZE WITH ASSOCIATED MOTOR HP. ACCEPTABLE MANUFACTURERS ARE: ROCKWELL AUTOMATION, INC., ALLEN-BRADLEY, SIEMENS ENERGY AND SQUARE - D.
10. UTILIZE EXISTING EF POWER CONDUIT FOR NEW FAN. INSTALL 3#10 + 1#10 G FROM THE STARTER TO PANEL GRP. REPLACE EXISTING 20A, 3P CIRCUIT BREAKER IN PANEL GRP WITH A 30A, 3P CIRCUIT BREAKER.
11. CONNECT THE NEW GENERATOR TO EXISTING GROUNDING SYSTEM IN THE PUMPING STATION AS PER NEC 250.30(A). IF NECESSARY, INSTALL NEW COPPER GROUND ROD (10'x3/4) IN ORDER TO MEET THE GROUNDING REQUIREMENTS OF NEC 250.30(A).
12. CONNECT THE NEW CONDUCTORS TO ATS LUGS AS SHOWN. REPLACE THE LUGS TO ACCOMMODATE FOR ADDITIONAL CONDUCTORS, IF NECESSARY.

ADD TO NOTE 9:
PROVIDE H-O-A SELECTOR SWITCH FOR NEW EXHAUST FAN. FAN TO START IN "HAND" MODE AND SHALL RUN IN "AUTO" MODE WHEN GENERATOR STARTS AND WITH A START COMMAND FROM THE SCADA PLC.

13. PROVIDE (1)#18 TSP IN 3/4" CONDUIT FROM GENERATOR FUEL TANK LEVEL SENSOR TO EXISTING SCADA I/O PANEL. LEAVE AT LEAST 6' OF SPARE WIRE AT BOTH ENDS FOR TERMINATIONS BY OTHERS.

14. PROVIDE (6)#14+#14 GND IN 3/4" CONDUIT FROM GENERATOR CONTROL PANEL TO EXISTING SCADA I/O PANEL. LEAVE AT LEAST 6' SPARE WIRE AT BOTH ENDS FOR TERMINATION BY OTHERS.

15. PROVIDE (1)#18 TSP IN 3/4" CONDUIT FROM TEMPERATURE SENSOR TO EXISTING SCADA I/O PANEL. LEAVE AT LEAST 6' OF SPARE WIRE T BOTH ENDS FOR TERMINATION BY OTHERS.

16. PROVIDE (8)#14+#14GND IN 3/4" CONDUIT FROM MOTOR STARTER CONTROL PANEL TO EXISTING SCADA I/O PANEL. LEAVER AT LEAST 6' WIRE AT BOTH ENDS FOR TERMINATION BY OTHERS.

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FLOOR PLAN & SINGLE LINE DIAGRAM - EXISTING/NEW

DRAWING NUMBER

E120EA

MECHANICAL GENERAL NOTES

GENERAL

1. THE INTENT OF THESE DRAWINGS IS TO PROVIDE COMPLETE AND PROPERLY FUNCTIONING HVAC SYSTEMS. PROVIDE ALL LABOR AND MATERIAL NECESSARY TO ACHIEVE SUCH ENDS. CONTRACTOR IS OBLIGATED TO EXAMINE PLANS. ANY OBSERVED FAULTS OR AMBIGUITY IN THESE PLANS SHALL BE CALLED TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE IMMEDIATELY, SO THAT THE MATTER MAY BE RESOLVED PRIOR TO SUBMISSION OF BIDS. BY SUBMISSION OF BID, THE CONTRACTOR SHALL ACKNOWLEDGE ACCEPTANCE OF THESE PLANS AS AN ADEQUATE DEFINITION OF THE SCOPE OF WORK AND EXTRA COST CLAIMS BASED ON INADEQUACY OF PLANS WILL NOT BE CONSIDERED.
2. THE ELECTRICAL CONTRACTOR IS REQUIRED TO PROVIDE POWER FOR ALL MECHANICAL EQUIPMENT. DURING BID PERIOD AND AGAIN PRIOR TO EQUIPMENT ORDERING, THE (GENERAL CONTRACTOR AND THE) MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL CONTRACTOR TO VERIFY THAT ALL EQUIPMENT ARE POWERED, AND PROPER VOLTAGE/WIRING/CAPACITY IS PROVIDED. IN THE EVENT OF REQUIREMENTS AMBIGUITY OR CONFLICT BETWEEN TRADES, THE CONTRACTOR IS REQUIRED TO GENERATE AN RFI ADDRESSING THE ISSUE AND REQUESTING CLARIFICATION. FAILURE TO DO SO WILL NEGATE HIS RIGHT FOR A CHANGE ORDER OR REQUEST FOR ADDITIONAL FUNDS DURING CONSTRUCTION RELATING TO THIS ISSUE.
3. ALL WORK ON THIS PROJECT SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST APPLICABLE CODES AND REGULATIONS.
4. THESE DRAWINGS ARE DIAGRAMMATIC AND INTENDED TO DEPICT THE GENERAL LOCATION OF HVAC SYSTEM COMPONENTS. CONSULT THE ELECTRICAL PLANS FOR PROPER DIMENSIONS AND LOCATION OF EQUIPMENT.
5. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF HVAC WORK WITH EXISTING CONDITIONS AND THE WORK OF OTHER TRADES. MINOR DEVIATIONS FROM THE PLANS MAY BE MADE TO AVOID MINOR CONFLICTS. WHEN MAJOR CONFLICTS ARE APPARENT, THE ENGINEER SHALL BE ADVISED IMMEDIATELY, AND AFFECTED WORK SHALL NOT BE INSTALLED UNTIL THE CONFLICT HAS BEEN RESOLVED.
6. THE CONTRACTOR SHALL OBTAIN AND PAY FOR PERMITS AND ARRANGE FOR INSPECTIONS BY LOCAL AUTHORITIES HAVING JURISDICTION.
7. PROVIDE OPENINGS IN BUILDING CONSTRUCTION FOR PASSAGE OF DUCTWORK. DO NOT PENETRATE STRUCTURAL MEMBERS WITHOUT PRIOR APPROVAL OF STRUCTURAL ENGINEER. VERIFY SLAB PENETRATION LOCATIONS PRIOR TO PROCEEDING WITH WORK IN ORDER TO LOCATE OBSTRUCTIONS EMBEDDED IN SLAB. SUBMIT DRAWING OF ALL SLAB PENETRATIONS FOR LANDLORD/ARCHITECT/ENGINEER APPROVAL PRIOR TO PROCEEDING WITH WORK.
8. ALL NECESSARY ALLOWANCES AND PROVISIONS SHALL BE MADE BY THIS CONTRACTOR FOR BEAMS, COLUMNS OR OTHER OBSTRUCTIONS OF THE BUILDING OR THE WORK OF OTHER CONTRACTORS, WHETHER OR NOT SAME IS INDICATED. WHERE NECESSARY TO AVOID OBSTRUCTIONS THE DUCTS SHALL BE TRANSFORMED, DIVIDED, OFFSET, RAISED OR LOWERED WITH THE REQUIRED FREE AREA BEING MAINTAINED.
9. INSTALL ALL EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
10. CONTROLS: THE CONTRACTOR SHALL FURNISH AND INSTALL ALL NECESSARY WIRING, CONTROLS, HARDWARE, FITTINGS, PARTS AND ACCESSORIES INCLUDING ALL SAFETY DEVICES REQUIRED FOR PROPER INSTALLATION AND OPERATION OF SYSTEM IN ACCORDANCE WITH ALL LOCAL CODE REQUIREMENTS. THE CONTROLS CONTRACTOR SHALL PROVIDE ELECTRICAL POWER TO ALL CONTROL DEVICES AND EQUIPMENT FROM THE NEAREST POWER SOURCE INDICATED FOR CONTROLS POWER AND IDENTIFIED ON ELECTRICAL DRAWINGS. THE CONTRACTOR SHALL VERIFY ALL VOLTAGE AND POWER REQUIREMENTS AND COORDINATE WITH ALL TRADES AS REQUIRED. FOR DDC APPLICATION THESE DEVICES SHALL BE DDC READY. PROVIDE 24VOLT TRANSFORMER, SWITCHES AND WIRING FOR A COMPLETE INSTALLATION THAT MEETS THE DESIGN INTENT OF THE SYSTEM OPERATION.
11. PROVIDE MOTOR STARTERS, ELECTRICAL DISCONNECTS, CONTROL WIRING AND ALL OTHER REQUIRED ACCESSORIES NECESSARY FOR AUTOMATIC OPERATION OF MECHANICAL EQUIPMENT.
12. MECHANICAL CONTRACTOR SHALL THOROUGHLY CLEAN HIS WORK AREA DAILY. MECHANICAL CONTRACTOR SHALL ALSO REMOVE ALL TRASH AFTER WORK COMPLETION.
13. WHERE EXISTING FIELD CONDITIONS ARE DIFFERENT THAN SHOWN, THE CONTRACTOR SHALL ADVISE THE ENGINEER OF DISCREPANCIES WHICH WILL AFFECT THE PROPOSED WORK PRIOR TO BEGINNING WORK.
14. PRIOR TO INSTALLATION OF NEW WORK, CONTRACTOR SHALL VERIFY THAT ALL DUCTWORK, EQUIPMENT, PIPING, ETC., SHALL BE FREE FROM INTERFERENCE WITH EXISTING CONDITIONS. WHERE CONFLICTS OCCUR, CONTRACTOR SHALL IMMEDIATELY CONTACT THE OWNER. WHERE THE WORK OF VARIOUS TRADES WILL BE INSTALLED IN CLOSE PROXIMITY TO ONE ANOTHER, OR WHERE THERE IS EVIDENCE THAT THE WORK OF ONE TRADE WILL INTERFERE WITH WORK OF OTHER TRADES, THE CONTRACTOR SHALL ASSIST IN WORKING OUT SPACE CONDITIONS TO MAKE A SATISFACTORY ADJUSTMENT. IF THE CONTRACTOR ALLOWS ONE TRADE TO INSTALL HIS WORK BEFORE COORDINATING WITH WORK OF OTHER TRADES, THE CONTRACTOR SHALL MAKE NECESSARY CHANGES TO CORRECT THE CONDITION WITHOUT EXTRA CHARGE.
15. THE CONTRACTOR SHALL LOCATE ALL EQUIPMENT WHICH MUST BE SERVICED, OPERATED, MAINTAINED IN FULLY ACCESSIBLE POSITION. EQUIPMENT SHALL INCLUDE, BUT NOT BE LIMITED TO, VALVES, TRAPS, CLEANOUTS, CONTROLLERS, DRAIN POINTS, ETC. IF REQUIRED FOR ACCESSIBILITY, FURNISH ACCESS DOORS FOR THIS PURPOSE. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
16. ALL EQUIPMENT WHICH REQUIRES INTERFACE WITH THE ELECTRICAL TRADE, SUCH AS MOTORS, DISCONNECTING SWITCHES, CONTROLLING DEVICES, ETC., SHALL BE FULLY COORDINATED BETWEEN ALL TRADES.
17. AS USED IN DRAWINGS AND SPECIFICATIONS FOR MECHANICAL WORK, CERTAIN NON-TECHNICAL WORDS SHALL BE UNDERSTOOD TO HAVE SPECIFIC MEANINGS AS FOLLOWS REGARDLESS OF INDICATIONS TO THE CONTRARY IN THE GENERAL CONDITION OR OTHER DOCUMENTS GOVERNING THE MECHANICAL WORK.

    "FURNISH" - PURCHASE AND DELIVER TO THE PROJECT SITE COMPLETE WITH EVERY NECESSARY APPURTENANCE AND SUPPORT, ALL AS PART OF THE MECHANICAL WORK. PURCHASING SHALL INCLUDE PAYMENT OF ALL SALES TAXES AND OTHER SURCHARGES AS MAY BE REQUIRED TO ASSURE THAT PURCHASED ITEMS ARE FREE OF ALL LIENS, CLAIMS OR ENCUMBRANCES.

    "INSTALL" - UNLOAD AT THE DELIVERY POINT AT THE SITE AND PERFORM EVERY OPERATION NECESSARY TO ESTABLISH SECURE MOUNTING AND CORRECT OPERATION AT THE PROPER LOCATION IN THE PROJECT, ALL AS PART OF THE MECHANICAL WORK.

    "PROVIDE" - "FURNISH" AND "INSTALL".

    "NEW" - MANUFACTURED WITHIN THE PAST TWO YEARS AND NEVER BEFORE USED.
18. ALL MATERIAL, EQUIPMENT AND ACCESSORIES, FURNISHED AND INSTALLED SHALL BE NEW AND EQUAL TO OR SURPASS THE QUALITY OF SIMILAR MATERIALS AS SCHEDULES. ALL MATERIALS, EQUIPMENT AND METHODS SHALL BE AS SPECIFIED IN THE BASE BUILDING CONTRACT DOCUMENTS UNLESS NOTED OTHERWISE.

