

HANOVER TOWNSHIP

BID DOCUMENTS

AND

TECHNICAL SPECIFICATIONS

FOR

HANOVER TOWNSHIP POLICE DEPARTMENT VEHICLE STORAGE BUILDING

BIDS DUE
JUNE 16, 2026 AT 1:45 PM
BID OPENING
JUNE 16, 2026 AT 2:00 PM

Project No. 25084



WIDMER ENGINEERING INC.
806 Lincoln Place
Beaver Falls, PA 15010
(724) 847-1696
FAX (724) 847-0419

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ADVERTISEMENT FOR BIDS

HANOVER TOWNSHIP POLICE DEPARTMENT VEHICLE STORAGE BUILDING

Sealed proposals for the **Police Department Vehicle Storage Building** shall be received by Hanover Township, 11 Municipal Drive Burgettstown, PA 15021 until **1:45 PM** prevailing time **June 16, 2026**, for furnishing labor, materials, and performing all work as set forth in the advertisement, general conditions, special provisions, and technical specifications. Bids shall be publicly opened and read aloud at or about **2:00 PM**.

The project consists of construction of a vehicle storage building for the police department.

Bid documents and specifications are available only via download from the Widmer Engineering web site at: widmerengineering.com under bids. All questions concerning this solicitation must be sent via email to **HanoverTwp@widmerengineering.com** no later than (5) five business days prior to the due date. Addenda, if any, will be issued to only those persons who are registered as having obtained contract documents. Electronic PDF documents are available at no charge. Hard copies will not be distributed.

Each proposal shall be accompanied by either a certified check or Surety Company bid bond in the amount of not less than ten (10%) of the contract amount. The same shall be made payable to Hanover Township.

Bids, whether mailed or delivered in person, shall be sealed, and marked "**HANOVER TOWNSHIP VEHICLE STORAGE BUILDING**" and shall be addressed to: Hanover Township, 11 Municipal Drive Burgettstown, PA 15021

The Township reserves the right to accept or reject individual Bids and to waive any irregularities and/or any informalities in the Bids or Bidding.

Chelsea Arthurs
Secretary/Treasurer
Hanover Township, Washington County

BID PROPOSAL

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ARTICLE 1 – BID RECEIPIENT

- 1.01 This Bid is submitted to:
Hanover Township, 11 Municipal Drive Burgettstown, PA 15021
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

The owner shall reject all bids or award the contract to the lowest responsible and responsive bidder within 60 days after the Bid opening. If the award is delayed due to the required approval of another government agency, the sale of bonds, or the award of a grant, the bidder may agree to delay the award upon request of Owner in writing.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

- 3.01 In submitting this Bid, Bidder represents that:
- A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Addendum, Date</u>
_____	_____
_____	_____
_____	_____

- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of all the work.
- C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

- D. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.
- E. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- F. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- G. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- H. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
- I. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.
- J. The Bidder certifies that Alternates of Bid Form include costs or coordination of related work, modification or adjustments to adjacent work, miscellaneous devices, accessory objects, overhead, general conditions and similar items incidental to or required for a complete installation.
- K. The bidder, for price stated, will provide and pay for all labor, materials, equipment, tools, machinery, transportation, superintendence of construction and licenses, and incidental work. Work will be place in an expeditious and workmanlike manor, will be completed to satisfaction and acceptance of Owner and Architect, and will be completed in accordance with the Contract Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the e execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

TOTAL OF BASE BID is \$ _____ (in figures)

_____ (in words)

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

- A. Required Bid security in the form of a Bid Bond of 10% of Bid Total
- B. List of Proposed Subcontractors;
- C. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;
- D. Required Bidder Qualification Statement with supporting data;
- E. Public Works Employment Verification Form;
- F. If bid is from a Partnership, Corporation, or Joint Venture, attach evidence of authority to sign the bid documents;
- G. Certificate of Compliance with the Pennsylvania Steel Products Procurement Act.

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – THE BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

By: _____
[Signature]

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
[Signature]

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

Telephone Number: _____

Contact Name and e-mail address: _____

Bidder's License No.: _____
(where applicable)

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INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

Whenever in these Contract Documents the following words, terms and expressions, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

Owner: Party of the First Part or First Party to this Contract, acting directly or through any agency, officer or employee duly authorized to act for the said party in the execution of the work required by this Contract.

Engineer: The person or organization duly authorized by the Owner to observe and inspect the execution of this Contract, acting directly or through properly authorized agents, engineers, assistants, inspectors, superintendents or other representatives acting severally within the scope of the particular duties entrusted to them.

Contractor: Party of the Second Part or Second Party to this Contract, acting directly or through his authorized lawful agents, legal representatives, or employees, appointed to act for said party in the performance of the work under Contract, or the Surety in case of default.

Surety or Sureties: The corporate body or bodies approved by the Owner, who are bound with and for the Contractor and who are primarily liable for the satisfactory and acceptable execution and fulfillment of this Contract, and/or the prompt payment in full for labor and materials as provided in the bonds.

Contract: The written agreement executed by and between the Owner and the successful Bidder including collectively all of the Contract Documents, covering the performance of the work and the furnishing of labor and materials in the construction of the Project. Also, any and all supplemental agreements which could reasonably be required to complete the construction contemplated.

Contract Documents: The Contract Documents consist of the Advertisement for Bids, Instruction to Bidders, Bid Proposal, Certification of Non-Segregated Facilities, Bid Bond, Non-Collusion Affidavit of Prime Bidder, Statement of Bidder's Qualifications, Wage Rates (if any), Addenda (if any), Notice of Award, Agreement, Nondiscrimination Clause, Stipulation Against Liens, Performance Bond, Labor and Material Payment Bond, Detailed Breakdown of Lump Sum Bid (if any), Notice to Proceed, Application and Certificate for Payment, Continuation Sheet, Change Order(s) (if any), Certificate of Substantial Completion, Maintenance Bond, General Conditions, Drawings and Technical Specifications.

Specifications: Collectively, all of the definitions, descriptions, directions, provisions, requirements, terms and stipulations contained in the Contract Documents, and all written supplements thereto, made or to be made, pertaining to the Contract, and the materials and workmanship to be furnished under the Contract.

Drawings or Plans: Collectively, all of the drawings or plans (or reproductions of them) pertaining to the construction of the Project and attached to the Contract or otherwise made a part thereof. Also, such supplementary drawings as the Engineer may issue from time to

time in order to elucidate or clarify said Contract Drawings, or for showing details which are not shown thereon, or for the purpose of showing changes in the work as authorized under Article 27 of the section entitled General Conditions.

Contract Price: The lump sum(s) or unit price(s) bid by the Contractor and named in the Proposal, or the total of all payments made or to be made under the Contract at the lump sum(s) or unit price(s), as the case may be.

Bidder: Any individual, firm or corporation submitting a Proposal for the work contemplated herein, acting directly or through a duly authorized representative.

Proposal or Bid or Bid Proposal: The written offer of a Bidder submitted on the approved form prepared for the purpose, to perform the work and to furnish the labor and materials embraced in this Contract, for the consideration of payment at the prices stated.

Proposal Security: The required security furnished with the proposal by a Bidder as guaranty of his ability and intent to qualify for award of the Contract and to enter into a Contract with the Owner for the performance of the work and to furnish satisfactory bonds, as required, if the work involved in the proposal is awarded to him. This may be a money deposit in the form of a draft or a certified check on a solvent bank, or, if permitted, a bid bond.

Certified Check: When the Advertisement indicates that a certified check is required, each Bidder shall submit with his proposal a certified check drawn upon a solvent clearing house bank, and the Bidder who has had the Contract awarded to him and who fails to promptly and properly execute the required Contract and bonds shall forfeit said check.

Bid Bond: When permitted, in lieu of certified checks, bid bonds to be approved by the Owner, may be furnished by the Bidders and their Sureties, conditioned upon the successful Bidder promptly and properly executing the required Contract and bonds.

Performance Bond: The approved and executed form of security furnished by the Contractor and his Surety as a guaranty of good faith to execute and complete the work in accordance with the terms of the Contract Documents.

Labor and Material Payment Bond: The approved and executed form of security furnished by the Contractor and his Surety as a guaranty of good faith to promptly pay or cause to be paid in full such sums as may be due for material furnished and/or labor supplied or performed, services rendered in the prosecution of the work under the Contract.