DEMOLITION

1. ANY DISCOVERED DISCREPANCY BETWEEN THE CONTRACT DOCUMENTS AND ACTUAL SITE CONDITIONS MAY BE BROUGHT TO THE ENGINEER'S ATTENTION PRIOR TO BID FOR CLARIFICATION. AFTER A CONTRACT IS EXECUTED CONTRACTOR SHALL SUBMIT A REQUEST FOR INFORMATION.
2. THE REQUIRED DEMOLITION SHALL NOT BE LIMITED TO THAT PORTION SHOWN ON THE PLANS ALONE, BUT SHALL INCLUDE ALL NECESSARY WORK COINCIDENTAL THERETO AND/OR WORK INDICATED ELSEWHERE ON THE DRAWINGS OR IN THE SPECIFICATIONS.
3. CONTRACTOR SHALL NOT VIOLATE THE PHYSICAL SECURITY OF THE BUILDING DURING DEMOLITION OR ASSOCIATED OPERATIONS. SECURITY SHALL BE CLOSELY COORDINATED WITH THE OWNER'S REPRESENTATIVE.
4. CONTRACTOR SHALL SCHEDULE ALL WORK, INCLUDING INTERRUPTION OF EXISTING UTILITIES, WITH THE OWNER, PRIOR TO STARTING WORK.
5. DO NOT ALTER THE EXISTING SYSTEMS WHICH ARE LOCATED IN AREAS NOT IN SCOPE OF WORK UNLESS SPECIFICALLY INDICATED. PROTECT EXISTING SYSTEMS WITHIN THE LIMITS OF WORK WHICH ARE TO BE RETAINED. ANY DAMAGE TO THE EXISTING SYSTEMS DUE TO CONTRACTOR NEGLIGENCE SHALL BE REPAIRED AND/OR REPLACED TO ITS ORIGINAL CONDITION TO THE COMPLETE SATISFACTION OF THE OWNER, AND AT NO COST TO THE OWNER.
6. UNLESS OTHERWISE NOTED, ALL FIXTURES/EQUIPMENT INDICATED TO BE REMOVED SHALL ALSO HAVE ALL ASSOCIATED PIPING REMOVED BACK TO THE NEAREST HORIZONTAL MAIN, RISER, OR STACK CONNECTION AND CAPPED IN A CONCEALED LOCATION.
7. UNLESS OTHERWISE INDICATED, EXISTING PIPING TO REMAIN FOLLOWING REMOVAL OF ADJACENT PORTIONS OF PIPING SHALL BE CAPPED/PLUGGED IN A CONCEALED LOCATION OR MADE READY FOR EXTENSION UNDER NEW WORK. FOR AREAS WITHOUT AN EXISTING CEILING IN WHICH A NEW CEILING WILL NOT BE INSTALLED, THE PIPING SHALL BE CAPPED/PLUGGED IN A LOCATION TO PROVIDE THE MAXIMUM POSSIBLE HEADROOM. UNDER NO CIRCUMSTANCE MAY AN EXISTING PIPE BE LEFT OPEN.
8. UNLESS OTHERWISE INDICATED, ALL FIXTURES, EQUIPMENT, PIPING, AND ACCESSORIES WHICH HAVE TO BE REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE PROJECT SITE AS SOON AS POSSIBLE.
9. COPPER AND STEEL PIPING SHALL BE CAPPED USING COMMERCIALLY MANUFACTURED "CAPS". CAST IRON SOIL PIPE SHALL BE PLUGGED USING COMMERCIALLY MANUFACTURED "BLIND PLUGS". CAP/PLUG INSTALLATION SHALL BE IN ACCORDANCE WITH NEW WORK INSTALLATION PROCEDURES. CRIMPING OF TUBING IS NOT ACCEPTABLE.
10. ALL EXISTING TO REMAIN PIPING SHALL BE COORDINATED WITH THE MECHANICAL DUCTWORK, AND IF REQUIRED PIPING SHALL BE REMOVED AND RELOCATED TO BETTER LOCATION.

GENERATOR EXHAUST SYSTEM

1. INSTALLATION SHALL FOLLOW MANUFACTURER'S RECOMMENDATIONS.
2. EXHAUST PIPE SHALL BE SIZED TO KEEP BACK PRESSURE WITHIN THE ENGINE'S LIMITS. ALL PIPE SHALL BE INSTALLED WITH A MINIMUM CLEARANCE OF 9 INCHES FROM COMBUSTIBLE MATERIALS.
3. MUFFLER AND EXHAUST FLEX CONNECTOR SHALL BE SUPPLIED BY DIV 26, AND INSTALLED BY DIV 23. COORDINATE GENERATOR EXHAUST SYSTEM INSTALLATION WITH ELECTRICAL CONTRACTOR AND GENERATOR MANUFACTURER.
4. EXHAUST PIPE SHALL NOT BE SUPPORTED DIRECTLY BY THE ENGINE BLOCK OR ENGINE COMPONENTS. ALLOWANCES SHALL BE MADE FOR SYSTEM MOVEMENT AND VIBRATION ISOLATION BY USING SUITABLE FLEXIBLE COMPONENTS SUCH AS RUBBER DAMPERS OR SPRINGS.
5. INSTALL METAL THIMBLE GUARDS FOR EXHAUST PIPE PASSING THROUGH WOODEN WALLS OR ROOFS. CUT EXHAUST PIPE OUTLETS AT 30 TO 45 DEG ANGLES, TO REDUCE EXHAUST GAS TURBULENCE AND NOISE.
6. PROVIDE INSULATION WITH ALUMINUM SHEATH SURROUNDING THE PIPE AND MUFFLER.

SYMBOLS

EXISTING/NEW WORK

	EXISTING TO REMAIN
	EXISTING TO BE REMOVED
	LIMIT OF DEMOLITION
	NEW WORK
	POINT OF CONNECTION NEW TO EXISTING

EQUIPMENT

	PUMP
	RETURN/EXHAUST GRILLE
	SUPPLY DIFFUSER
	VAV TERMINAL UNIT - COOLING ONLY
	FPT TERMINAL UNIT WITH REHEAT
	VAV TERMINAL UNIT WITH REHEAT COIL

GENERAL DUCTWORK

Ø	DIAMETER OF ROUND DUCT
	RECTANGULAR DUCT BREAK (DOUBLE LINE)
	DUCT BREAK (SINGLE LINE)
	RECTANGULAR EXHAUST DOWN
	RECTANGULAR EXHAUST UP
	RECTANGULAR RETURN DOWN
	RECTANGULAR RETURN UP
	RECTANGULAR SUPPLY DOWN
	RECTANGULAR SUPPLY UP
	ROUND DUCT BREAK (DOUBLE LINE)
	ROUND EXHAUST/RETURN/SUPPLY DOWN
	ROUND EXHAUST/RETURN/SUPPLY UP

DUCTWORK ACCESSORIES

BDD	BACKDRAFT DAMPER
FD	FIRE DAMPER
FSD	FIRE/SMOKE DAMPER
M	MOTORIZED DAMPER
SD	SMOKE DAMPER
	VOLUME DAMPER
U	DOOR UNDERCUT

GENERAL PIPING

	AUTOMATIC AIR VENT
	DIRECTION OF PIPE PITCH
FD	FLOOR DRAIN
	FLOW DIRECTION
	MANUAL AIR VENT
	PIPE CONTINUES
CD	CONDENSATE DRAIN
D	DRAIN
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY

PIPE FITTINGS/CONNECTIONS

	FLANGE CONNECTION
	FLEXIBLE CONNECTOR
	PIPE CONNECTION - BOTTOM
	PIPE CONNECTION - TOP
	PIPE DOWN
	PIPE END CAP
	PIPE REDUCER - CONCENTRIC
	PIPE REDUCER - ECCENTRIC
	PIPE UP
	UNION CONNECTION

PIPING VALVES

	BALL VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	GLOBE VALVE
	SHUT-OFF VALVE
	PRESSURE REDUCING VALVE
	RELIEF VALVE
	SOLENOID VALVE
	VALVE IN RISER
	Y STRAINER
	Y STRAINER (WITH VALVE)
	2-WAY AUTOMATIC CONTROL VALVE
	3-WAY AUTOMATIC CONTROL VALVE

PIPING INSTRUMENTATION

	PRESSURE GAUGE WITH GAUGE COCK
	THERMOMETER

CONTROLS

T	THERMOSTAT (MOUNT 48" AFF)

REFERENCE

	DETAIL
	SECTION

ABBREVIATIONS

AABC	ASSOCIATED AIR BALANCE COUNCIL
AAV	AUTOMATIC AIR VENT
ABV	ABOVE
AC	AIR CONDITIONING UNIT
ACT	ACOUSTICAL CEILING TILE
AD	ACCESS DOOR
ADDT'L	ADDITIONAL
ADJ	ADJUST
AFC	ABOVE FINISHED CEILING
AFCP	AIR FLOW CONTROL PANEL
AFF	ABOVE FINISHED FLOOR
AFM	AIR FLOW MEASURING STATION
AHU	AIR HANDLING UNIT
AL	ALUMINUM
AMB	AMBIENT
AMT	AMOUNT
APD	AIR PRESSURE DROP
ARCH	ARCHITECT
ARI	AMERICAN REFRIGERATION INSTITUTE
AS	AIR SEPARATOR
ASHRAE	AMERICAN SOCIETY OF REFRIGERATION AND AIR CONDITIONING ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ATU	AIR TERMINAL UNIT
AUTO	AUTOMATIC
B	BOILER
BAL	BALANCE/ING
BCU	BUILDING CONTROL UNIT
BHP	BOILER HORSEPOWER/BRAKE HORSEPOWER
BOP	BOTTOM OF PIPE
BLDG	BUILDING
BLW	BELOW
BOS	BOTTOM OF STEEL
BPD	BACK PRESSURE DAMPER
BTUH	BRITISH THERMAL UNIT PER HOUR
CA	COMBUSTION AIR
CAD	CEILING AIR DIFFUSER
CAL	COMBUSTION AIR LOUVER
CAP	CAPACITY
CAV	CONSTANT AIR VOLUME
CC	COOLING COIL
CF	CENTRIFUGAL FAN
CFM	CUBIC FEET PER MINUTE
CLG	CEILING
CO	CLEAN OUT
CONC	CONCRETE
COND	CONDITIONING
CONN	CONNECT/CONNECTION
CONT	CONTINUATION
CP	CIRCULATING PUMP
CSR	CEILING SUPPLY REGISTER
CU	CONDENSING UNIT
CV	CONTROL VALVE
CW	COLD WATER
DB	DRY BULB
dB	DECIBEL
DDC	DIRECT DIGITAL CONTROL
ΔP	PRESSURE DROP
DIA	DIAMETER
DIFF	DIFFERENCE
DISC SW	DISCONNECT SWITCH
DN	DOWN
DP	DEW POINT
DTL	DETAIL
DWG	DRAWING
DX	DIRECT EXPANSION
(E)	EXISTING TO REMAIN
EA	EXHAUST AIR/EACH
EAL	EXHAUST AIR LOUVER
EAR	EXHAUST AIR REGISTER
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRICAL CONTRACTOR
ECON	ECONOMIZER
EER	ENERGY EFFICIENCY RATIO
EF	EXHAUST FAN
EFF	EFFICIENCY
ELEV	ELEVATION
ELL	ELBOW
ENT	ENTERING
EQUIP	EQUIPMENT
EQUIV	EQUIVALENT
ESP	EXTERNAL STATIC PRESSURE
EST	ESTIMATED
EWH	ELECTRIC WALL HEATER
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
EXIST	EXISTING
°F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION
FD	FIRE DAMPER
FFE	FINISHED FLOOR ELEVATION
FLA	FULL LOAD AMP
FLEX	FLEXIBLE
FLG	FLANGE
FLR	FLOOR
FM	FACTORY MUTUAL
FPM	FEET PER MINUTE
FT	FEET
FT WG	FEET OF WATER GAUGE
GA	GAUGE
GAL	GALLONS
GC	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
H	HEIGHT
HD	HEAD
HP	HORSEPOWER
HVAC	HEATING, VENTILATION & AIR CONDITIONING
HZ	HERTZ
IN	INCHES
INSUL	INSULATE/INSULATION
IWG	INCHES WATER GAUGE
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LB	POUND
LBG	LINEAR BAR GRILLE
LB/HR	POUNDS PER HOUR
LRA	LOCKED ROTOR AMP
LWT	LEAVING WATER TEMPERATURE
M	MOTORIZED DAMPER
MA	MIXED AIR
MAT	MIXED AIR TEMPERATURE
MAX	MAXIMUM
MBH	ONE THOUSAND BTUH
MC	MECHANICAL CONTRACTOR
MCC	MOTOR CONTROL CENTER
MD	MANUAL DAMPER
MECH	MECHANICAL
MER	MECHANICAL EQUIPMENT ROOM
MFGR	MANUFACTURER
MIN	MINIMUM
MUA	MAKE-UP AIR
MUAU	MAKE-UP AIR UNIT
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED/NOISE CRITERIA
NEC	NATIONAL ELECTRICAL CODE
NG	NATURAL GAS
NO	NUMBER/NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAF	OUTSIDE AIR FAN
OAL	OUTSIDE AIR LOUVER
OBD	OPPOSED BLADE DAMPER
OC	ON CENTER
OCC	OCCUPIED
OF	OVERFLOW
OPP	OPPOSITE
ORIG	ORIGINAL
O&M	OPERATION AND MAINTENANCE
P	PUMP
PC	PLUMBING CONTRACTOR
PD	PRESSURE DROP
PDCV	PRESSURE DIFFERENTIAL CONTROL VALVE
PH	PHASE
PRV	PRESSURE REDUCING VALVE
PPH	POUNDS PER HOUR
PRESS	PRESSURE
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
PVC	POLYVINYL CHLORIDE
QTY	QUANTITY
RA	RETURN AIR
RAG	RETURN AIR GRILLE
RAR	RETURN AIR REGISTER
REF	REFER/REFERENCE
REG	REGISTER
RF	RETURN/RELIEF FAN
RLA	RATED LOAD AMP
RLAD	RETURN LINEAR AIR DIFFUSER
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR
SAG	SUPPLY AIR GRILLE
SAN	SANITARY
SAR	SUPPLY AIR REGISTER
SC	SHADING COEFFICIENT
SD	SMOKE DAMPER/SPLITTER DAMPER
SDC	SOUND DIGITAL CONTROLLER
SEER	SEASONAL ENERGY EFFICIENCY RATIO
SF	SUPPLY FAN
SIM	SIMILIAR
SLAD	SLOT LINEAR AIR DIFFUSER
SMACNA	SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
SO	SCREENED OPENING
SP	STATIC PRESSURE
SPEC	SPECIFICATION
SQ FT	SQUARE FEET
SQ IN	SQUARE INCHES
SRV	STEAM RELIEF VENT
SS	STAINLESS STEEL
STL	STEEL
STN	SECTION
SUSP	SUSPENSION
SWR	SIDE WALL REGISTER
SYM	SYMBOL
T	THERMOSTAT
TCC	TEMPERATURE CONTROL CONTRACTOR
TD	TEMPERATURE DIFFERENCE
TEMP	TEMPERATURE
TG	TRANSFER GRILLE
TOS	TOP OF STEEL
TOT	TOTAL
TSP	TOTAL STATIC PRESSURE
TV	TURNING VANE
TXV	THERMAL EXPANSION VALVE
TYP	TYPICAL
UC	UNDERCUT
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORY
UNOCC	UNOCCUPIED
V	VOLTS
VAV	VARIABLE AIR VOLUME
VD	VOLUME DAMPER
VDR	VANED RETURN REGISTER
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
VTR	VENT THROUGH ROOF
W	WATT
W/	WITH
WB	WET BULB
WG	WATER GAUGE
WPD	WATER PRESSURE DROP
W/O	WITHOUT

SHEET NUMBERING LEGEND

DISCIPLINE: "M0" DEMO, "M" NEW WORK

M111A

SECTOR

PLAN TYPE: "1" FLOOR PLAN, "2" ENLARGED FLOOR ETC.