Notice to Proceed: A written notice to the Contractor, from the Owner or Engineer, of the date on or before which the former is to begin prosecution of the work and on which the Contract period starts.

Project: All the necessary performance and materials required for the satisfactory completion of the work under the Contract as described in the other Contract Documents.

Site: The area which has been secured or reserved by the Owner for use in the performance of the Contract.

Final Estimate: The estimate made by the Engineer to the Owner of the final price of all work performed under the Contract.

Subcontractor: A person, firm or corporation having a direct contract with the Contractor to perform part of the latter's Contract; such as one who installs or furnishes and installs at the site, equipment forming a permanent part of the Contract work, or who furnishes labor at the site for work required by the Contract in accordance with the Contract Documents. This term does not include individual workmen furnishing labor only, nor one who merely furnishes material not worked to a special design.

"Directed", etc.: Wherever in these Contract Documents the words "directed", "required", "permitted", "ordered", "instructed", "designated", "considered necessary", "prescribed", or words of like import are used, it shall be understood that the direction, requirements, permission, order, instruction, designation, or prescription, etc., of the Engineer is intended, unless otherwise specifically stated.

"Approved", etc.: The words "approved", "acceptable", "satisfactory", or words of like import, shall mean approved by, or acceptable or satisfactory to, the Engineer, unless another meaning is plainly intended or otherwise specifically stated.

2. RECEIPT OF BIDS

The place to which Proposals must be delivered, the amount of Proposal Security required, and the date, time and place of opening of Proposals, are stated in the Advertisement. The proposal form indicates the location and description of the project to be constructed, and shows the approximate quantities of work to be performed and materials to be furnished, if a unit price contract.

3. STATEMENT OF BIDDER'S QUALIFICATIONS

Each bidder shall, upon request of the Owner, submit on the form furnished for that purpose a statement of the Bidder's qualifications, his experience record in constructing the type of improvements embraced in the Bid Proposal, and his organization and equipment available for the work contemplated; and, when specifically requested by the Owner, a detailed financial statement. The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform his obligations under the Contract, and the Bidder shall furnish the Owner all such information and data for this purpose as it may request. The right is reserved to reject any Bid where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified to carry out properly the terms of the Contract.

4. COLLUSIVE AGREEMENTS

Each Bidder submitting a Bid to the Owner for any portion of the work contemplated by the Contract Documents on which bidding is based shall execute and attach thereto, an affidavit substantially in the form herein provided, to the effect that he has not colluded with any other person, firm or corporation in regard to any Bid submitted.

5. BIDDER RESPONSIBILITY

The Bidder is required to carefully examine the site of the project, the Contract Documents, and all other forms pertinent to the work contemplated. It will be assumed that he has satisfied himself as to the conditions to be encountered, the character, quality, and quantities of work to be performed and materials to be furnished, and the requirements of the Contract Documents. No allowance or concession will be made for lack of such information on the part of the Contractor.

Whenever information concerning subsurface materials or conditions is given on the Drawings, it is understood, in the absence of any qualifying notation, that it was obtained in the usual manner and the location, depths, and character of the material have been recorded in good faith. There is no expressed or implied agreement that the depths or the character of the material have been correctly indicated and Bidders should take into account the possibility that conditions affecting the cost or quantities of work to be done may differ from those indicated.

6. APPROXIMATE ESTIMATE OF QUANTITIES

The Bidder's attention is directed to the fact that, in contracts based on unit prices the estimate of quantities of work to be done and materials to be furnished is approximate and is given only as a basis of calculation upon which to determine the lowest bidder. The Owner does not assume any responsibility that the quantities shall be obtained in the construction of the Project, nor shall the Contractor plead misunderstanding or deception because of such estimate of quantities, or of the character of the work or location, or other conditions pertaining thereto. The Owner reserves the right to increase or diminish any or all of the above mentioned quantities of work or to omit any of them, as it may deem necessary and such increase or decrease of the quantities given for any of the items shall not be considered as sufficient grounds for granting an increase in the unit prices bid, except as set forth in Article 27 of the Section entitled General Conditions.

7. PREPARATION OF PROPOSAL

The Bidder shall sign his name and give his business address in the spaces provided therefor. If the Proposal is made by a partnership, it shall be signed by all partners. If made by a corporation, it shall be signed in the name of the corporation by one of the officers thereof and shall have affixed the seal of the corporation.

8. PROPOSAL SECURITY

Each Proposal shall be accompanied by security in the form of a certified check, or, when specifically permitted, a bid bond, payable to the Owner, in the amount indicated in the Advertisement. Within seven (7) days after the opening of bids, the securities therefor will be returned excepting those which the Owner elects to hold until the award is made and the successful bidder qualifies and executes the Contract. Such Proposal Security of the successful Bidder shall be forfeited to the Owner as liquidated damages if the successful Bidder fails to execute and deliver the Contract in conformity with the form of Agreement, and furnish bonds and insurance certificates as specified within ten (10) days after notification by the Owner of the acceptance of his bid. The security of the successful Bidder will be returned to him when the Contract is executed by both parties hereto. If all

Proposals are rejected, the securities therefor will be returned immediately after the determination of such rejection.

9. WITHDRAWAL OF PROPOSALS

All Bidders specifically waive any right to withdraw a Proposal after it has been submitted to the Owner, except as hereinafter provide. A Bidder may withdraw a Proposal provided the Bidder makes a request to do so by telephone, telegraph, or in writing to the Owner and provided that such requests reach the office of the Owner not later than the day previous to the date set for opening thereof. Requests by telephone or telegraph must be confirmed in writing, by the Bidder in person, or by an accredited representative of the Bidder before the time set for the opening of Proposals. No bids may be withdrawn for the period of time stipulated in the Proposal.

10. RIGHT TO REJECT PROPOSALS

The unqualified right is reserved by the Owner to waive any informalities in, or reject any or all proposals as may be deemed to the best interest of the Owner. Proposals which contain any omission, erasures, alterations, additions not called for, conditional bids, or irregularities of any kind, or Proposals otherwise regular which are not accompanied by Proposal Security, may be rejected as informal. Proposals in which the bid prices are obviously unbalanced may be rejected.

11. CHANGES PRIOR TO THE OPENING OF BIDS

During the period allowed for preparation of bids, the Bidders may be furnished addenda or bulletins for additions to or alterations of the Contract Documents, which shall be included in the work covered by the proposal and become a part of the Contract Documents. If any prospective bidder is in doubt as to the true meaning of any part of the Contract Documents, he may submit to the Engineer a written request for an interpretation thereof. The Bidder submitting the request will be responsible for its prompt delivery. An interpretation of the Contract Documents will be made only by an addendum duly issued and a copy of such addendum will be mailed or delivered to each prospective bidder on record. The Owner will not be responsible for any other explanations or interpretations of the Contract Documents.

12. SCOPE OF WORK

Unless otherwise provided it is the intent of the Contract Documents to prescribe a complete project which the Bidder proposes to construct, by furnishing all labor, materials, equipment, tools, necessary utilities and other facilities, and performing all work necessary or incidental to such construction, in full compliance with the Contract Documents.

13. SUBMITTING PROPOSAL

Proposals, accompanied by the Proposal Security, and all Addenda, if any, shall be submitted in a sealed envelope, addressed to the Owner. The name of the bidder & the contract name shall appear on the envelope.

14. AWARD AND EXECUTION OF CONTRACT

When a Proposal received has been determined to be satisfactory, a Contract will be awarded to the lowest responsible Bidder within the time specified in the Proposal.

The Bidder to whom the award is made shall execute the Contract and return it, together with the properly executed Bonds and insurance certificates, to the office of the Owner, within the time specified in the Proposal.

15. CANCELLATION OF AWARD

The Owner reserves the right to cancel the award of any Contract at any time prior to its execution by the Owner.

16. SURETY BONDS

With the execution and delivery of this Contract the successful Bidder receiving the Contract award will be required to furnish, within the time specified, in Article 7, a "performance bond" covering faithful and satisfactory performance of the work contracted, in an amount not less than one hundred percent (100%) of the total contract price, and a "labor and material payment bond" in an amount not less than one hundred percent (100%) of the Contract amount, covering payment in full for all services rendered, and materials furnished. A one-year Maintenance Bond is also to be provided securing the work for one year from the date of completion and acceptance.

17. INDEMNITY AND INSURANCE

The Contractor shall not commence work under this Contract until he has obtained all insurance required under this paragraph and such insurance has been approved by the Owner and Engineer, nor shall the Contractor allow any subcontractor to commence work on a subcontract until all similar insurance required of the subcontractor has been so obtained and approved.

A. Compensation Insurance

The Contractor shall take out and maintain during the life of this contract, Workmen's Compensation Insurance for all of his employees employed at the site of the project, and in case any work is sublet, the Contract shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all the latter's employees unless such employees are covered by the protection afforded by the Contractor. The Contractor, shall at all times, indemnify and save harmless the Owner, of and from all claims for Workmen's Compensation which may be made by any employee of the Contractor or his subcontractors.

B. The Contractor shall take out and maintain during the life of this Contract such Public Liability and Property Damage Insurance as shall protect him, the Owner, and the Engineer from claims for damages for personal injury, including accidental death, as well as from claims for property damages, which may arise from operations under this Contract, whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by either of them.

Hazards insured against for property damage liability shall include explosion, collapse, underground object, and blasting to the extent that any such exposure exists. The amounts of such insurance shall be non-deductible and as follows:

1) Public Liability

In an amount not less than \$1,000,000.00 for injuries, including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than \$1,000,000.00 on account of one accident.

2) Property Damage

In an amount not less than \$1,000,000.00, with an aggregate of \$1,000,000.00.

The same limits apply to coverage to be provided on any automobiles or trucks used at the site. The policies shall be written on an occurrence basis.

The Contractor shall indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

In any and all claims against the Owner or the Engineer or any of their agents or employees by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, the indemnification obligation under this Article shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

The obligations of the Contractor under this Article shall not extend to the liability of the Engineer, his agents or employees arising out of (a) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications or (b) the giving of or the failure to give directions or instructions by the Engineer, his agents or employees provided such giving or failure to give is the primary cause of injury or damage.

C. Builder's Risk Insurance

The Contractor during the progress of the work and until final acceptance by

the Owner upon completion of the entire Contract, shall maintain insurance on all work included in the Contract against loss or damage by fire, lightning, wind, explosion, and those perils covered by extended coverage endorsement and vandalism and malicious mischief on the completed value form, in the names of the Owner and the Contractor as their respective interests may appear in an amount equal to one hundred percent (100%) of the insurable value of each building or structure and materials included in this Contract as shall fully protect the interest of the Owner and the Contractor; the risk of damage to the construction work due to the perils covered by said insurance, as well as any other hazards which might result in damage to the construction work, is that of the Contractor and Surety, and no claims for such loss or damage shall be recognized by the Owner, nor will such loss or damage excuse the complete and satisfactory performance of the Contract by the Contractor.

D. Protective Liability and Property Damage Insurance

The Contractor shall submit certificates or other documentary evidence to the Owner for approval, covering Workmen's Compensation Insurance, and Public Liability and Property Damage Insurance, and Builder's Risk Insurance, and Railroad Protective Liability and Property Damage Insurance if required.

Each certificate or other documentary evidence presented shall contain therein or have contained in a rider attached thereto and made a part thereof, a clause to the effect that the insurer will notify the insured and the Owner in writing five (5) days prior to cancellation of the policy. The certificate for each policy shall be executed in triplicate.

18. CANCELLATION OF CONTRACT

As soon as practicable after the satisfactory execution of the Contract by both parties, written notice to proceed with the work will be given to the Contractor. If such notice is not given within ninety (90) days after Contract execution, and the delay is not caused by the Contractor or accepted by him in writing, the Contract may be declared null and void.

If the Contractor incurs any expense in furtherance of the Contract prior to receipt of the Notice to Proceed, he does so on his own responsibility.

19. COMPLETION TIME AND LIQUIDATED DAMAGES

The Bidder shall understand that the time limit indicated for completion of this Contract shall be **180 (One Hundred Eighty) calendar days** from the "Notice to Proceed", and the amount of liquidated damages to be charged against the Contractor shall be **\$200.00 per day**. The amounts deducted are liquidated damages not penalties.

20. WAGES AND SALARIES

Prevailing wage rates applicable per Pennsylvania Department of Labor & Industry, Bureau of Labor Law Compliance (projects in excess of \$25,000).

21. EQUAL EMPLOYMENT OPPORTUNITY

Attention of Bidders is particularly called to the requirement for insuring that employees and applicants for employment are not discriminated against because of race, color, religion, sex or national origin.

22. HUMAN RELATIONS ACT

The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 (P.L. 744) (43 P.S. Section 951, et. seq.) of the Commonwealth of Pennsylvania prohibits discrimination because of race, color, religious creed, ancestry, age, sex, national origin, handicap or disability by employer, employment agencies, labor organizations, contractors, and others. The Contractor shall agree to comply with the provisions of this Act, as amended.

23. STANDARD OF QUALITY

The various materials and products specified by name or description are given to establish a standard of quality and of cost for bid purposes. It is not the intent to limit the acceptance to any one material or product specified, but rather to name or describe a material or product as minimum standard that is desired and acceptable. Where proprietary names are used, whether or not followed by the words "or approved equal", that shall be subject to equals only as approved by the Engineer.

24. STEEL PRODUCTS PROCUREMENT ACT

In accordance with Pennsylvania Statutes, Title 73, Trade and Commerce, Chapter 25, Steel Products Procurement Act (2013) if any steel products are to be used or supplied on this project. The Certification of Compliance with the Pennsylvania Steel Product Procurement Act form attached will need to be completed.

25. MAINTENANCE BOND

Attention to Bidders is particularly called to the requirement that the Contractor must provide the Owner with a two (2) year maintenance bond in the amount of 100% of the Contract amount upon completion of said project. Said bond shall be in effect for a period of two (2) year from the date indicated on the Certificate of Substantial Completion or as required by Articles 9 and 33 in the General Conditions.

SPECIAL INSTRUCTIONS TO BIDDERS

The following items are incidental to the project:

1. Contractor is to field verify all dimensions and conditions prior to beginning work and report to engineer any defects or discrepancies which may alter the scope of work.
2. Contractor must notify the township a minimum of ten (10) working days prior to start of the project.
3. Contractor shall be responsible for all defects that occur within two (2) years of application.
4. **PA Wage rates are attached and applicable for projects in excess of \$25,000 per PA Bureau of Law Compliance. Certified Payrolls will be requested for this project.**
5. The structural steel framing of the building to be performed on a 'Design-Build' basis. Contractor to provide certified drawings sealed by a professional engineer of the building frame from supplier. Design is to meet International Building Code, latest edition. Wind bracing to meet International Building Code, latest edition. All other components of this structure to be constructed as per drawings, details and specifications contained herewithin.
6. Contractor shall maintain the highest standards of honesty and integrity during the performance of this contract and shall take no action in violation of state or federal laws or regulations or any other applicable laws or regulations, or other requirements applicable to Contractor or that govern contracting or procurement with the Commonwealth.
7. Contractor, its affiliates, agents, employees and anyone in privity with Contractor shall not accept, agree to give, offer, confer, or agree to confer or promise to confer, directly or indirectly, any gratuity or pecuniary benefit to any person, or to influence or attempt to influence any person in violation of any federal or state law, regulation, executive order of the Governor of Pennsylvania, statement of policy, management directive or any other published standard of the Commonwealth in connection with performance of work under this contract, except as provided in this contract.
8. Contractor shall not have a financial interest in any other contractor, subcontractor, or supplier providing services, labor, or material under this contract, unless the financial interest is disclosed to the Commonwealth in writing and the Commonwealth consents to Contractor's financial interest prior to Commonwealth execution of the contract. Contractor shall disclose the financial interest to the Commonwealth at the time of bid or proposal submission, or if no bids or proposals are solicited, no later than Contractor's submission of the contract signed by Contractor.
9. Contractor certifies to the best of its knowledge and belief that within the last five (5) years Contractor or Contractor Related Parties have not:
 - (i) been indicted or convicted of a crime involving moral turpitude or business honesty or integrity in any jurisdiction;
 - (ii) been suspended, debarred or otherwise disqualified from entering into any contract with any governmental agency;
 - (iii) had any business license or professional license suspended or revoked;
 - (iv) had any sanction or finding of fact imposed as a result of a judicial or administrative proceeding related to fraud, extortion, bribery, bid rigging, embezzlement, misrepresentation or anti-trust; and
 - (v) been, and is not currently, the subject of a criminal investigation by any federal, state or local prosecuting or investigative agency and/or civil anti-trust investigation by any federal, state or local prosecuting or investigative agency.