SYSTEM TYPE: "1" FOR DUCT WORK, "2" FOR PIPING

FLOOR LEVEL: "0" LOWEST FLOOR, "1" NEXT FLOOR LEVEL ETC.

ARLINGTON VIRGINIA

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PROJECT:

NEW GENERATOR AND TEMPORARY GENERATOR CONNECTION FOR PUMPING STATIONS
ETHAN ALLEN

REVISIONS:

-	-

REGISTRATION:

COMMONWEALTH OF VIRGINIA
VASSILIS K. STARDIS
Lic. No. 0402022554
PROFESSIONAL ENGINEER

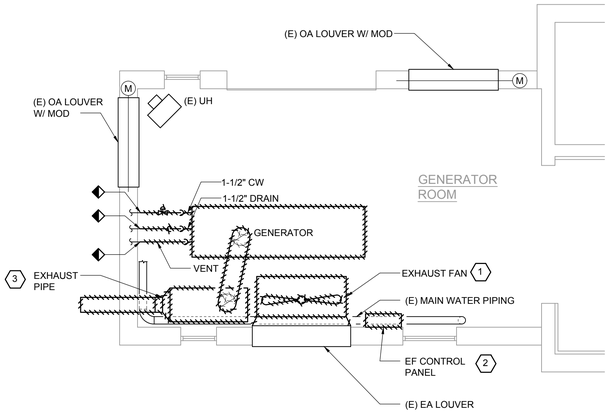
DRAWN BY:	HS
DATE:	05-17-2019
PROJECT NO.:	F18-14

DRAWING TITLE:

MECHANICAL COVER SHEET

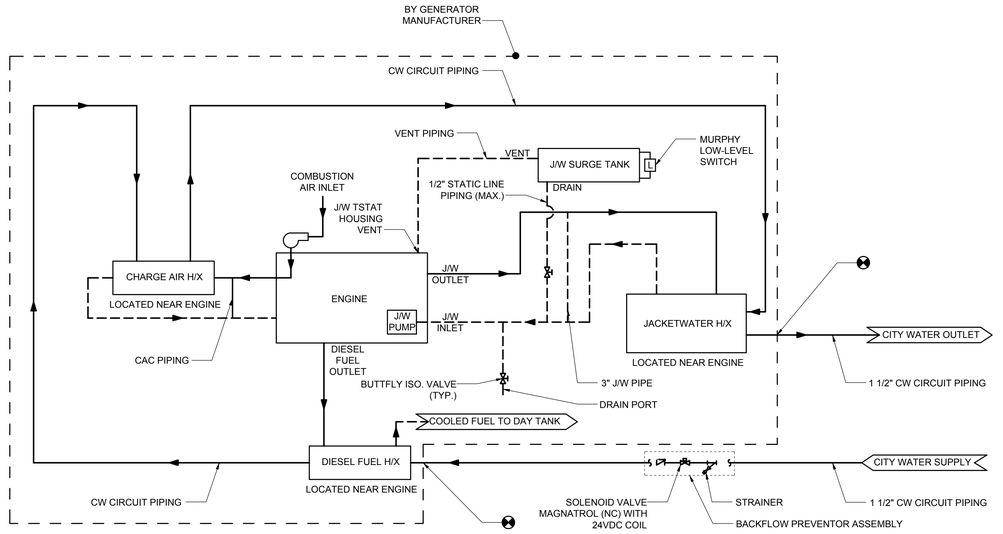
DRAWING NUMBER

M001



1 FT. ETHAN ALLEN - MECHANICAL FLOOR PLAN - DEMOLITION

SCALE: 1/4" = - 1'-0"



NOTES:

1. GENERATOR CITY WATER COOLING SYSTEM SCHEMATIC IS BY "BOULDEN ENERGY SYSTEMS" AND IS SHOWN HERE FOR DEMONSTRATION AND REFERENCE PURPOSES.
2. COOLING SYSTEM EQUIPMENT DESIGN AND SELECTIONS ARE BY "BOULDEN ENERGY SYSTEMS". CONTRACTOR IS RESPONSIBLE FOR THE DESIGN INTEND OF THESE DETAILS IF "BOULDEN ENERGY SYSTEMS" IS NOT SELECTED.
3. GENERATOR MANUFACTURER SHALL LOCATE AND SUPPORT THE HEAT EXCHANGERS (DIESEL FUEL HX, CHARGE AIR HX, JACKET WATER HX) AND SURGE TANK.
4. GENERATOR MANUFACTURER SHALL INSTALL FUEL PIPING, CHARGE AIR PIPING, JACKET WATER PIPING, VENT PIPE, AND ACCESSORIES IN COOLING SYSTEM AS INDICATED ABOVE WITHIN THE DASHED LINE.
5. DIESEL FUEL HX - SIMILAR TO "THERMAL TRANSFER PRODUCTS" MODEL SB-702-A6-O, CHARGE AIR HX - SIMILAR TO "THERMAL TRANSFER PRODUCTS" MODEL CC-1660-C4-1, JACKETWATER HX - SIMILAR TO "THERMAL TRANSFER PRODUCTS" MODEL C-1724-8.4-6-F, SURGE TANK - SIMILAR TO "ROCORE" 8 GAL.

3 FT. ETHAN ALLEN - CITY WATER COOLING SYSTEM SCHEMATIC

SCALE: NOT TO SCALE

GENERAL NOTES

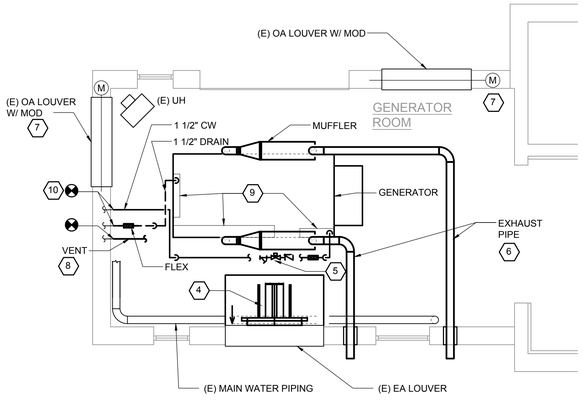
1. REFER TO M001 FOR GENERAL NOTES, SYMBOL LEGEND AND LIST OF ABBREVIATIONS.
2. PIPING ROUTING ARE SCHEMATICS ONLY, AND GENERATOR COOLING SYSTEM INSTALLATION SHALL FOLLOW GENERATOR MANUFACTURER'S RECOMMENDATIONS.
3. MUFFLER AND EXHAUST FLEX CONNECTOR SHALL BE SUPPLIED BY DIV 26, AND INSTALLED BY DIV 23. COORDINATE WITH ELECTRICAL CONTRACTOR AND GENERATOR MANUFACTURER. GENERATOR EXHAUST SYSTEM INSTALLATION SHALL FOLLOW MANUFACTURER'S RECOMMENDATIONS.
4. PROVIDE MINIMALLY REQUIRED SUPPORT FROM CEILING ABOVE, PROTECT PENETRATION WITH FIRE PROTECTION MATERIALS.
5. COORDINATE NEW EXHAUST PIPE HEIGHT WITH AVAILABLE CEILING SPACE (APPROX. 128" AFF).

(#) KEYED NOTES

1. DEMOLISH TWO EXHAUST FANS, ASSOCIATED CONTROLS AND THE SCREEN GUARD.
2. DEMOLISH VENTILATOR FAN CONTROL PANEL. PROTECT THE CONTROL WIRES OF EXISTING OA LOUVER DAMPERS FOR NEW FAN CONNECTION.
3. DEMOLISH GENERATOR EXHAUST PIPE AND MUFFLER. FILL WALL PENETRATION AND MATCH WITH EXISTING WALL FINISH. USE FIRE STOPPING MATERIALS AS NECESSARY.
4. PROVIDE EXHAUST FAN (SIMILAR TO GREENHECK SBCE-3H36-50) WITH DDC CONTROLS. INTERLOCK NEW EF WITH GENERATOR. PROVIDE OSHA MOTOR SIDE GUARD. PROVIDE HARDWARE FOR SIDE WALL MOUNTING.
5. PROVIDE BACKFLOW PREVENTER ASSEMBLY. SOLENOID VALVE (NORMALLY CLOSED WITH 24VDC COIL) IS SIMILAR TO MAGNATROL 35A46. PROVIDE STRAINER WATTS MODEL 2-77-DFI-125, 2" FNPT THREADED, OR APPROVED EQUAL.
6. PROVIDE SEAMLESS BLACK STEEL SCHEDULE 80 EXHAUST PIPE WITH WELDED JOINTS AND BUTT WELDING FITTINGS. INSULATE EXHAUST PIPE AND MUFFLER WITH MINERAL-FIBER INSULATION. COORDINATE EXHAUST PIPE SIZES AND CONNECTIONS TO GENERATOR WITH ELECTRICAL CONTRACTOR AND GENERATOR MANUFACTURER. PROVIDE EXTERIOR WALL PENETRATION FOR EXHAUST PIPE.
7. INTERLOCK EXISTING OA LOUVER DAMPERS WITH NEW EF. CLEAN AND REMOVE DUST FROM THE LOUVER. REPAIR BROKEN BLADE IF ANY.
8. EXTEND AND CONNECT VENT PIPE TO GENERATOR FUEL TANK.
9. HEAT EXCHANGERS INSTALLED BY GENERATOR MANUFACTURER.
10. CONTRACTOR SHALL IDENTIFY ISOLATION VALVE FOR THE BRANCH PIPING AND ISOLATE FOR CONNECTION NEW PIPING TO EXISTING.

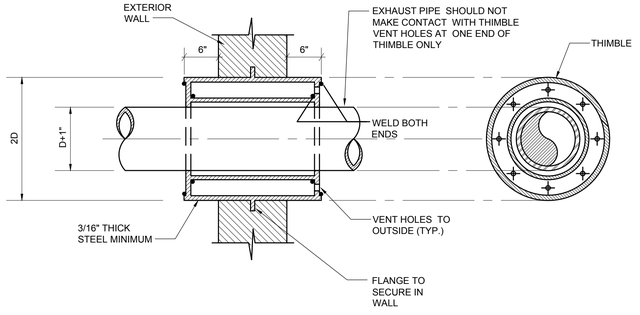
CONTROLS NOTES

1. GENERATOR SHALL BE INTERLOCKED WITH OUTDOOR AIR LOUVER DAMPER, NEW EXHAUST FAN. EXHAUST FAN SHALL BE INTERLOCKED WITH EXHAUST AIR LOUVER DAMPER. WHEN GENERATOR IS ENERGIZED, OA LOUVER DAMPER SHALL OPEN, EA LOUVER DAMPER SHALL OPEN, EF SHALL BE ENERGIZED. WHEN GENERATOR IS DE-ENERGIZED, OA LOUVER DAMPER SHALL CLOSE, EA LOUVER DAMPER SHALL CLOSE, EF SHALL BE DE-ENERGIZED.