If Contractor cannot so certify to the above, then it must submit along with its bid, proposal or contract a written explanation of why such certification cannot be made and the Commonwealth will determine whether a contract may be entered into with the Contractor. The Contractor's obligation pursuant to this certification is ongoing from and after the effective date of the contract through the termination date thereof. Accordingly, the Contractor shall have an obligation to immediately notify the Commonwealth in writing if at any time during the term of the contract it becomes aware of any event which would cause the Contractor's certification or explanation to change. Contractor acknowledges that the Commonwealth may, in its sole discretion, terminate the contract for cause if it learns that any of the certifications made herein are currently false due to intervening factual circumstances or were false or should have been known to be false when entering into the contract.

10. Contractor shall comply with the requirements of the Lobbying Disclosure Act (65 Pa.C.S. §13A01 et seq.).
11. When Contractor has reason to believe that any breach of ethical standards as set forth in law, the Governor's Code of Conduct, or these Contractor Integrity Provisions has occurred or may occur, including but not limited to contact by a Commonwealth officer or employee which, if acted upon, would violate such ethical standards, Contractor shall immediately notify the Commonwealth contracting officer or the Office of the State Inspector General in writing.
12. Contractor, by submission of its bid or proposal and/or execution of this contract and by the submission of any bills, invoices or requests for payment pursuant to the contract, certifies and represents that it has not violated any of these Contractor Integrity Provisions in connection with the submission of the bid or proposal, during any contract negotiations or during the term of the contract, to include any extensions thereof. Contractor shall immediately notify the Commonwealth in writing of any actions for occurrences that would result in a violation of these Contractor Integrity Provisions. Contractor agrees to reimburse the Commonwealth for the reasonable costs of investigation incurred by the Office of the State Inspector General for investigations of the Contractor's compliance with the terms of this or any other agreement between the Contractor and the Commonwealth that results in the suspension or debarment of the Contractor. Contractor shall not be responsible for investigative costs for investigations that do not result in the Contractor's suspension or debarment.
13. Contractor shall cooperate with the Office of the State Inspector General in its investigation of any alleged Commonwealth agency or employee breach of ethical standards and any alleged Contractor non-compliance with these Contractor Integrity Provisions. Contractor agrees to make identified Contractor employees available for interviews at reasonable times and places. Contractor, upon the inquiry or request of an Inspector General, shall provide, or if appropriate, make promptly available for inspection or copying, any information of any type or form deemed relevant by the Office of the State Inspector General to Contractor's integrity and compliance with these provisions. Such information may include, but shall not be limited to, Contractor's business or financial records, documents or files of any type or form that refer to or concern this contract. Contractor shall incorporate this paragraph in any agreement, contract or subcontract it enters into in the course of the performance of this contract/agreement solely for the purpose of obtaining subcontractor compliance with this provision. The incorporation of this provision in a subcontract shall not create privity of contract between the Commonwealth and any such subcontractor, and no third-party beneficiaries shall be created thereby.

14. For violation of any of these Contractor Integrity Provisions, the Commonwealth may terminate this and any other contract with Contractor, claim liquidated damages in an amount equal to the value of anything received in breach of these Provisions, claim damages for all additional costs and expenses incurred in obtaining another contractor to complete performance under this contract, and debar and suspend Contractor from doing business with the Commonwealth. These rights and remedies are cumulative, and the use or non-use of any one shall not preclude the use of all or any other. These rights and remedies are in addition to those the Commonwealth may have under law, statute, regulation, or otherwise.
15. Pursuant to the Act of May 11, 2006 (P.L. 173, No. 43), known as the Prohibition of Illegal Alien Labor on Assisted Projects Act, the Contractor shall not knowingly employ, or knowingly permit any of its subcontractors to knowingly employ, the labor services of an illegal alien on activities funded in whole or in part by a grant or loan issued by an executive agency of the Commonwealth of Pennsylvania.

In the event that the Contractor

(A) knowingly employs, or knowingly permits any of its subcontractors to knowingly employ, the labor services of an illegal alien on activities funded in whole or in part by grants or loans issued by an executive agency of the Commonwealth of Pennsylvania; and

(B) the Contractor or any of its subcontractors may be sentenced under Federal law for an offense involving knowing use of labor by an illegal alien on activities funded in whole or in part by grants or loans issued by an executive agency of the Commonwealth of Pennsylvania.

16. Compliance with the State Contractor Responsibility Program:

For the purpose of these provisions, the term Contractor is defined as any person, including, but not limited to, a bidder, offeror, loan recipient, grantee or lessor, who has furnished or performed or seeks to furnish or perform, goods, supplies, services, leased space, construction or other activity, under a contract, grant, lease, purchase order or reimbursement agreement with the Commonwealth of Pennsylvania (Commonwealth). The term Contractor includes a permittee, licensee, or any agency, political subdivision, instrumentality, public authority, or other public entity in the Commonwealth.

(1) The Contractor certifies, in writing, for itself and its subcontractors required to be disclosed or approved by the Commonwealth, that as of the date of its execution of this Bid/Contract, that neither the Contractor, nor any such subcontractors, are under suspension or debarment by the Commonwealth or any governmental entity, instrumentality, or authority and, if the Contractor cannot so certify, then it agrees to submit, along with its Bid/Contract, a written explanation of why such certification cannot be made.

(2) The Contractor also certifies, in writing, that as of the date of its execution of this Bid/Contract it has no tax liabilities or other Commonwealth obligations, or has filed a timely administrative or judicial appeal if such liabilities or obligations exist, or is subject to a duly approved deferred payment plan if such liabilities exist.

(3) The Contractor's obligations pursuant to these provisions are ongoing from and after the effective date of the Contract through the termination date thereof. Accordingly, the Contractor shall have an obligation to inform the Commonwealth if, at any time during the term of the Contract, it becomes delinquent in the payment of taxes, or other Commonwealth obligations, or if it or, to the best knowledge of the Contractor, any of its subcontractors are suspended or debarred by the Commonwealth, the federal government, or any other state or governmental entity. Such notification shall be made within 15 days of the date of suspension or debarment.

(4) The failure of the Contractor to notify the Commonwealth of its suspension or debarment by the Commonwealth, any other state, or the federal government shall constitute an event of default of the Contract with the Commonwealth.

(5) The Contractor agrees to reimburse the Commonwealth for the reasonable costs of investigation incurred by the Office of State Inspector General for investigations of the Contractor's compliance with the terms of this or any other agreement between the Contractor and the Commonwealth that results in the suspension or debarment of the contractor. Such costs shall include, but shall not be limited to, salaries of investigators, including overtime; travel and lodging expenses; and expert witness and documentary fees. The Contractor shall not be responsible for investigative costs for investigations that do not result in the Contractor's suspension or debarment.

(6) The Contractor may search the current list of suspended and debarred Commonwealth contractors by visiting the eMarketplace website at <http://www.emarketplace.state.pa.us> and clicking the Debarment List tab.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, _____

_____ as Principal, and _____

_____, as Surety are held and firmly bound unto Hanover

Township (hereinafter called the Owner), in the sum of

_____ Dollars (\$ _____) lawful money of the United States, for

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

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying bid, dated _____, 20__ for: **“Police Department Vehicle Storage Building”**.

NOW THEREFORE, if the Principal shall not withdraw said bid within the period specified therein after the opening of the same, or, if no period be specified, within sixty (60) days after said opening, and shall within Sixty (60) days after the prescribed forms are presented to him for signature, enter into a written contract with the Owner in accordance with the bid accepted, and give bond with good and sufficient surety, as may be required, for the faithful performance and proper fulfillment of such contract, or in the event of the withdrawal of said bid within the period specified, or the failure to enter such contract and give such bond within the time specified, if the Principal or his Surety shall pay the Owner ten percent (10%) of the amount specified in said bid as liquidated damages, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals this _____ day of _____, 20__, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

IN PRESENCE OF:

(Individual Principal) _____(SEAL)

(Address) _____(Business Address)

(Individual Principal) _____(SEAL)

(Address) _____(Business Address)

ATTEST:

(Corporate Principal)

(Business Address)

By: _____
(AFFIX CORPORATE SEAL)

(Corporate Surety)

WITNESS:

(Corporate Surety)

(Business Address)

(Power-of-Attorney) for person signing for surety company must be attached to bond.

SUBCONTRACTORS

- | | Name & Address | Project Responsibility |
|----|----------------|------------------------|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

Signature

Company

Name (Printed)

Address

Title

Witness of Signature

Telephone Number

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

State of _____

SS:

County of _____

_____ being first duly sworn according to law, deposes and says as follows:

- (1) He is _____ of _____, the bidder that has submitted the attached bid;
- (2) He is fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such bid;
- (3) Such bid is genuine and is not a collusive or sham bid;
- (4) Neither the said bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived, or agreed, directly or indirectly, with any other bidder, firm or person to submit a collusive or sham bid in connection with the contract for which the attached bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other bidder, firm or person to fix the price or prices in the attached bid or of any other bidder, or, to fix any overhead profit or cost element of the bid price of the bid price of any other bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement, any advantage against the _____, or any person interested in the proposed contract; and
- (5) The price or prices quoted in the attached bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

By _____

Bidder

Sworn to and subscribed before me this _____ day of _____, 20__.

Notary Public

My commission expires: _____

STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered and the data given must be clear and comprehensive. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information they desire.

1. Name of Bidder _____

2. Principal Office address _____

3. How many years has your organization been in business under your present business name?

4. If a corporation, where incorporated _____

5. How many years have you been engaged in the contracting business under your present firm or trade name? _____

6. How many years of experience does your organization have in this type of work?

7. Bidder shall submit information indicating experience of similar work. (Failure to complete this section may be cause for rejection of bid).

A. Name and Address of Work:

Contact Person:

Name

Telephone Number

B. Name and Address of Work:

Contact Person:

Name

Telephone Number

C. Name and Address of Work:

Contact Person:

Name

Telephone Number

8. Have you ever been terminated, defaulted or failed to complete any work awarded to you?
If so, where and why?

Owner may request written information such as financial data, equipment list and current work load status.

The signatory of this questionnaire guarantees the truth and accuracy of all statements and of all answers to interrogatories hereinafter made.

Name of Bidder: _____

By: _____

Title: _____

AGREEMENT

THIS AGREEMENT, made this _____ day of _____ 20__, by and between Hanover Township hereinafter called OWNER, and _____, doing business as a Corporation hereinafter called "CONTRACTOR".

WITNESSETH, that the OWNER and the CONTRACTOR mutually agree to the following:

1. The CONTRACTOR, for and in consideration of the payment herein specified and agreed to by the OWNER hereby covenants and agrees to furnish and deliver all the materials and to do and perform all the work, labor and other services necessary for the construction and completion of the PROJECT as described herein.

The OWNER will pay the CONTRACTOR for the performance of the AGREEMENT, in current funds, subject to additions and deductions as provided in the GENERAL CONDITIONS of the CONTRACT AGREEMENT, the sum of _____

(\$_____).

The Contract Documents prepared by Widmer Engineering Inc., hereinafter called ENGINEER, are made part of this AGREEMENT.

2. The PROJECT location and description being situated as follows:

Police Department Vehicle Storage Building.

The work includes the construction of a building per bid drawings and specifications.

3. The CONTRACTOR further covenants and agrees that all work shall be performed in the best and most workmanlike manner. He also agrees that all materials furnished and labor performed shall be in strict and complete conformity in every respect, with all parts of this AGREEMENT and shall be subject to the inspection and acceptance of authorized representatives of the OWNER. In the event that any portion of the work (including materials supplied pursuant thereto) performed by the CONTRACTOR is rejected by the authorized representatives as defective, unsuitable, or unacceptable, the CONTRACTOR agrees to remove and replace all such rejected portions of work in conformance with this AGREEMENT and to the satisfaction of and at no expense to the OWNER. The CONTRACTOR further covenants that prompt payment will be made in full for all labor and materials used in the performance of work on this PROJECT.
4. The CONTRACTOR covenants and agrees that all work (including, but not limited to, all labor performed and all materials supplied) on this PROJECT shall be performed and completed to the satisfaction of the OWNER on or before the expiration of **one hundred eighty (180) calendar days** after written Notice to Proceed with work has been given by the OWNER. If for any reason, except as provided in the GENERAL CONDITIONS, the CONTRACTOR fails to complete all work on this PROJECT to the satisfaction of the ENGINEER within the aforementioned time allowed, the OWNER shall deduct from any sums due or which may become due the CONTRACTOR **two hundred dollars (\$200.00)** for each calendar day used in excess of the aforementioned number of days allowed, or, in case a completion date is fixed, for each calendar day elapsing between the completion date and the actual date of completion. If no sums are due the CONTRACTOR, the CONTRACTOR agrees to remit to the OWNER the aforementioned sum for each day used in excess of the time allowed for completion of the PROJECT. The amounts deducted or

remitted under this paragraph are liquidated damages not penalties.

5. The CONTRACTOR further covenants and warrants that he has had sufficient time to examine the site of the project to determine the conditions to be encountered; that he is fully aware and knows of the conditions to be encountered; and that he has based the BID PROPOSAL prices on his own independent examination and investigation of the project site and conditions, and has not relied on any subsurface information furnished to him by the OWNER, or its agents or its consultants.
6. The CONTRACTOR shall not do any work (including, but not limited to, the supply of labor and/or materials) not covered by the CONTRACT DOCUMENTS, unless such work has been authorized in writing by the ENGINEER. In no event shall the CONTRACTOR incur any liability by reason of refusing to obey any verbal directions or instructions that he might be given to perform additional or extra work. Likewise, the OWNER will not be liable for any work performed as additional or extra work, unless such work is required of the CONTRACTOR in writing by the ENGINEER. All such work which might have been performed by the CONTRACTOR without such written order first being given shall be at the CONTRACTOR'S risk, cost and expense, and the CONTRACTOR hereby covenants and agrees compensation for such unauthorized work.
7. It is further distinctly agreed that the CONTRACTOR shall not assign this AGREEMENT, or any part thereof, nor any right to any sums to be paid him hereunder, nor shall any part of the work to be done or material furnished under this AGREEMENT be sublet, without the consent in writing of the OWNER.
8. The OWNER will pay to the CONTRACTOR in the manner at such times as set forth in the GENERAL CONDITIONS such amounts as required by the CONTRACT DOCUMENTS. When a BID PROPOSAL is made on a Lump Sum Basis, the CONTRACTOR agrees to submit, to the ENGINEER, a detailed breakdown of costs to serve as a basis of estimate for periodic payment during construction.
9. It is also agreed and understood that the acceptance of the final payment by the CONTRACTOR shall be considered as a release in full of all claims against the OWNER arising out of, or by reason of, the work done and materials furnished under this AGREEMENT.
10. In order to secure proper and complete compliance with the terms and provisions of this AGREEMENT, the CONTRACTOR shall provide a bond in a sum equal to one hundred percent (100%) of the contract price of the work to be done. The CONTRACTOR shall also secure an additional bond in the same amount for the prompt payment in full for all labor and materials supplied in performing work on this PROJECT. The CONTRACTOR shall also secure an additional bond in the same amount for maintenance of the completed project for a period of two (2) years from the date of final acceptance by the OWNER. All bonds are attached hereto.
11. The CONTRACTOR in undertaking the work to be performed under the terms of this AGREEMENT, covenants and agrees to comply with the required contract provisions set forth in the Nondiscrimination Clause which is attached.