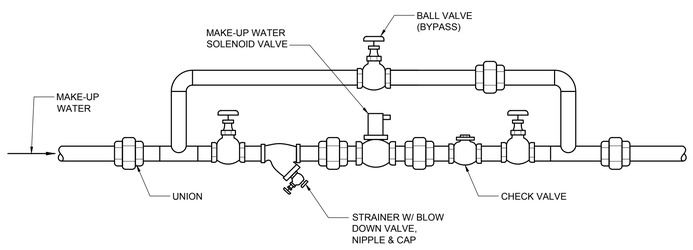
2 FT. ETHAN ALLEN - MECHANICAL FLOOR PLAN - NEW WORK

SCALE: 1/4" = - 1'-0"



4 GENERATOR THIMBLE DETAIL

SCALE: NOT TO SCALE



5 BACKFLOW PREVENTER ASSEMBLY DETAIL

SCALE: NOT TO SCALE

1/4"=1'-0"

4 0' 4' 8'

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PROJECT:

NEW GENERATOR AND TEMPORARY GENERATOR CONNECTION FOR PUMPING STATIONS ETHAN ALLEN

REVISIONS:

- -

REGISTRATION:

COMMONWEALTH OF VIRGINIA
VASSILIOS K. SKARDIS
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PROFESSIONAL ENGINEER

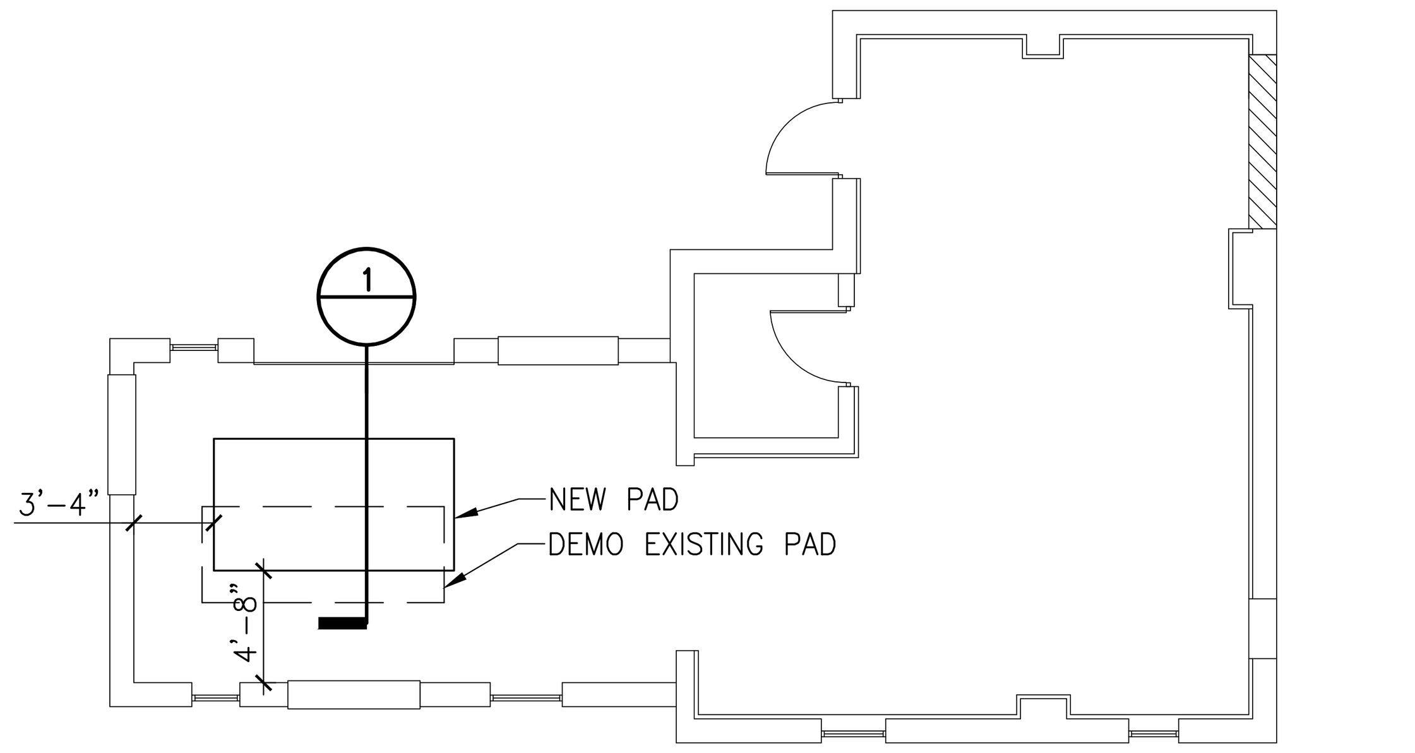
DRAWN BY:	HS
DATE:	05-17-2019
PROJECT NO.:	F18-14

DRAWING TITLE:

MECHANICAL PLANS & SCHEMATICS

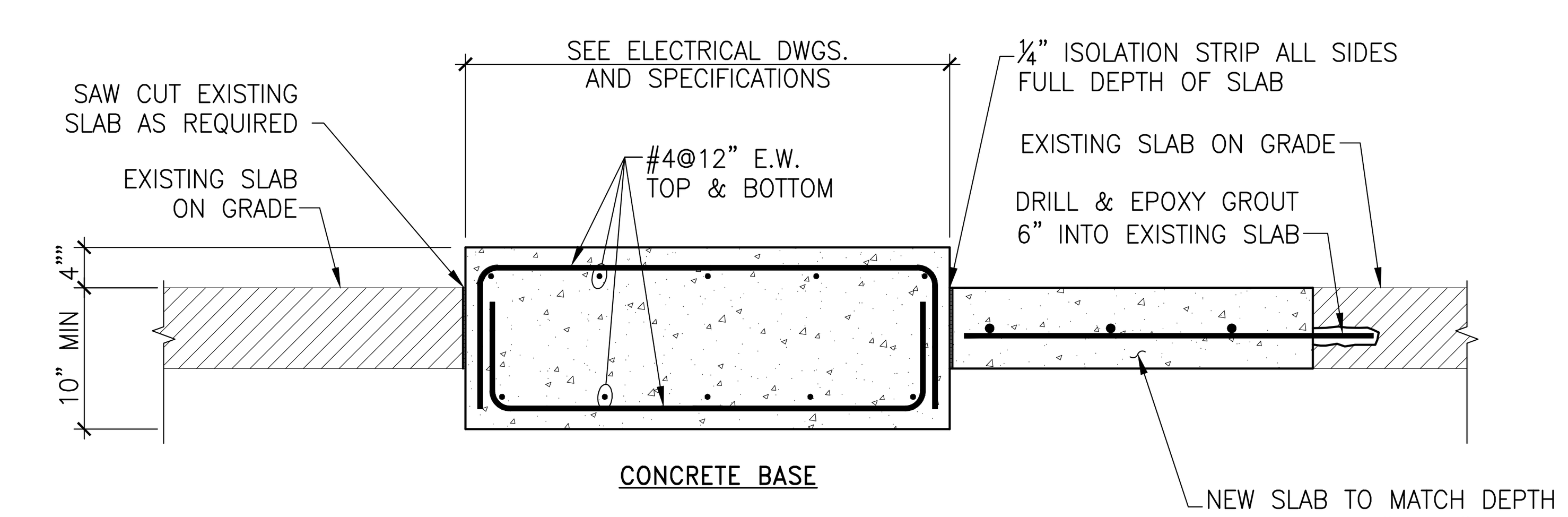
DRAWING NUMBER

M110EA



FT. ETHAN ALLEN – FLOOR PLAN

1/8" = 1'-0"



NOTE:
1. ADHESIVE GROUTED DOWELS ACCEPTABLE. MATCH REBAR SIZE AND LOCATIONS SHOWN AND EMBED A MINIMUM OF 2½".
2. VERIFY ALL BASE AND PAD LOCATIONS, DIMENSIONS AND ADEQUACY WITH THE ELECTRICAL ENGINEER AND THE INDIVIDUAL EQUIPMENT REQUIREMENTS. ELECTRICAL ENGINEER TO SPECIFY ISOLATION DATA.

1 CONCRETE BASE AND PAD FOR EQUIPMENT AT EXISTING SLAB

NTS.

SPECIFICATIONS

1. THE WORK SHOWN ON THESE DRAWINGS ADDRESSES STRUCTURAL INFORMATION ONLY. THE STRUCTURAL DOCUMENTS INCLUDE THESE S-SERIES DRAWINGS AND GENERAL NOTES. THERE ARE NO TECHNICAL SPECIFICATIONS IN ADDITION TO THESE GENERAL NOTES.

BUILDING CODE

1. THE FOLLOWING BUILDING CODES AND STANDARDS, INCLUDING ALL SPECIFICATIONS REFERENCED WITHIN, SHALL APPLY TO THE DESIGN, CONSTRUCTION, QUALITY CONTROL, AND SAFETY OF ALL WORK PERFORMED ON THE PROJECT.
   A. "2015 VIRGINIA UNIFORM STATEWIDE BUILDING CODE," VIRGINIA BOARD OF HOUSING AND COMMUNITY DEVELOPMENT.
   B. "INTERNATIONAL BUILDING CODE – 2015," INTERNATIONAL CODE COUNCIL, INCLUDING LOCAL JURISDICTION AMENDMENTS.
   C. "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES," (ANSI/ASCE 7 – 10, 2010), AMERICAN SOCIETY OF CIVIL ENGINEERS.
   D. ADDITIONAL CODES AND STANDARDS FOR DIFFERENT MATERIALS ARE LISTED IN THE SECTIONS THAT FOLLOW.

DESIGN LOADS

1. EQUIPMENT LOADS – SEE CUT SHEETS OF PURCHASED UNITS

GENERAL

1. THESE DRAWINGS REPRESENT THE COMPLETED PROJECT WHICH HAS BEEN DESIGNED FOR THE WEIGHTS OF MATERIALS, FOR THE SUPERIMPOSED LOADS INDICATED IN THE DESIGN LOAD CRITERIA ABOVE, AND FOR LOADS INDICATED ON THE DRAWINGS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ALLOWABLE CONSTRUCTION LOADS.
2. DEVELOPING AND IMPLEMENTING JOB SITE SAFETY AND CONSTRUCTION PROCEDURES ARE SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.
3. ALL COSTS OF INVESTIGATION AND REDESIGN DUE TO CONTRACTOR MIS-LOCATION OF STRUCTURAL ELEMENTS OR OTHER LACK OF CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS SHALL BE AT THE CONTRACTOR'S EXPENSE.
4. CONTRACTOR SHALL REFER TO OTHER DISCIPLINES' DRAWINGS INCLUDING, BUT NOT LIMITED TO MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS FOR SIZE AND LOCATION OF GENERATORS AND ATTACHMENT POINTS
5. IN CASE OF CONFLICT BETWEEN THE GENERAL NOTES AND DETAILS, THE MOST STRINGENT SHALL GOVERN.
6. WORK IN SOME AREAS IS NOT EXPLICITLY DETAILED ON THE DRAWINGS BUT IS IMPLIED TO BE SIMILAR TO CORRESPONDING AREAS. WORK IN THESE AREAS SHALL BE THE SAME AS THAT SHOWN AT THE CORRESPONDING LOCATIONS.

SUBMITTALS

1. SHOP DRAWINGS FOR ALL STRUCTURAL ELEMENTS SHOWN ON THE CONTRACT DOCUMENTS ARE REQUIRED TO BE SUBMITTED BY THE CONTRACTOR AND REVIEWED BY THE STRUCTURAL ENGINEER.
2. SHOP DRAWINGS SHALL BE SUBMITTED ELECTRONICALLY IN PORTABLE DOCUMENT FORMAT (PDF). A MARKED-UP PDF COPY OF THE SHOP DRAWINGS WITH THE STRUCTURAL ENGINEER'S COMMENTS WILL BE RETURNED TO THE CONTRACTOR.
3. ALLOW 10 BUSINESS DAYS FOR STRUCTURAL REVIEW OF SHOP DRAWINGS. THIS TIME SHOULD BE ALLOTTED IN THE CONTRACTOR'S SCHEDULE.
4. SHOP DRAWINGS SHALL BEAR THE CONTRACTOR'S STAMP OF APPROVAL WHICH SHALL CONSTITUTE CERTIFICATION THAT THEY HAVE VERIFIED ALL FIELD MEASUREMENTS, CONSTRUCTION CRITERIA, MATERIALS, AND SIMILAR DATA AND HAVE CHECKED EACH DRAWING FOR COMPLETENESS, COORDINATION, AND COMPLIANCE WITH THE CONTRACT DOCUMENTS. SHOP DRAWINGS NOT REVIEWED BY THE CONTRACTOR WILL NOT BE REVIEWED BY SIMPSON GUMPERTZ & HEGER.

CONCRETE WORK

1. CODES AND STANDARDS:
   A. "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE, ACI 318-14," AMERICAN CONCRETE INSTITUTE.
   B. "ACI MANUAL OF CONCRETE PRACTICE – PARTS 1 THROUGH 5," AMERICAN CONCRETE INSTITUTE.
2. STANDARD SPECIFICATIONS AND REFERENCE STANDARDS:
   A. "MANUAL OF STANDARD PRACTICE," CONCRETE REINFORCING STEEL INSTITUTE.
   B. FOLLOW THE LATEST RECOMMENDATIONS AND SPECIFICATIONS OF THE AMERICAN CONCRETE INSTITUTE:
      1) ACI 301 SPECIFICATIONS FOR STRUCTURAL CONCRETE
      2) ACI 302 CONCRETE FLOOR AND SLAB CONSTRUCTION
      3) ACI 304 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE
      4) ACI 305 HOT WEATHER CONCRETING
      5) ACI 306 COLD WEATHER CONCRETING
      6) ACI 315 DETAILING REINFORCING STEEL
      7) ACI 318 GENERAL DESIGN OF ITEMS NOT OTHERWISE SPECIFIED
      8) ACI 347 FORMWORK
3. CONCRETE MIX PROPERTIES:

A. ELEMENT (NORMAL WEIGHT UNO)	28-DAY STRENGTH	W/C MAX	AIR CONTENT
1) EQUIPMENT PADS	4,500 PSI	0.45	3%+/-1.5

   B. PORTLAND CEMENT: ASTM C150, TYPE I, II, OR I/II.
   C. FLY ASH: ASTM C618, TYPE C OR F
      1) LIMIT TO 30% MAXIMUM REPLACEMENT OF PORTLAND CEMENT
   D. SLAG CEMENT: ASTM C989, GRADE 100
      1) LIMIT TO 50% MAXIMUM REPLACEMENT BY WEIGHT OF PORTLAND CEMENT
   E. FOR MIXTURES INCLUDING BOTH FLY ASH AND SLAG CEMENT
      1) LIMIT REPLACEMENT BY WEIGHT OF PORTLAND CEMENT TO 50% MAXIMUM.
   F. NORMAL WEIGHT AGGREGATES: ASTM C33
   G. NORMAL WEIGHT CONCRETE DENSITY: 145 PCF
   H. AIR-ENTRAINMENT: ASTM C260
4. STEEL REINFORCEMENT:
   A. DEFORMED REINFORCING BARS: ASTM A615 GRADE 60
5. CONCRETE COVER:
   A. MILD REINFORCED CONCRETE
      1) CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH: 3 IN.
      2) CONCRETE EXPOSED TO EARTH OR WEATHER:
         a. #6 BAR OR LARGER 2 IN.
         b. #5 BAR OR SMALLER 1 1/2 IN.
      3) CONCRETE NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND:
         a. SLABS, WALLS, AND JOISTS: #11 BAR OR SMALLER 3/4 IN.
         b. BEAMS AND COLUMNS (TO TIES, STIRRUPS, OR SPIRALS): 1 1/2 IN.
6. GENERAL REQUIREMENTS:
   A. EXISTING SURFACE TREATMENT: ROUGHEN ALL EXISTING CONCRETE SURFACES COMMON WITH NEW CONCRETE TO AMPLITUDE OF 1/4 IN.
   B. FORMWORK, SHORING, AND RESHORING: SHALL BE DESIGNED AND SUBMITTED BY THE CONTRACTOR'S ENGINEER REGISTERED IN THE PROJECT'S JURISDICTION WITH ALL SUBMISSIONS BEARING THE ENGINEER'S SEAL AND SIGNATURE. REFER TO SUBMITTALS SECTION FOR ADDITIONAL REQUIREMENTS.
   C. INSERTS AND SLEEVES: CONTRACTOR SHALL FURNISH DIMENSIONED SHOP DRAWINGS SHOWING LOCATIONS OF ALL CAST-IN-PLACE SLEEVES AND INSERTS REQUIRED BY ALL TRADES FOR REVIEW BY THE MEP AND STRUCTURAL ENGINEER.
   D. CORES AND DRILLED FASTENERS:
      1) DRILLED OR POWDER DRIVEN FASTENERS WILL BE PERMITTED WHEN PROVEN TO THE SATISFACTION OF THE STRUCTURAL ENGINEER THAT THE FASTENERS WILL NOT SPALL THE CONCRETE OR DAMAGE EXISTING REINFORCEMENT.
      2) WHEN INSTALLING POST-INSTALLED FASTENERS, THE CONTRACTOR SHALL TAKE MEASURES TO AVOID DRILLING OR CUTTING OF ANY EXISTING REINFORCING AND DESTRUCTION OF CONCRETE. ALL FASTENERS SHALL BE INSTALLED PER THE RELEVANT ICC-ES ESR REPORT AND THE MANUFACTURER'S SPECIFICATIONS.
   E. CHAMFER ALL EXPOSED CONCRETE CORNERS, 3/4 IN. X 3/4 IN. MINIMUM.
7. SPLICING AND PLACEMENT OF REINFORCEMENT:
   A. REINFORCEMENT SPLICES ARE NOT PERMITTED EXCEPT AS DETAILED OR AUTHORIZED BY THE STRUCTURAL ENGINEER. MAKE BARS CONTINUOUS AROUND CORNERS. WHEN PERMITTED, SPLICES SHALL BE MADE BY CONTACT TENSION LAP SPLICE, UNLESS NOTED OTHERWISE.
   B. REINFORCEMENT WELDING IS NOT PERMITTED UNLESS SPECIFICALLY DETAILED OR APPROVED IN WRITING BY THE STRUCTURAL ENGINEER.
   C. PROVIDE #4 CHAIR BARS, HIGH CHAIRS, TIES, SLAB BOLSTERS, AND OTHER ACCESSORIES WHERE NOT SPECIFIED ON THE DRAWINGS IN ACCORDANCE WITH MANUAL OF STANDARD PRACTICE OR DETAILING REINFORCING CONCRETE STRUCTURES ACI 315 OR CRSI-WRSI MANUAL OF STANDARD PRACTICE. USE PLASTIC TIPS ON ALL CHAIRS PLACED ON THE CONCRETE FORMWORK.
   D. PROVIDE PLASTIC TIPPED BOLSTERS AND CHAIRS AT ALL LOCATIONS WHERE THE CONCRETE SURFACE IS EXPOSED.
8. REINFORCEMENT SHOP DRAWINGS:
   A. SUBMIT FOR APPROVAL, COMPLETE BENDING AND PLACING DETAILS OF ALL REINFORCEMENT, INCLUDING WELDED WIRE REINFORCEMENT, INDICATING POSITION OF SPLICES. INCLUDE ACCESSORY DRAWINGS.
9. HOUSEKEEPING PADS AND CURBS:
   A. PADS AND CURBS SHOWN ON PLAN ARE FOR REFERENCE ONLY. SEE ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR LOCATIONS AND COORDINATE WITH EQUIPMENT MANUFACTURER'S REQUIREMENTS. USE SAME CONCRETE MIXTURE AS BASE SLAB, UNLESS DETAILED OTHERWISE.
10. INSPECTION AND TESTING:
   A. THE CONTRACTOR SHALL ENGAGE A QUALIFIED TESTING AGENCY TO PROVIDE SERVICES IN ACCORDANCE WITH THE LATEST EDITIONS OF ACI 311.6 AND ACI 311.7 AND AS INDICATED BELOW AND TO SUBMIT REPORTS.
   B. CAST-IN-PLACE CONCRETE:
      1) THE AGENCY SHALL INSPECT THE FORMWORK, REINFORCING STEEL, CONCRETE PLACEMENT, ETC. FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS, APPLICABLE CODES AND STANDARDS, AND THE SHOP DRAWINGS.
      2) SAMPLE AND TEST FRESH CONCRETE FOR EACH MIXTURE PLACED EACH DAY, ONCE AT INITIAL DELIVERY AND REPEATED FOR EACH [50 OR 100] CUBIC YARDS PLACED.
      3) CAST, CURE, AND TEST COMPOSITE SAMPLES OF STANDARD CYLINDERS. ONE COMPOSITE SAMPLE SHALL CONSIST OF (2)6"X12" OR (3)4"X8" STANDARD CYLINDERS. NUMBER OF COMPOSITE SAMPLES AT EACH TEST SHALL BE AS FOLLOWS:
         a. FOOTINGS AND OTHER STRUCTURAL CONCRETE:
            (1) LAB CURED 1@7 DAYS, 1@28 DAYS
         b. THE AGENCY WILL MAKE ADDITIONAL TEST OF IN-PLACE CONCRETE AT THE CONTRACTOR'S EXPENSE WHEN THE TEST RESULTS INDICATE SPECIFIED CONCRETE STRENGTHS HAVE NOT BEEN ATTAINED, AS DIRECTED BY THE STRUCTURAL ENGINEER.
   C. POST-INSTALLED DOWELS:
      1) INSPECT INITIAL INSTALLATIONS WITH ADHESIVE AND PERIODICALLY THROUGHOUT PROJECT.
      2) MINIMUM INSPECTION SHALL INCLUDE:
         a. INSTALLER CERTIFICATION WHERE REQUIRED (VERTICAL/OVERHEAD)
         b. HOLE DRILLING METHOD AND LOCATION, DIAMETER AND DEPTH OF HOLE
         c. HOLE CLEANING
         d. ADHESIVE IDENTIFICATION AND EXPIRATION
         e. ADHESIVE AND ANCHOR INSTALLATION

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PROJECT:

NEW GENERATOR AND TEMPORARY GENERATOR CONNECTION FOR PUMPING STATIONS
ETHAN ALLEN

REVISIONS:

- -

REGISTRATION:

COMMONWEALTH OF VIRGINIA
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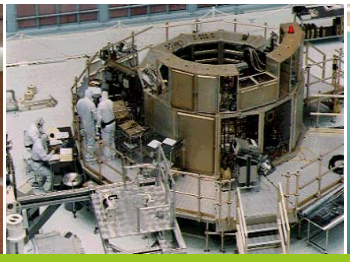

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TABLE OF CONTENTS
TECHNICAL MANUAL Ft ETHAN ALLEN PUMPING STATION

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feetabove sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

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

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation.

Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230523.12 - BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel ball valves.
2. Iron ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.1 for power piping valves.
7. ASME B31.9 for building services piping valves.

C. Refer to HVAC valve schedule articles for applications of valves.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types:

1. Handlever: For quarter-turn valves smaller than NPS 4.

G. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, One-Piece:

1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass or bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass or stainless steel.
h. Ball: Chrome-plated brass or stainless steel.
i. Port: Reduced.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, One-Piece with Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Reduced.

2.4 STEEL BALL VALVES

A. Steel Ball Valves with Full Port and Stainless-Steel Trim, Class 150:

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

a. Apollo Flow Controls; Conbraco Industries, Inc.
b. Jamesbury; Metso.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel, ASTM A216, Type WCB.
e. Ends: Flanged.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

2.5 IRON BALL VALVES

A. Iron Ball Valves, Class 125:

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

a. American Valve, Inc.
b. Apollo Flow Controls; Conbraco Industries, Inc.
c. KITZ Corporation.
d. Sure Flow Equipment Inc.
e. WATTS.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Steel Piping, NPS 2 and Smaller: Threaded ends.

2. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 CITY WATER VALVE SCHEDULE

A. Pipe NPS 2and Smaller: Brass or bronze ball valves, one piece with stainless-steel trim, full regular port, threaded or press connection-joint ends.

1. Valves may be provided with solder-joint ends instead of threaded ends.

B. Pipe NPS 2-1/2 and Larger:

1. Iron ball valves, Class 125.

a. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Steel ball valves, Class 150.

END OF SECTION 230523.12

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Fastener systems.
4. Equipment supports.

B. Related Requirements:

1. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Equipment supports.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 THERMAL-HANGER SHIELD INSERTS

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

1. Buckaroos, Inc.
2. CADDY; a brand of nVent.
3. Carpenter & Paterson, Inc.
4. National Pipe Hanger Corporation.
5. Pipe Shields Inc.
6. Piping Technology & Products, Inc.
7. Rilco Manufacturing Co., Inc.
8. Value Engineered Products, Inc.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psiminimum compressive strength.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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

a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.
d. Simpson Strong-Tie Co., Inc.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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

a. B-line, an Eaton business.
b. Empire Tool and Manufacturing Co., Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
e. MKT Fastening, LLC.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Generator exhaust pipe: The pipe shall not be supported directly by the engine block or engine components. Allowances shall be made for system movement and vibration isolation by using suitable flexible components such as rubber dampers or springs.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

C. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inchesthick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 incheslong and 0.048 inchthick.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation mounts.
2. Open-spring isolators.
3. Pipe-riser resilient supports.
4. Resilient pipe guides.
5. Elastomeric hangers.
6. Spring hangers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

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

a. Ace Mountings Co., Inc.
b. CADDY; a brand of nVent.
c. California Dynamics Corporation.
d. Isolation Technology, Inc.
e. Kinetics Noise Control, Inc.
f. Korfund.
g. Mason Industries, Inc.
h. Novia; A Division of C&P.
i. Vibration Eliminator Co., Inc.
j. Vibration Isolation.
k. Vibration Management Corp.
l. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.2 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

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

    a. Ace Mountings Co., Inc.
    b. CADDY; a brand of nVent.
    c. California Dynamics Corporation.
    d. Isolation Technology, Inc.
    e. Kinetics Noise Control, Inc.
    f. Korfund.
    g. Mason Industries, Inc.
    h. Novia; A Division of C&P.
    i. Vibration Eliminator Co., Inc.
    j. Vibration Isolation.
    k. Vibration Management Corp.
    l. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.3 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

2.4 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.5 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

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

   a. Ace Mountings Co., Inc.
   b. CADDY; a brand of nVent.
   c. California Dynamics Corporation.
   d. Kinetics Noise Control, Inc.
   e. Mason Industries, Inc.
   f. Novia; A Division of C&P.
   g. Vibration Eliminator Co., Inc.
   h. Vibration Isolation.
   i. Vibration Management Corp.
   j. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.6 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

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

   a. Ace Mountings Co., Inc.
   b. CADDY; a brand of nVent.
   c. California Dynamics Corporation.
   d. Kinetics Noise Control, Inc.
   e. Mason Industries, Inc.
   f. Novia; A Division of C&P.
   g. Vibration Eliminator Co., Inc.
   h. Vibration Isolation.
   i. Vibration Management Corp.
   j. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 230548.13

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

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

   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc.
   j. Seton Identification Products.

2. Material and Thickness: anodized aluminum, 0.032-inchminimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inchfor viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

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

   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc.
   j. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inchthick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inchfor name of units if viewing distance is less than 24 inches, 1/2 inchfor viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inchbond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Marking Sevices Inc.
9. National Marker Company.

10. Seton Identification Products.
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Red.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inchfor name of units if viewing distance is less than 24 inches, 1/2 inchfor viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

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

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Sevices Inc.
11. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1/2 inchfor viewing distances up to 72 inchesand proportionately larger lettering for greater viewing distances.

2.4 DUCT LABELS

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

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. Kolbi Pipe Marker Co.
8. LEM Products Inc.
9. Marking Sevices Inc.
10. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inchthick, and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inchfor name of units if viewing distance is less than 24 inches, 1/2 inchfor viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feetalong each run. Reduce intervals to 25 feetin areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Refrigerant Piping: White letters on a safety-purple background.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Red: For supply ducts.
2. Green: For return ducts.
3. Blue: For exhaust-air ducts.
4. Purple: For outside-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feetin each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 23 0553

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Sections:

1. Section 232113 "Hydronic Piping".

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material test reports.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber: Mineral wool. Comply with ASTM C547.

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

2. Johns Manville; a Berkshire Hathaway company.

3. Knauf Insulation.

4. Manson Insulation Inc.

5. Owens Corning.

6. 850 deg F.
7. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
8. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Calcium Silicate. Comply with ASTM C533.

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

2. Johns Manville; a Berkshire Hathaway company.

3. Knauf Insulation.

4. Manson Insulation Inc.

5. Owens Corning.

6. 850 deg F.
7. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
8. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

2.3 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
d. Mon-Eco Industries, Inc.
e. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
3. Color: White.

2.4 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. FSK and Metal Jacket Flashing Sealants:

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

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

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

   a. 3M Industrial Adhesives and Tapes Division.
   b. Avery Dennison Corporation, Specialty Tapes Division.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inchin width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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

   a. 3M Industrial Adhesives and Tapes Division.
   b. Avery Dennison Corporation, Specialty Tapes Division.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

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

a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel, with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. C & F Wire.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Turbocharger and manifold.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies.

F. Wall or Roof Thimbles: Engine’s exhaust piping passing through combustible walls must be guarded at the point of passage by an approved metal ventilated thimble to prevent exhaust pipe heat from being transmitted to the combustible material. Thimble must be suitable for the application. Consider the type of exhaust system, construction materials used and local fire codes.

1. Wall thimble: Shall be constructed to extend at least 6 inches both ways from the surface of the wall. Wall thimbles shall have ventilation holes on one end which should be oriented to the inside of the building.
2. Roof thimble: Shall be constructed to extend at least 9 inches both ways from the surface of roof. Roof thimbles shall have ventilation holes on both ends, and a rain shield shall be

provided above the thimble. Rain caps on the end of exhaust pipe shall be provided. Extend the exhaust pipe well beyond the roof and use a gradual “U” bend at the end to direct the exhaust outlet downward which will keep rain, snow out of the pipe. The outlet of exhaust pipe shall be far enough away from the roof to prevent ignition of the roof material from hot exhaust.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape

insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections, with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.

3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material:

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

3.8 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Underground piping.
   2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Generator exhaust piping:

   1. NPS 3/4 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Type II: 1-1/2inchesthick.
      b. Calcium Silicate, 1-1/2inchesthick.

   2. NPS 1 and Larger: Insulation shall be the following:
      a. Mineral-Fiber, Type II: 3 inchesthick.
      b. Calcium Silicate, 3 inchesthick.

   3. Muffler: Insulation shall be the following:
      a. Mineral-Fiber, Type II: 3 inchesthick.
      b. Calcium Silicate, 3 inchesthick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

   1. Aluminum, Smooth: 0.024 inch thick.

END OF SECTION 230719

SECTION 230923.11 - CONTROL VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stand-alone control valves and actuators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.
2. Include diagrams for pneumatic signal and main air tubing.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

C. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

D. Determine control valve sizes and flow coefficients by ISA 75.01.01.

E. Control valve characteristics and rangeability shall comply with ISA 75.11.01.

1. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.
2. In water systems, select modulating control valves at terminal equipment for a design Cv based on a pressure drop of 5 psig at design flow unless otherwise indicated.

2.2 SOLENOID VALVES

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

1. ASCO Valve, Inc.

2. Magnatrol.

B. Description:

1. Action: normally closed in the event of electrical power failure.
2. Size to close against the system pressure.
3. Manual override capable.
4. Heavy-duty assembly.
5. Body: Bronze or stainless steel.
6. Seats and Discs: NBR or PTFE.
7. Solenoid Enclosure: NEMA 12.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduits to comply with requirements indicated.

D. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

E. Firestop penetrations made in fire-rated assemblies and seal penetrations made in acoustically rated assemblies.

F. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

G. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.2 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.3 CONTROL VALVES

A. Install pipe reducers for valves smaller than line size. Position reducers as close to valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer-recommended clearance.

B. Install flanges or unions to allow drop-in and -out valve installation.

C. Where indicated, install control valve with three-valve bypass manifold to allow for control valve isolation and removal without interrupting system flow by providing manual throttling valve in bypass pipe.

D. Install drain valves in piping upstream and downstream of each control valve installed in a three-valve manifold and for each control valve larger than NPS 2.

E. Valve Orientation:

1. Where possible, install globe and ball valves installed in horizontal piping with stems upright and not more than 15 degrees off of vertical, not inverted.
2. Install valves in a position to allow full stem movement.
3. Where possible, install butterfly valves that are installed in horizontal piping with stems in horizontal position and with low point of disc opening with direction of flow.

F. Clearance:

1. Locate valves for easy access and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
2. Install valves with at least 12 inches of clear space around valve and between valves and adjacent surfaces.

G. Threaded Valves:

1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
2. Align threads at point of assembly.
3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.

H. Flanged Valves:

1. Align flange surfaces parallel.
2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

I. Connect electrical devices and components to electrical grounding system. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

J. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at

points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

K. Install engraved phenolic nameplate with valve identification on valve and on face of ceiling directly below valves concealed above ceilings.

3.4 CHECKOUT PROCEDURES

A. Control Valve Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check valves for proper location and accessibility.
3. Check valves for proper installation for direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
4. For pneumatic products, verify air supply for each product is properly installed.
5. For pneumatic valves, verify that pressure gauges are provided in each air line to valve actuator and positioner.
6. Verify that control valves are installed correctly for flow direction.
7. Verify that valve body attachment is properly secured and sealed.
8. Verify that valve actuator and linkage attachment are secure.
9. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
10. Verify that valve ball, disc, and plug travel are unobstructed.
11. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

3.5 ADJUSTMENT, CALIBRATION, AND TESTING

A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressures.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

D. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION 230923.11

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Steel pipe and fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pipe.
2. Fittings.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Engine’s cooling system Water Piping: 80 psig at 150 deg F.
2. Drain Piping: 200 deg F.
3. Generator Exhaust Piping: 700 deg F.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Plain-End Mechanical-Joint Couplings:

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

a. Anvil International.
b. NormaGroup.
c. Shurjoint-Apollo Piping Products USA Inc.
d. Victaulic Company.

2. Housing: ASTM A-536 Grade 65-45-12 segmented ductile iron or type 304 stainless steel.
3. Gasket: EPDM.
4. Sealing Mechanism: Double-lip sealing system or carbon steel case-hardened jaws.
5. Bolts, hex nuts, washers, or lock bars based on manufacturer's design.
6. Minimum Pressure Rating: Equal to that of the joined pipes.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Engine’s cooling system Water Piping: Schedule 40 black steel with welded joints between engine generator and heat exchangers.

B. Drain Piping: Schedule 40 black steel with welded joints.

C. Generator Exhaust Pipe: Schedule 80 black steel with welded joints and butt welded fittings.

1. Maximum back pressure of the muffler, exhaust flex connector and exhaust pipe shall not exceed the generator manufacturer’s recommendation.

2. Coordinate exhaust pipe sizes and connections to generator with electrical contractor and generator manufacturer.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

K. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

L. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

M. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

N. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

O. Install valves.

P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install shutoff valve immediately upstream of each dielectric fitting.

S. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

T. Engine’s exhaust piping shall be constructed and installed in accordance with NFPA 37 Standard for the installation and use of stationary combustion engines and gas turbines.

Routing of exhaust piping should be as short and direct as possible. Where possible, sweep elbows with a radius of at least 3 times the pipe diameter should be used.

U. To prevent condensed moisture from running back into the engine, exhaust piping shall be sloped away from the engine and a condensate trap and drain shall be incorporated at a low point ahead of engine manifolds for an exhaust system with lengthy piping. The trap shall be drained periodically.

V. Horizontal extended exhaust pipe shall terminate with a 45 deg tail pipe to prohibit rain from entering the system. A screen shall be provided across the end of tail pipe to keep small animals from entering the system. Where vertical exhaust stack is used, a rain cap shall be provided to exclude rain and snow from the exhaust pipe.

W. The exhaust flex (supplied by engine manufacturer) shall not be bent or used to make up for misalignment between engine exhaust and the exhaust piping.

3.3 HANGERS AND SUPPORTS

A. Comply with requirements specified in Section 230548 "Vibration Controls for HVAC."

B. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Spring hangers to support vertical runs.

D. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support horizontal piping within 12 inches of each fitting and coupling.

G. Exhaust piping shall be independently supported with no weight applied to the engine, exhaust manifold or flex connector. Where exhaust pipes attach to the engine, they must be connected with flexible connectors to minimize vibrations that can cause damage to the exhaust system.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Plain-End Mechanical-Coupled Joints: Prepare, assemble, and test joints in accordance with manufacturer's written installation instructions.

3.5 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

3.6 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.

2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Inspect and set operating temperatures of hydronic equipment, to specified values.
6. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232116 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hydronic specialty valves.
2. Air-control devices.
3. Strainers.
4. Connectors.

B. Related Requirements:

1. Section 230523.15 "Gate Valves for HVAC Piping".
2. Section 230923.11 “Control Valves”.
3. Section 232113 “Hydronic Piping”.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. Include construction details and material descriptions for hydronic piping specialties.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

B. Safety Valves and Pressure Vessels: Shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

A. Diaphragm-Operated Safety Valves: ASME labeled.

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

    a. AMTROL, Inc.
    b. Apollo Flow Controls; Conbraco Industries, Inc.
    c. Armstrong Pumps, Inc.
    d. Bell & Gossett; a Xylem brand.
    e. Spence Engineering Company, Inc.
    f. WATTS.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:

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

    a. AMTROL, Inc.
    b. Apollo Flow Controls; Conbraco Industries, Inc.
    c. Armstrong Pumps, Inc.
    d. Bell & Gossett; a Xylem brand.
    e. Hays Fluid Controls.
    f. HCI; Hydronics Components Inc.
    g. Nexus Valve, Inc.
    h. NuTech Hydronic Specialty Products.
    i. TACO Comfort Solutions, Inc.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/8.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg F.

B. Expansion Tanks:

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

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.

c. Bell & Gossett; a Xylem brand.
d. Flo Fab Inc.
e. Rocore.
f. TACO Comfort Solutions, Inc.

2. Tank: Welded steel, rated to withstand maximum closed-loop coolant system pressure for engine used, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
5. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch-diameter gage glass, and slotted-metal glass guard.

C. In-Line Air Separators:

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

a. AMTROL, Inc.
b. Armstrong Products, Inc.
c. Bell & Gossett; a Xylem brand.
d. Spirotherm, Inc.
e. TACO Comfort Solutions, Inc.

2. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
3. Maximum Working Pressure: Up to withstand maximum closed-loop coolant system pressure for engine used.
4. Maximum Operating Temperature: Up to 300 deg F.

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 40-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

2.4 CONNECTORS

A. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.

3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

C. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install piping from air separator to expansion tank with a 2 percent upward slope toward tank.

C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

D. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

E. Install expansion tanks near the engine. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116

SECTION 233416 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backward-inclined centrifugal fans, including airfoil and curved blade fans.
2. Forward-curved centrifugal fans.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fan room layout and relationships between components and adjacent structural and mechanical elements, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BACKWARD-INCLINED CENTRIFUGAL FANS

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

1. Acme Engineering & Manufacturing Corp.
2. Aerovent; a division of Twin City Fan Companies, Ltd.
3. Central Blower Company.
4. COMEFRI.
5. Greenheck.
6. Loren Cook Company.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
2. Factory-installed and -wired disconnect switch.

C. Housings:

1. Housing Material: Reinforced steel.
2. Housing Coating: Powder-baked enamel.
3. Housing Assembly: Sideplates spot welded or attached by continuous Pittsburgh lock seal or similar seal.
4. Formed panels to make curved-scroll housings with shaped cutoff.
5. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
6. Horizontally split, bolted-flange housing.
7. Spun inlet cone with flange.
8. Outlet flange.
9. Discharge Arrangement: Fan scroll housing is field rotatable to any of seven discharge positions. Provide fan with discharge positioned in proper direction to minimize connected duct turns.

D. Wheels:

1. Wheel Configuration: SWSI or DWDI construction with a precision-spun curved inlet flange and a backplate fastened to shaft with setscrews. Wheels shall be statically and dynamically balanced, and nonoverloading.
2. Wheel and Blade Material: Steel or Aluminum.

    a. Spark-Resistant Construction: Classified according to AMCA 99, Type A.

3. Wheel and Blade Coating: Powder-baked enamel.
4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
5. Backward-Inclined Airfoil Blades:

    a. Aerodynamic design.
    b. Heavy backplate.

c. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.

6. Backward-Inclined Curved Blades:

a. Curved design.
b. Heavy backplate.
c. Single-thickness blades continuously welded at tip flange and backplate.

E. Shafts:

1. Statically and dynamically balanced, and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Bearings:

1. Prelubricated and Sealed Shaft Bearings:

a. Self-aligning, pillow-block-type ball bearings.

2. Grease-Lubricated Shaft Bearings, Tapered Roller:

a. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
b. Extended Lubrication Lines: Extend lines to accessible location.

3. Grease-Lubricated Shaft Bearings, Ball or Roller:

a. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
b. Extended Lubrication Lines: Extend lines to accessible location.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch pulleys for use with motors larger than 5 hp.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Comply with OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146 inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short-circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

H. Motor Enclosure: Open, dripproof.

I. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around, and to, shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
5. Inlet Screens: Grid screen of same material as housing.
6. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
7. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
8. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.
9. Piezometer Ring: Piezometer ring mounted at fan inlet cone for airflow measurement.

2.2 FORWARD-CURVED CENTRIFUGAL FANS

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

1. Acme Engineering & Manufacturing Corp.

2. Greenheck.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt- driven centrifugal fans, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Housing Material: Reinforced steel.
2. Housing Coating: Powder-baked enamel.
3. Housing Assembly: Sideplates spot welded or attached by continuous Pittsburgh lock seal or similar seal.
4. Formed panels to make curved-scroll housings with shaped cutoff.
5. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
6. Horizontally split, bolted-flange housing.
7. Spun inlet cone with flange.
8. Outlet flange.
9. Discharge Arrangement: Fan scroll housing field rotatable to any of seven discharge positions. Provide fan with discharge positioned in proper direction to minimize connected duct turns.

D. Wheels:

1. Wheel Configuration: SWSI or DWDI construction with a curved inlet flange, and a backplate fastened to shaft with setscrews.
2. Wheel and Blade Material: Steel.

a. Spark-Resistant Construction: Classified according to AMCA 99, Type A.

3. Wheel and Blade Coating: Powder-baked enamel.
4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with setscrews.
5. Forward-Curved Wheels:

a. Black-enameled or galvanized-steel construction with inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow.
b. Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with setscrews.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Bearings:

1. Prelubricated and Sealed Shaft Bearings:

a. Self-aligning, pillow-block-type ball bearings.

2. Grease-Lubricated Shaft Bearings, Tapered Roller:

a. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
b. Extended Lubrication Lines: Extend lines to accessible location.

3. Grease-Lubricated Shaft Bearings, Ball or Roller:

a. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
b. Extended Lubrication Lines: Extend lines to accessible location.

G. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch for use with motors larger than 5 hp.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Comply with OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146 inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short-circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

H. Motor Enclosure: Open, dripproof.

I. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around, and to, shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
5. Inlet Screens: Grid screen of same material as housing.
6. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
7. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
8. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.
9. Piezometer Ring: Piezometer ring mounted at fan inlet cone for airflow measurement.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

2.4 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. AMCA Compliance: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.