12. The term "CONTRACT DOCUMENTS" means and includes the following:
- (a) ADVERTISEMENT FOR BIDS
 - (b) BID PROPOSAL
 - (c) INSTRUCTIONS TO BIDDERS
 - (d) SPECIAL INSTRUCTIONS TO BIDDERS
 - (e) BID BOND
 - (f) SUBCONTRACTORS
 - (g) NON-COLLUSION AFFIDAVIT OF PRIME BIDDER
 - (h) STATEMENT OF BIDDER'S QUALIFICATIONS
 - (i) AGREEMENT
 - (j) CORPORATE CERTIFICATE
 - (k) PARTNERSHIP CERTIFICATE
 - (l) NO-LIEN AGREEMENT
 - (m) PERFORMANCE BOND
 - (n) LABOR AND MATERIAL PAYMENT BOND
 - (o) MAINTENANCE BOND
 - (p) AFFIDAVIT RE- ACCEPTING PROVISION OF THE WORKMAN'S COMPENSATION ACT
 - (q) ANTI-COLLUSION AFFIDAVIT
 - (s) CERTIFICATE OF INSURANCE
 - (t) APPLICATION AND CERTIFICATE FOR PAYMENT
 - (u) PUBLIC WORKS EMPLOYMENT VERIFICATION FORM
 - (v) CHANGE ORDER(S) (if any)
 - (w) NON-DISCRIMINATION CLAUSE
 - (x) CERTIFICATE OF COMPLIANCE WITH THE PENNSYLVANIA STEEL PRODUCTS PROCUREMENT ACT
 - (y) GENERAL CONDITIONS
 - (z) TECHNICAL SPECIFICATIONS AND DRAWINGS, PREPARED BY THE ENGINEER
 - (zz) PREVAILING WAGE RATES
 - (yy) DETAILED BREAKDOWN OF LUMP SUM BID (IF ANY)
 - (xx) NOTICE OF AWARD LETTER
 - (ww) NOTICE TO PROCEED LETTER

13. The CONTRACTOR agrees to execute and record a "No-Lien Agreement" in the form provided herewith prior to commencement of any work required thereby, or the acquisition of any materials therefor.

14. This AGREEMENT, including all CONTRACT DOCUMENTS, shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this AGREEMENT in **three (3) copies** each of which shall be deemed an original on the date first above written.

ATTEST:

OWNER: HANOVER TOWNSHIP SUPERVISORS

By _____
Chairman – Dale Handick

Name _____

By _____
Vice Chairman – William Michael

Title _____

By _____
Supervisor – Shawn Miller

(SEAL)

ATTEST:

CONTRACTOR:

Name_____

Name_____

Title_____

Address_____

(SEAL)

(Use only when Contractor is a Corporation)

Certification:

I, _____, certify that I am the _____ of the Corporation named as CONTRACTOR herein; that _____ who signed this AGREEMENT on behalf of the CONTRACTOR, was the _____ of said Corporation; that said AGREEMENT was duly signed for and in behalf of said Corporation by authority of its governing body, and is within the scope of its corporate powers.

(Corporate Seal)

Title:_____

CORPORATE CERTIFICATE

I, _____, certify that I am the Secretary of the Corporation named as Contractor in the foregoing Instrument; that _____ who signed the said Instrument on behalf of the Contractor was then _____ of said Corporation; that said Contract was duly signed for and in behalf of said Corporation by authority of its governing body, and is within the scope of its corporate power.

(Corporate Seal)

PARTNERSHIP CERTIFICATE

State of _____

SS

County of _____

On this _____ day of _____ 20__, before me personally appeared _____, known to me and known by me to be the person who executed the above instrument, who being by me first duly sworn, did depose and say that he is a general partner in the firm of _____; and that said firm consists of himself and _____ that he executed the foregoing instrument on behalf of said firm for the uses and purposes stated herein.

Notary Public in and for the County

of _____

State of _____

(NOTARIAL SEAL)

NO LIEN AGREEMENT

WHEREAS _____, with a mailing address of _____ entered into an agreement with the Hanover Township to provide materials and perform labor for all operations in connection with the:

Police Department Vehicle Storage Building

NOW THEREFORE, it is hereby stipulated and agreed by and between the said parties, as part of the said Contract and for the consideration therein set forth, that neither the undersigned Contractor, any subcontractor or materialman, nor any other person furnishing labor or materials to the said Contractor under this Contract shall file a lien, commonly called a mechanic's lien, for work done or materials furnished to the said building or any part thereof, or to the grounds adjacent thereto.

This stipulation is made and intended to be filed with the County Prothonotary within ten (10) days after date, in accordance with the requirements of Assembly of Pennsylvania, in such case provided.

IN WITNESS WHEREOF, the said parties hereto have hereunder set their hands and seals this _____ day of _____ 20__.

CONTRACTOR:

HANOVER TOWNSHIP SUPERVISORS

(Business Name)

By _____

Chairman – Dale Handick

Title _____

Vice Chairman – William Michael

Supervisor – Shawn Miller

WITNESS:

WITNESS:

Signature

Signature

DATED _____

DATED _____

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that _____,
(Contractor Name)

(Contractor Address)

a _____, herinafter called Principal,
(Corporation, Partnership, or Individual)

and _____
(Surety Name)

(Surety Address)

herinafter called Surety, are held and firmly bound unto **Hanover Township** (hereinafter called the Obligee,) in the full and just sum of

_____ dollars, (\$ _____, ____),
lawful money of the United States, for payment of which sum well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents:

WHEREAS said Principal has entered into a certain contract with said Obligee dated _____, 20____ (hereinafter called the Contract) for the **“Police Department Vehicle Storage Building”**. The contract and the specifications for said work shall be deemed a part hereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal shall faithfully perform the contract on his part at the time and in the manner therein provided, including any and all warranties and representations of the Principal set forth in said contract, and satisfy all claims and demands incurred in or for the same, or growing out of the same, or for injury or damage to persons or property in the performance thereof, and shall fully identify and save harmless the said Obligee from any and all cost and damage which the said Obligee may suffer by reason of failure to do so, and shall fully reimburse and repay the said Obligee any and all outlay and expense which it may incur by reason of any such default, then this obligation shall be null and void; otherwise it shall remain in full force and virtue.

The said surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder of the specifications accompanying the same shall in any way affect its obligations or bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

Signed, sealed, and delivered in three (3) counterparts this

_____ day of _____, 20____,

(Individual Principals Sign Here)

_____ (Seal)

_____ (Seal)

In the presence of:

_____ (Seal)

_____ (Seal)

(Corporate Principals Sign Here)

ATTEST:

Printed /Typed Corporate Company Name

(Surety Sign Here)

Printed/Typed Surety Company Name

(Performance Bond)

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that _____,
(Contractor Name)

(Contractor Address)

a _____, herinafter called Principal,
(Corporation, Partnership, or Individual)

and _____
(Surety Name)

(Surety Address)

herinafter called Surety, are held and firmly bound unto **Hanover Township** (hereinafter called the Obligee,) in the penal sum of _____ dollars, (\$ _____), lawful money of the United States, for payment of which sum well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS said Principal has entered into a certain contract with said Obligee dated _____, 20____ (hereinafter called the Contract) for the **“Police Department Vehicle Storage Building”**., which contract and the specifications for said work shall be deemed a part hereof as fully as if set out herein.

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

PROVIDED, FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any wise affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition of the terms of the contract or to the WORK or to the SPECIFICATIONS.

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

IN WITNESS WHEREOF, this instrument is executed in _____
(Number) counterparts, each one of which shall be deemed an original, this the _____ day
of _____, 20__.

ATTEST:

Principal

(Principal) Secretary

By: _____

(SEAL)

Witness as to Principal

Address

ATTEST:

Surety

(Surety) Secretary

(SEAL)

Witness as to Surety

By: _____
Attorney-in-fact

Address

Address

NOTE: Date of BOND must not be prior to date of Contract. If the CONTRACTOR is a Partnership, all partners should execute the BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

(Payment Bond)

MAINTENANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that _____,
(Contractor)

(Contractor Address)

a _____, herinafter called Principal,
(Corporation, Partnership, or Individual)

and _____
(Surety Name)

(Surety Address)

herinafter called Surety, are held and firmly bound unto **Hanover Township** (hereinafter called the Obligee,) in the full and just sum of _____ dollars, (\$_____.____), lawful money of the United States, for payment of which sum well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents:

THE CONDITION OF THIS OBLIGATION IS SUCH WHEREAS that, said Principal has entered into a certain contract, hereto attached, with the Owner dated _____, 20__ for: **“Police Department Vehicle Storage Building”**.

NOW, THEREFORE, if the Principal shall remedy without cost to the Obligee any defects which develop during a period of two years from the date of completion and acceptance of the work performed under said contract provided such defects, in the judgment of the Obligee or his successor having jurisdiction in the premises, are caused by defective, inferior materials or workmanship, then this obligation shall be void; otherwise it shall remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals this _____ day of _____, 20__, the name and corporate seal of each corporate party being hereto affixed and these presented duly signed by its undersigned representative, pursuant to authority of its governing body.