C. Fan Sound Ratings: Comply with AMCA 311 and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.

D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.

E. Operating Limits: Classify fans according to AMCA 99.

PART 3 - EXECUTION

3.1 INSTALLATION OF CENTRIFUGAL HVAC FANS

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:

1. Install floor- or roof-mounted centrifugal fans on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
3. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Curb Support, Field Built-Up: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," detail "Equipment Support Curb," number "SPF-9" (page 1409) and detail "Equipment Support Curb," number "SPF-9S" (page 1410). Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

F. Curb Support, Prefabricated: Rail-type wood support provided by fan manufacturer.

G. Unit Support: Install centrifugal fans level on structural curbs or pilings. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

H. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration-isolation devices.

1. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.
2. Comply with requirements in Section 230548.13 "Vibration Controls for HVAC" for vibration-isolation devices.

I. Install units with clearances for service and maintenance.

J. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK AND PIPING CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

D. Install heat tracing on all drain piping subject to freezing temperature and as indicated on Drawings. Furnish and install heat tracing according to Section 230533 "Heat Tracing for HVAC Piping."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Perform tests and inspections.

D. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that there is adequate maintenance and access space.
4. Verify that cleaning and adjusting are complete.
5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
6. Adjust belt tension.
7. Adjust damper linkages for proper damper operation.
8. Verify lubrication for bearings and other moving parts.
9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
10. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.

11. Remove and replace malfunctioning units and retest as specified above.

E. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer's authorized service representative.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

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

1. Alpha Wire Company.
2. American Bare Conductor.
3. Encore Wire Corporation.

4. General Cable Technologies Corporation.
5. Okonite Company (The).
6. Service Wire Co.
7. Southwire Company.
8. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:
1. Type THHN and Type THWN-2: Comply with UL 83.
2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
3. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Limited applications as indicated on the plans.

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

1. AFC Cable Systems; a part of Atkore International.
2. Alpha Wire Company.
3. American Bare Conductor.
4. General Cable Technologies Corporation.
5. Okonite Company (The).
6. Service Wire Co.
7. Southwire Company.

D. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

E. Circuits:

1. Single circuit with color-coded conductors.

F. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

G. Ground Conductor: Insulated green ground conductor.

H. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

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

1. 3M Electrical Products.
2. AFC Cable Systems; a part of Atkore International.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; a brand of Emerson Industrial Automation.
9. Service Wire Co.
10. TE Connectivity Ltd.
11. Thomas & Betts Corporation; A Member of the ABB Group.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Feeders: Copper for feeders smaller than No. 4 AWG; copper for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
1. Vibrating equipment circuits. Metal-Clad type MC Cable for final connection, maximum length 36”.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) 12 inches (300 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
b. Test bolted connections for high resistance using one of the following:

1) A low-resistance ohmmeter.
2) Calibrated torque wrench.
3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.
d. Inspect for correct identification.
e. Inspect cable jacket and condition.
f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove

box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

4. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

D. Cables will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Structural steel for fabricated supports and restraints.
4. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
5. Fabricated metal equipment support assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Ductwork, piping, fittings, and supports.
3. Structural members to which hangers and supports will be attached.
4. Size and location of initial access modules for acoustical tile.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M**.**

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design hanger and support system.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-(10-mm-) diameter holes at a maximum of 8 inches (200 mm) O.C. in at least one surface.

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

a. Allied Tube & Conduit; a part of Atkore International.
b. B-line, an Eaton business.
c. Flex-Strut Inc.
d. Gripple Inc.
e. GS Metals Corp.
f. G-Strut.
g. MIRO Industries.
h. Thomas & Betts Corporation; A Member of the ABB Group.
i. Unistrut; Part of Atkore International.
j. Wesanco, Inc.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

3. Material for Channel, Fittings, and Accessories: Galvanized steel and or Stainless steel, Type 316 where indicated.
4. Channel Width: 1-5/8 inches (41.25 mm).
5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

        1) Hilti, Inc.
        2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

        1) B-line, an Eaton business.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti, Inc.
        4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M, Grade A325 (Grade A325M).
6. Toggle Bolts: All -steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways (3 or more) or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, conduits may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, disconnect switches, control enclosures, pull and junction boxes, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

C. EMT: Electrical Metallic Tube

1.4 ACTION SUBMITTALS

A. Product Data: For wireways and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

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

    a. AFC Cable Systems; a part of Atkore International.
    b. Allied Tube & Conduit; a part of Atkore International.
    c. Anamet Electrical, Inc.
    d. Calconduit.
    e. FSR Inc.
    f. NEC, Inc.
    g. O-Z/Gedney; a brand of Emerson Industrial Automation.
    h. Perma-Cote.
    i. Picoma Industries, Inc.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040 inch (1 mm), minimum.

6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

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

    a. AFC Cable Systems; a part of Atkore International.
    b. Allied Tube & Conduit; a part of Atkore International.
    c. Anamet Electrical, Inc.
    d. Calconduit.
    e. FSR Inc.
    f. NEC, Inc.
    g. O-Z/Gedney; a brand of Emerson Industrial Automation.
    h. Perma-Cote.
    i. Picoma Industries, Inc.

2. Comply with NEMA FB 1 and UL 514B.

3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: compression.

7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

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

1. B-line, an Eaton business.
2. Hoffman; a brand of nVent.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.3 BOXES, ENCLOSURES, AND CABINETS

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

1. Crouse-Hinds, an Eaton business.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. FSR Inc.
5. Hoffman; a brand of nVent.
6. Hubbell Incorporated.
7. Hubbell Incorporated; Wiring Device-Kellems.
8. Kraloy.
9. Milbank Manufacturing Co.
10. MonoSystems, Inc.
11. O-Z/Gedney; a brand of Emerson Industrial Automation.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 (UON) with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

J. Cabinets:

1. NEMA 250, Type 1 (UON) galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, UON.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

a. Loading dock.
b. Spaces used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

I. Support conduit within 12 inches (300 mm) of enclosures to which attached.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Conduit extending from interior to exterior of building.
   2. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
   3. Where otherwise required by NFPA 70.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches (915 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install fire-stopping at penetrations of fire-rated floor and wall assemblies.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

E. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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

a. HOLDRITE.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Cable ties.
7. Paint for identification.
8. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C).

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

4. Color for Neutral: White or gray.
5. Color for Equipment Grounds: Green.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 48 INCHES (1200MM)."

E. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

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

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Grafoplast Wire Markers.
e. HellermannTyton.
f. LEM Products Inc.
g. Marking Services, Inc.
h. Panduit Corp.
i. Seton Identification Products.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

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

a. Brady Corporation.
b. HellermannTyton.
c. Marking Services, Inc.
d. Panduit Corp.
e. Seton Identification Products.
f.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.

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

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

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

    a. A'n D Cable Products.
    b. Brady Corporation.
    c. Brother International Corporation.
    d. emedco.
    e. Grafoplast Wire Markers.
    f. HellermannTyton.
    g. Ideal Industries, Inc.
    h. LEM Products Inc.
    i. Marking Services, Inc.
    j. Panduit Corp.
    k. Seton Identification Products.

2. Minimum Nominal Size:

    a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
    b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
    c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 4 inches (100 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

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

    a. Brady Corporation.
    b. HellermannTyton.
    c. Marking Services, Inc.
    d. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

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

    a. Brady Corporation.
    b. Panduit Corp.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

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

    a. Carlton Industries, LP.
    b. Champion America.
    c. HellermannTyton.
    d. Ideal Industries, Inc.
    e. Marking Services, Inc.
    f. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

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

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.

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

    a. HellermannTyton.
    b. LEM Products Inc.
    c. Marking Services, Inc.
    d. Seton Identification Products.

2.6 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

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

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.
    e. Seton Identification Products.

2.7 CABLE TIES

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

1. HellermannTyton.
2. Ideal Industries, Inc.
3. Marking Services, Inc.
4. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."

M. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

V. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV- stabilized cable ties.

W. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

X. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

Y. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

Z. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Indoors and outdoors: UV-stabilized nylon.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, use vinyl wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.

G. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.
b. Controls with external control power connections.

I. Arc Flash Warning Labeling: Self-adhesive labels.

J. Operating Instruction Signs: Self-adhesive labels.

K. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated acrylic or melamine sign 4 inches (100 mm) high.
3. Equipment installed under this contract to Be Labeled.

END OF SECTION 260553

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Non-fusible switches.
   2. Molded-case circuit breakers (MCCBs).
   3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current ratings (interrupting and withstand, as appropriate).
   4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
   5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
   6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.2 NONFUSIBLE SWITCHES

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

1. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.3 MOLDED-CASE CIRCUIT BREAKERS

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

1. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; by Schneider Electric.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.

E. MCCBs shall be equipped with kirk-key interlock.

F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
4. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) and brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel) as shown on drawings.

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts.

D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager and the County no fewer than five days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's and or the County’s written permission.
4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 4X.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

f. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
g. Verify correct phase barrier installation.
h. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

E. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
e. Determine the following by primary current injection if applicable:

1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as shown on the plans.

END OF SECTION 262816

SECTION 263213.14 - DIESEL ENGINE GENERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes engine generators used to supply non-emergency power, with the following features:

1. Diesel engine.
2. Diesel fuel-oil system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Vibration isolation devices.
7. Finishes.

1.2 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer’s descriptive literature, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
5. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor, and reference air-supply temperature. Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
6. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.
7. Include computer generated sizing calculation.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.

4. Design calculations for selecting vibration isolators and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.

C. Field quality-control reports.

D. Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For engine generators to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operations and maintenance manual.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. MTU Onsite Energy Corporation. (Bases of Design)
2. Kohler Power Systems.
3. Caterpillar, Inc. Electric Power Division.

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.

C. UL Compliance: Comply with UL 2200.

D. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local (Arlington County Virginia) government requirements.

E. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 104 deg F (Minus 15 to plus 40 deg C).
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: Standby.

D. Service Load: As indicated on the plans.
1. Generator size (kW) indicated on the plans is based on generator sizing calculation software by MTU. All the loads on the generator are shown on the single line diagram. Other manufacturer's product shall demonstrate that they are capable of handling the indicated loads on one-step while maintaining indicated kW rating and foot-print/ physical size shown.

E. Power Factor: 0.8, lagging.

F. Frequency: 60 Hz.

G. Voltage: 480 -V ac.

H. Phase: Three-phase, four wire, wye.

I. Induction Method: Turbocharged.

J. Governor: Adjustable isochronous, with speed sensing.

K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.

L. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

M. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: within 10 seconds.

2.4 DIESEL ENGINE

A. Fuel: ASTM D 975, diesel fuel oil, Grade 2-D S15.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499.

E. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump (if required).

1. Coolant: City Water.
2. Heat Exchanger: Mounted on the generator skid completely piped and valved for its intended operation (Refer to mechanical drawings and schematics diagram). Capacities as noted on plans/schedules.
3. Temperature Control: Self-contained, thermostatic-control valve modulates city water flow automatically to maintain optimum constant temperature as recommended by engine manufacturer.
4. City Water Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer: Supper critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 73 dBA or less.

G. Air-Intake Filter: Single-stage, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: Match engine ECU and generator set control voltage requirements.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified..
4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F (10 deg C) regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 to 140 deg F (minus 40 to plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 30.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 1 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Due to limitation in the space, the physical dimension of the tank shall not exceed from the basis of design and what is shown on the plans. Features include the following:

1. Tank level indicator.
2. Fuel-Tank Capacity: Minimum 133 percent of total fuel required for planned operation plus fuel for periodic maintenance operations between fuel refills.
3. Leak detection in interstitial space.
4. Vandal-resistant fill cap.
5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 30 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.

F. Unit-mounted Control and Monitoring Panel:

1. Digital engine generator controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Analog control panel with dedicated gages and indicator lights for the instruments and alarms indicated below.
3. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gage.
    b. Engine-coolant temperature gage.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, for each phase.
    f. AC ammeter, for each phase.
    g. AC frequency meter.
    h. Generator-voltage adjusting rheostat.

4. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low-water temperature alarm.
    g. High engine temperature pre-alarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Low fuel main tank.

        1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required in "Fuel Tank Capacity" Subparagraph in "Diesel Fuel-Oil System" Article.

    m. Coolant low-level alarm.
    n. Coolant low-level shutdown device.
    o. Coolant high-temperature prealarm.
    p. Coolant high-temperature alarm.
    q. Coolant low-temperature alarm.
    r. Coolant high-temperature shutdown device.
    s. Battery high-voltage alarm.
    t. Low cranking voltage alarm.
    u. Battery-charger malfunction alarm.
    v. Battery low-voltage alarm.
    w. Lamp test.
    x. Contacts for local and remote common alarm.
    y. Low-starting air pressure alarm.
    z. Low-starting hydraulic pressure alarm.
    aa. Remote manual stop shutdown device.
    bb. Air shutdown damper alarm when used.
    cc. Air shutdown damper shutdown device when used.
    dd. Generator overcurrent-protective-device not-closed alarm.
    ee. Hours of operation.

ff. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

G. Connection to Datalink:

1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.
2. Provide connections for datalink transmission of indications to existing SCADA panel which is located in the generator room through dry contact or other compatible solution.

H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

B. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator output rating.
3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
4. Mounting: Adjacent to, or integrated with, control and monitoring panel.

C. Generator Disconnect Switch: Molded-case type; 100 percent rated.

1. Trip Rating: Matched to generator output rating. UON.
2. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.

D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide 12 -lead alternator.

E. Range: Provide limited range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 30 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 15 percent and stabilize at rated frequency within 2 seconds.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Sub-transient Reactance: 12 percent, maximum.

2.9 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

B. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.10 FINISHES

A. Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.
9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
10. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before engine generator installation.

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

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.
3. Contractor shall provide a temporary generator as stand-by during working at each station so that the stations will not be without backup power at any time.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with engine generator manufacturers' written installation and alignment instructions.