IN THE PRESENCE OF:

(Individual Principal) _____ (SEAL)

(Address) _____ (Business Address)

(Individual Principal) _____ (SEAL)

(Address) _____ (Business Address)

ATTEST: _____
(Corporate Name)

(Business Address)

By: _____
(Affix Corporate Seal,
printed name and title)

WITNESS: _____
(Corporate Surety)

(Business Address)

By: _____
(Affix Corporate Seal,
printed name and title)

The rate of premium on this bond is _____ per thousand. Total amount of premium charged, \$ _____. (The above must be filled in by Corporate Surety.)

(Maintenance Bond)

AFFIDAVIT RE

ACCEPTING PROVISIONS OF THE WORKMAN'S COMPENSATION ACT

State of Pennsylvania

SS:

County of

(Name of Officer, if corp.)

(Title of Officer, if corp.)

(Name of Contractor)

being duly sworn according to law deposed and says that he/they/it has/have accepted the provisions of the Workmen's Compensation Act of 1915 of the Commonwealth of Pennsylvania, with its supplements and amendments, and has/have insured his/their/its liability thereunder in accordance with the terms of said Act

with _____ Company.

(Contractor)

Signature of Officer or Agent

SWORN to and subscribed before me this _____ day of

_____, 20__.

(Notary Public)

My Commission Expires:

REQUIRED INSURANCE

- A. Workmen’s Compensation Insurance\$1,000,000
- B. Comprehensive Bodily Inure Liability Insurance.....\$1,000,000
- C. Comprehensive Property Damage Liability Insurance\$1,000,000
- D. Comprehensive Automobile Bodily Injury and Property Damage Insurance
 - (1) Personal Injury\$1,000,000
 - (2) Property Damage\$1,000,000

NOTE: Owner to be named as additional insured on everything except Workmen’s Compensation.

APPLICATION AND CERTIFICATE FOR PAYMENT (EXAMPLE)

PROJECT: Police Department Vehicle Storage Building

ENGINEER: Widmer Engineering Inc.
806 Lincoln Place
Beaver Falls, PA 15010
(724) 847-1696

TO:

CONTRACTOR:

ESTIMATED DATE:

ESTIMATE NO.:

ATTN:

PERIOD FROM:

TO:

CHANGE ORDER SUMMARY

Change Orders approved in previous months by Owners --		ADDITIONS \$	DEDUCTIONS \$
Total			
Subsequent Change Order			
Numbers	Approved (Date)		

TOTALS

Net change by Change Orders \$ _____

BILLING SUMMARY

ORIGINAL CONTRACT SUM	\$ _____
Net change by Change Orders	\$ _____
Contract Sum to Date	\$ _____
Total Completed and Stored to Date	\$ _____
RETAINAGE _____ %	\$ _____
TOTAL EARNED LESS RETAINAGE	\$ _____
Less Previous Certificates for Payment	\$ _____
CURRENT PAYMENT DUE	\$ _____

Contractor:

By: _____ Date: _____

In accordance with the Contract and this Application for Payment the Contractor is entitled to payment in the amount shown above.

Project Engineer

Date

This Certificate is not negotiable. It is payable only to the payee named herein and its issuance, payment and acceptance are without prejudice to any rights of the Owners or Contractor under their Contract

APPLICATION AND CERTIFICATION FOR PAYMENT (EXAMPLE)

QUANTITY ITEMIZATION SHEET

Page No. _____ of _____

Estimate No.:
 Contractor:
 Period From:
 Federal Project No.:

Project: Police Department Vehicle Storage Building
 Address:
 To:
 State Project No.:

Item No.	Description	Contract Quantity	(1) Previous Quantity	(2) Current Quantity	(1+2=3) Total Quantity	(4) Unit Price	(3x4=5) Work Completed	(6) Material Stored	(5+6=7) Total
TOTAL									

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GENERAL CONDITIONS

1. CONTRACT DOCUMENTS

All of the Contract Documents are complementary, and the requirements of any one shall be considered as the requirements of all.

- A. In the event the Contractor discovers any discrepancy in the Contract Documents, the matter shall immediately be submitted to the Engineer, whose decision therein shall be final. The Contractor will not be held responsible for the discovery of such discrepancies, but any work done on the item involved after such discovery, and prior to authorization by the Engineer, will be done at the Contractor's risk.
- B. In case of any discrepancy between scaled dimensions and figures, figured dimensions shall govern. In case any work dimension is not given on the Drawings, the Contractor shall obtain the figure from the Engineer. In no case shall the Contractor determine such dimensions by scaling the Drawings.
- C. Deviations from the Contract Documents required by the exigencies of construction shall be determined by the Engineer only and authorized in writing.
- D. Supplemental detailed drawings and instructions shall be furnished by the Engineer when and as he determines that such drawings and instructions are required for successful completion of the Project.
- E. Unless otherwise provided, the Contractor will be furnished two (2) copies of the Contract Documents free of charge, with additional copies, if required, being furnished at cost.
- F. At all times, the Contractor shall keep on the Project Site, available to the Engineer and his representatives, one (1) copy of the Contract Documents.

2. ENGINEER'S STATUS DURING CONSTRUCTION

The Engineer shall be the Owner's representative during the construction period. All instructions of the Owner to the Contractor shall be issued through the Engineer. The duties and responsibilities and the limitations of authority of the Engineer as the Owner's representative during construction are set forth in these General Conditions and shall not be extended without written consent of the Owner and Engineer.

The Engineer will make periodic visits to the site to observe the progress and quality of the executed work and to determine, in general, if the work is proceeding in accordance with the Contract Documents. He will not be required to make exhaustive or continuous on-site inspections to check the quality of the work nor will he be responsible for the construction means, methods, techniques, sequences or procedures, or the safety precautions incident thereto. His efforts will be directed toward providing assurance for the Owner that the completed Project will conform to the requirements of the Contract Documents, but he will not be responsible for the Contractor's failure to perform the work in accordance with the Contract Documents. On the basis of his on-site observations as an experienced and qualified design professional, he will keep the Owner informed of the progress of the work and will endeavor to guard the Owner against defects and deficiencies in the work of contractors.

If the Owner and Engineer agree, the Engineer will provide one or more full time Resident Project Representatives to assist the Engineer in carrying out his responsibilities at the site.

Neither the Engineer's authority to act under this Article nor any decision made by him in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any subcontractor, any of their agents or employees or any other person performing any of the work.

3. ENGINEER'S INTERPRETATIONS AND DECISIONS

The Engineer will issue with reasonable promptness such written clarifications or interpretations (in the form of drawings or otherwise) as he may determine necessary for the proper execution of the work, such clarifications and interpretations to be consistent with or reasonably inferable from the overall intent of the Contract Documents. If the Contractor believes that a written clarification and interpretation entitles him to an increase in the Contract Price, he may make a claim therefore as provided in Article 27.

The Engineer will be the initial interpreter of the terms and conditions of the Contract Documents and the judge of the performance thereunder. In his capacity as interpreter and judge he will exercise his best efforts to insure faithful performance by both the Owner and the Contractor. He will not show partiality to either and shall not be liable for the result of any interpretation or decision rendered in good faith. Claims, disputes and other matters relating to the execution and progress of the work or the interpretation of or performance under the Contract Documents shall be referred initially to the Engineer for decision, which he shall render in writing within a reasonable time.

Either the Owner or the Contractor may demand arbitration with respect to any such claim, dispute or other matter that has been referred to the Engineer, except any which have been waived by the making or acceptance of final payment, such arbitration to be in accordance with Article 5. However, no demand for arbitration of any such claim, dispute or other matter shall be made until the earlier of (a) the date on which the Engineer has rendered his decision or (b) the tenth day after the parties have presented their evidence to the Engineer if he has not rendered his written decision before that date. No demand for arbitration shall be made later than thirty days after the date on which the Engineer rendered his written decision in respect of the claim, dispute or other matter as to which arbitration is sought, and the failure to demand arbitration within said thirty days' period shall result in the Engineer's decision being final and binding upon the Owner and the Contractor. If the Engineer renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but shall not supersede the arbitration proceedings, except where the decision is acceptable to the parties concerned.