C. Equipment Mounting:

1. Install engine generators on cast-in-place concrete equipment bases. Coordinate size and location of concrete bases for engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Cooling System: Install Schedule 40 black steel piping with welded joints for cooling water piping between engine generator and heat exchanger.

1. Install isolating thimbles where exhaust piping penetrates combustible surfaces. Provide a minimum of 9 inches (225 mm) of clearance from combustibles.

E. Exhaust System: Install Schedule 40 black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.

1. Space and ceiling height is limited in generator rooms. The existing opening for the exhaust pipe through exterior wall shall be utilized. Coordinate exact location of the new muffler, exhaust pipe and any other components of the new generator in the field.
2. Install flexible connectors and steel piping materials according to manufacturer's recommendation.
3. Insulate muffler/silencer and exhaust system components according to manufacturer's recommendation.
4. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches (225 mm) of clearance from combustibles.

F. Drain Piping: Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.

G. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.

C. Connect cooling-system water piping to engine generator and heat exchanger with flexible connectors.

D. Connect engine exhaust pipe to engine with flexible connector.

E. Connect fuel piping to engines with a gate valve and union and flexible connector.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.5 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with Drawings and the Specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify that the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Perform insulation-resistance tests according to IEEE 43.

            a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.
            b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.

        2) Test protective relay devices.
        3) Verify phase rotation, phasing, and synchronized operation as required by the application.
        4) Functionally test engine shutdown for low oil pressure, over-temperature, overspeed, and other protection features as applicable.
        5) Perform vibration test for each main bearing cap.
        6) Verify correct functioning of the governor and regulator.

2. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.

b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within manufacturer's specifications.

3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
5. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
6. Exhaust Emissions Test: Comply with applicable government test criteria.
7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
9. Noise Level Tests: Measure A-weighted level of noise emanating from engine generator installation, including engine exhaust and cooling-air intake and discharge, at four locations 25 feet (8 m) from edge of the generator to the property lines and compare measured levels with required values.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Remove and replace malfunctioning units and retest as specified above.

K. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

M. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's authorized service representative. Include quarterly preventive maintenance and exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Parts shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213.14

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ATTACHMENT A – PRICING SHEET

FURNISHING ALL LABOR, MATERIALS, AND EQUIPMENT FOR THE ETHAN ALLEN GENERATOR REPLACEMENT

PLEASE PROVIDE PRICES IN ALL CELLS HIGHLIGHTED IN BLUE. BIDDERS SHALL PROVIDE THEIR BID PRICES IN THE CELLS HIGHLIGHTED IN BLUE BELOW. BIDDERS SHALL INCLUDE A BID PRICE FOR ALL ITEMS. FAILURE TO PROVIDE A PRICE FOR ALL ITEMS, OR ANY MODIFICATIONS OR ADDITIONS TO THE BID FORM MAY RESULT IN BID REJECTION.

PROJECT COST BREAKDOWNS

ITEM	DESCRIPTION	MANUFACTURER	QTY	UNIT	UNIT PRICE	TOTAL
1	MOBILIZATION/DE-MOBILIZATION (NOT TO EXCEED 5% OF THE TOTAL BID AMOUNT) – LABOR, MATERIALS, EQUIPMENT, ETC.		1	LS	$32,400.00	$32,400.00
2	DEMOLITION – LABOR, MATERIALS, EQUIPMENT, TEMPORARY CONSTRUCTION, ETC.		1	LS	$47,000.00	$47,000.00
Major Work						
ITEM	**DESCRIPTION**		**QTY**	**UNIT**	**UNIT PRICE**	**TOTAL**
3	GENERATOR PAD – LABOR & MATERIALS	N/A	1	LS	$12,200.00	$12,200.00
4	450kW 480/277V GENERATOR WITH 250 GAL DOUBLE WALL DIESEL BELLY FUEL TANK – LABOR & MATERIALS	MTU	1	LS	$359,000.00	$359,000.00
5	400A 480V, 3-PHASE 4W PIN AND SLEEVE TYPE TEMPOARY GENERATOR PLUG WITH DISCONNECT SWITCH – LABOR & MATERIALS	Appleton	1	LS	$12,000.00	$12,000.00
6	REMOVING OLD FEEDERS AND INSTALLING NEW FEEDER AND OTHER BRANCH CIRCUIT WIRING – LABOR & MATERIALS	N/A	1	LS	$62,000.00	$62,000.00
7	DEMOLISHING OLD FAN AND INSTALLING NEW WITH NEW CIRCUITING – LABOR & MATERIALS	Greenheck	1	LS	$33,240.00	$33,240.00
Miscellaneous						
ITEM	**DESCRIPTION**		**QTY**	**UNIT**	**UNIT PRICE**	**TOTAL**
8	WIRING, CONDUIT, FITTINGS, MISC. ELECTRICAL – LABOR & MATERIALS		1	LS	$13,860.00	$13,860.00
9	OVERHEAD, PROFIT, TAXES, ETC.		1	LS	$77,327.00	$77,327.00
					LUMP SUM TOTAL BID PRICE	**$649,027.00**

Bidder Name: FHP Tectonics Corp.

COMMONWEALTH of VIRGINIA
DEPARTMENT OF LABOR AND INDUSTRY

Gary G. Pan
COMMISSIONER

Main Street Centre
600 East Main Street, Suite 207
Richmond, Virginia 23219
PHONE (804) 371-2327
FAX (804) 371-6524

Virginia Department of Labor and Industry Wage Determination Decision

Project Name	Generator Replacement for Ethan Allen
County Project Code	DES-ITBPW-341
DOLI Project Number	ARLC-22-0019 UPDATE
County or Independent City	Arlington County
Publication Date	02/22/2023
Construction Type	Building

Wage Determinations	Wage	Fringe
Asbestos Worker/Heat & Frost Insulator (Duct, Pipe & Mechanical System Insulation)*	$39.27	$18.67
Boilermaker	$42.62	$24.81
Brick Pointer/Caulker/Cleaner	$19.68	
Bricklayer	$34.00	$12.59
Carpenter, Includes Acoustical Ceiling Installation, Drywall Hanging, and Form Work	$23.36	$5.20
Cement Mason/Concrete Finisher	$21.94	$3.36
Drywall Finisher/Taper	$26.61	$11.41
Electrician (Includes Low Voltage Wiring and Installation of Alarms and Sound and Communication Systems)	$50.00	$20.49
Firestopper**	$29.41	$8.73
Floor Layer: Soft Floors	$18.75	

Wage Determinations	Wage	Fringe
Glazier	$29.92	$13.35
Ironworker	$34.85	$24.84
Ironworker, Reinforcing	$27.46	$8.71
Laborer: Common or General, including brick mason tending and cement mason tending	$15.55	$2.44
Laborer: Pipelayer	$16.81	$4.26
Marble Finisher	$25.81	$11.55
Mason - Stone	$40.81	$19.43
Operator: Backhoe/Excavator/Trackhoe	$23.50	$4.50
Operator: Bobcat/Skid Steer/Skid Loader	$18.95	$4.03
Operator: Bulldozer	$21.99	$4.98
Operator: Crane	$30.45	$4.14
Operator: Forklift	$21.56	$7.57
Operator: Loader	$22.26	$3.57
Operator: Roller	$16.25	$4.88
Painter (Brush, Roller, and Spray)	$26.61	$11.41
Pipefitter (Includes HVAC Pipe, Unit and Temperature Controls Installations)***	$47.98	$23.12
Plumber****	$48.00	$20.75
Roofer	$15.83	$3.06
Sheet Metal Worker (Includes HVAC Duct Installer)*****	$44.37	$21.33
Sprinkler Fitter (Fire Sprinklers)	$38.67	$24.66
Tile Finisher	$23.40	
Tile Setter	$27.80	$10.25
Truck Driver: Dump Truck	$19.22	$2.58
Waterproofer	$21.75	$1.57

Additional Notes

* Asbestos Worker/Heat & Frost Insulator (Duct, Pipe & Mechanical System Insulation) * PAID HOLIDAYS: New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the day after Thanksgiving and Christmas Day provided the employee works the regular work day before and after the paid holiday. *

** Firestopper ** Includes the application of materials or devices within or around penetrations and openings in all rated wall or floor assemblies, in order to prevent the passage of fire, smoke of other gases. The application includes all components involved in creating the rated barrier at perimeter slab edges and exterior cavities, the head of gypsum board or concrete walls, joints between rated wall or floor components, sealing of penetrating items and blank openings. PAID HOLIDAYS: New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the day after Thanksgiving and Christmas Day provided the employee works the regular work day before and after the paid holiday. **

*** Pipefitter (Includes HVAC Pipe, Unit and Temperature Controls Installations)*** PAID HOLIDAYS: New Year's Day, Martin Luther King's Birthday, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and the day after Thanksgiving and Christmas Day. ***

**** Plumbing **** PAID HOLIDAYS: New Year's Day, Martin Luther King's Birthday, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and the day after Thanksgiving and Christmas Day. ****

***** Sheet Metal Worker (Includes HVAC Duct Installer)***** PAID HOLIDAYS: New Year's Day, Martin Luther King's Birthday, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and the day after Thanksgiving and Christmas Day. *****

All wage rates to be used on a contract will be set at the time the contract is awarded. While DOLI maintains a list of wage determinations online for reference purposes, only the wage determinations made in an official Wage Determination Decision, sent by DOLI to the contracting agency, can be used to ascertain the exact rates to be paid for a specific contract.

All rates are determined by DOLI and any appeals of specific classifications may be made through the Wage Determination Appeal form available at http://www.doli.virginia.gov/wp-content/uploads/2021/04/Appeal-for-Wage-Determination-Clarification.pdf

Any additional classifications may be requested through the Additional Wage Classification form available at http://www.doli.virginia.gov/wp-content/uploads/2021/04/Request-for-Additional-Wage-Classification.pdf
Understand your duties as a contractor under Virginia law by referencing our Contractor Responsibilities information sheet available at http://www.doli.virginia.gov/wp-content/uploads/2021/04/PREVAILING-WAGE-CONTRACTOR-RESPONSIBILITIES.pdf

Your employees have specific rights, which can be found on our List of Employee Rights information sheet available at http://www.doli.virginia.gov/wp-content/uploads/2021/04/PREVAILING-WAGE-EMPLOYEE-RIGHTS.pdf
Any further questions should be directed to PrevailingWage@doli.virginia.gov

CONTRACTOR PERFORMANCE EVALUATION POLICY

Department of Management & Finance, Purchasing Division

Dr. Sharon Lewis, Ed.D., LL.M., CPPB, VCO
Division Chief

1.0 Table of Contents

2.0 Background and Purpose

For quality assurance purposes, it is essential the County has a mechanism to collect contractor performance information for capital construction projects.

This Policy identifies roles and responsibilities and establishes policies and procedures for collecting and reporting contractor performance. This operating procedure applies to all Arlington County capital construction contracts greater than $250,000.00 and may be used for projects other than construction.

Please be advised, the clause must be added to the solicitation to be used for any resulting contract. The Contractor must be notified, in advance of responding to any Bid or RFP, that their performance will be monitored using the criteria in the performance form.

3.0 Policy

It is the Purchasing Division's policy that clear and timely evaluations of a contractor's performance are performed.

3.1. The evaluation should be an objective report of a contractor's performance during the contract.

3.2. Evaluation factors for each assessment shall include at a minimum:

a) Technical (quality of product or service)

b) Cost Control

c) Schedule/Timeliness

d) Sub-contractor Management

e) Other (late or non-payment to subcontractors, termination, etc.)

3.3. The Project Officer (PjO) responsible for assessing a contractor's performance and recording that information must ensure that the information accurately depicts and corresponds to the contractor's performance.

3.4. An evaluation must be completed for all capital construction contracts equal to or greater than $250,000.00.

3.5. Evaluations are not completed for subcontractors. However, evaluation of a contractor's performance should include information on the ability of a prime contractor to manage and coordinate subcontractor efforts if applicable.

3.6. The Project Officer must certify in all evaluation forms as to the accuracy of its contents and shall not negotiate the contents of the Contractor Evaluation Form or the Ratings with the Contractor or its representative for any reason. The Contractor must be allowed the opportunity to provide comments related to the contents of the evaluation.

3.7. An evaluation will be valid for no more than three (3) years.

4.0 Procedures

4.1 The Project Officer (PjO) may deem it necessary to complete the Contractor Evaluation Form during different phases of the Contract as noted below:

a) At 50% completion of the work.

b) After final completion for a single project or task order, but prior to final payment;

c) Prior to exercising an option year;

d) Anytime during the course of the project, if the Project Officer deems it necessary to provide feedback as to the performance of the Contractor;

e) Upon termination of a Contractor.

4.2 The Project Officer will forward the completed and signed Contractor Evaluation Form to the Procurement Officer or the Assistant Purchasing Agent (APA) for review.

4.2 The Contractor may, within thirty (30) calendar days of receipt of the evaluation, submit a written response to the Project Officer if they concur or do not concur with the evaluation.

a) If the contractor does not concur with the evaluation and is disputing any information contained in the evaluation, they may provide additional information concerning the project that may be relevant to the evaluation of the Contractor's performance to the Project Officer and Purchasing Agent.

b) If the Project Officer finds it necessary for good cause to revise an evaluation, they may do so provided they include a written explanation for the revision acceptable to the Purchasing Agent. If not, the evaluation will be closed, remain as written, but include any Contractor response, and included in the Project and Procurement File.

c) After the thirty (30) day comment period, any additional information provided by the Contractor will not be accepted.

5.0 Internal Controls

5.1 This Policy shall be reviewed at least every two years to ensure the contents remain relevant and reflects current regulations and guidance.

5.2 The Project Officer is responsible for documenting the department's contract file with the Contractor Performance Evaluation Form.

5.3 The Procurement Officer that conducted the solicitation process will conduct spot checks to ensure a Contractor Performance Evaluation is conducted, with oversight by the Assistant Purchasing Agents.