4. ORDER OF WORK: USE OF COMPLETED PORTIONS

The Contractor shall complete any portion or portions of the work in such order of time and shall direct the application of forces to any portion of the work, as in the judgment of the Engineer is required. The Owner shall have the right to take possession of and use any completed or partially completed portions of the work even though the time for completing the entire work or such portions may not have expired, but such taking possession and use shall not be deemed as acceptance of that portion of work by the Owner.

5. ARBITRATION

All decisions of the Engineer shall be final except in cases involving time or financial considerations, which, if no agreement regarding such cases is reached, shall be subject to arbitration. The demand for and procedure of arbitration, and the selection of arbitrators shall conform to the practice recommended by the Joint Conference on Standard Construction Contracts, as set forth in the "Standard General Conditions for Engineering Construction", issued by said Joint Conference.

6. ENGINEERING STAKES

Unless otherwise indicated in other sections of the Contract Documents, the Contractor shall furnish, set and maintain without cost to the Owner, suitable stakes, grade boards, temporary structures, templates and other materials for establishing and maintaining points, marks, and lines, and shall furnish the Engineer with such assistance as he may require in checking such points, marks, or lines and in checking measurements necessary in the prosecution of the work.

The Contractor shall be held responsible for the preservation of all stakes and marks.

7. DEFECTIVE WORK

When any material not conforming to the requirements of the Contract Documents has been delivered upon the site of the Project or incorporated in the work, or when any work performed is of inferior quality, such material or work shall be considered as defective and shall be immediately removed and renewed or made satisfactory as directed by the Engineer, at the expense of the Contractor. Failure or neglect on the Engineer, to condemn or reject any bad or inferior work or materials shall not be construed to imply an acceptance of such work or materials, if such bad or inferior material or work becomes evident at any time prior to the final acceptance of the work and the release of the Contractor by the Owner; nor shall it be construed as barring the Owner at any subsequent time from the recovery of damage in such sum of money as may be needed to build anew all portions of the work in which fraud was practiced or improper materials hidden, whenever found.

The Contractor shall remove at his own expense any work or material condemned, and shall rebuild and replace the same without extra charge, or in case the Engineer should not consider the defect of sufficient importance to require the Contractor to rebuild or replace any imperfect work or material, he shall have the power and is hereby authorized to make an equitable deduction from the stipulated price.

The Contractor shall promptly move from the premises all materials condemned by the Engineer as failing to conform to the Contract Documents whether incorporated in the structure or not, and the Contractor shall promptly replace his own work in accordance with the Contract and without expense to the Owner, and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

If the Contractor does not remove such condemned work and materials within a reasonable time, fixed by written notice, or if materials previously condemned and removed from the site of the work are subsequently found at the same or other site of work, the Owner may remove them and may store the material at the expense of the Contractor. If the Contractor does not pay the expenses of such removal within ten (10) days thereafter, the Owner may, upon ten (10) days written notice, deduct all the costs and expenses of such removal from any monies that may be due the Contractor.

8. MATERIALS

- A. The Contractor shall furnish the Engineer, promptly after the award or execution of the Contract, with a complete statement of the origin, composition and manufacture of all materials to be used in the construction of the Project. Only materials conforming to the requirements of the Contract Documents and approved by the Engineer shall be used in the work.
- B. Representative preliminary samples of the materials, of the character and quality prescribed in the Contract Documents, shall be submitted when indicated or directed, for advance examination or test, and written approval of the quality of such samples shall be received by the Contractor prior to obtaining materials from the respective sources of supply.
- C. Samples of all materials requiring laboratory tests shall be taken under the direction or supervision of, or in the manner prescribed by the Engineer, and such materials shall not be used until accepted as the result of such tests, and then only so long as the quality of the material remains equal to that of the accepted sample. The acceptance at any time of any material shall not be a bar to its future rejection if it is subsequently found to be defective or inferior in quality of uniformity to the material specified.
- D. Required laboratory tests of materials shall be made by a testing laboratory or agency selected or approved by the Engineer and in accordance with the methods indicated herein. When standard specifications and serial numbers of technical societies and associations are stipulated, the reference shall be construed to be the latest of such specifications and serial numbers.
- E. The Contractor shall be responsible for payment for all laboratory tests, mill inspection and tests conducted by the testing laboratory or agency at the shops or mills of the producers.
- F. For tests or inspections conducted by, and at the option of, the Engineer, at sites other than the testing laboratory and not under the jurisdiction thereof, the Contractor, without cost to the Owner, shall furnish all material, labor, tools, and equipment, and every facility for the verification of the accuracy of all scales, measures and testing equipment, necessary for such tests or inspections.
- G. The Contractor shall permit or arrange with the producer to permit the Engineer or any agent of the testing laboratory to inspect or test any and all material being used or to be used, at any time before, during or after its preparation, or while being used during the progress of the work or after the work has been completed.
- H. Materials shall be stored so as to insure preservation of their specified quality and fitness for the work. When considered necessary, they shall be placed on wooden platforms or other hard and clean surfaces, and not on the ground, and shall be placed under cover when directed. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without permission of the Owner or lease of the property.

- I. If any material intended for use in the construction of this Project has been inspected and rejected after such materials have been delivered to the Site, all such rejected material shall be immediately removed from the property by the Contractor.

9. EQUIPMENT AND MACHINERY

All apparatus, mechanisms, equipment, machinery and manufactured articles for incorporation in the work shall be the new and unused standard products of recognized reputable manufacturers.

Unless otherwise specifically provided in the Contract Documents, all workmanship, equipment, materials, and articles incorporated in the work covered by this Contract are to be of the highest quality and grade of their type. Whenever in the Contract Documents, any material, article, device, product, fixture, form, type of construction, or process is indicated or specified by patent or proprietary name, by name of the manufacturer, or by catalog number, such shall be deemed to be used for the purpose of establishing a standard and shall be deemed to be followed by the words "or approved equal."

Where the Contractor desires to use a non-specified item or method, which is considered to be an "approved equal" to the item or method specified, the approval of the Engineer must be obtained. The Engineer shall be the sole judge as to the quality of the item or method proposed by the Contractor.

All equipment and machinery, and parts and assemblies thereof, entering into the work shall be tested as specified. Unless waived in writing by the Engineer all field and operating tests shall be made in the presence of the Engineer or his authorized representative. When such a waiver is issued, sworn statements in duplicate of the tests made and the results thereof shall be furnished to the Engineer by the Contractor or manufacturer. Costs of all tests and trials, with the exception of the Engineer's expenses, shall be borne by the Contractor and shall be included in the Contract Price. Inspections or tests of apparatus, machinery, or equipment shall be made at the option of the Engineer at the point of production, manufacturer, installation or shipment.

Unless otherwise provided in the Agreement all machinery and equipment, parts and assemblies thereof to be furnished and installed by the Contractor, shall be guaranteed against defective materials and workmanship by the Contractor for a period of one (1) year from the date indicated on the Certificate of Substantial Completion. In the event of failure of any part or parts during the period specified, due to the above causes, the affected part or parts shall be replaced by the Contractor promptly upon notice of the Owner. In the event of failure of prompt replacement by the Contractor, such replacement may be made by the Owner at the Contractor's expense.

10. OBSERVANCE OF LAWS

The Contractor shall at all times observe and comply with all Federal and State laws and local by-laws, ordinances and regulations in any manner affecting the conduct of the work or applying to employees on the Project, as well as all orders or decrees which have been promulgated or enacted, or which may be promulgated or enacted, by any legal bodies or tribunals having authority or jurisdiction over the work, materials, equipment, employees or the Contract.

11. REGULATIONS OF THE DEPARTMENT OF LABOR AND INDUSTRY

Special attention is drawn to the regulations of the State Department of Labor and Industry relating to trenches and excavations, tunnel construction, equipment, materials, labor, safety, sanitation, and other regulations on which the Contractor shall be fully informed and with which he shall fully comply.

The Contractor shall receive no additional compensation for sheeting, bracing and shoring, or other work or materials required on his part solely for the purpose of conforming to the regulations of the State Department of Labor and Industry. Observance of and compliance with said regulations shall be solely and without qualification the responsibility of the Contractor, without reliance or superintendence of or direction by the Owner or Engineer.

12. SANITARY CONVENIENCES

Sanitary conveniences complying with the regulations of the State Health Department or other bodies having jurisdiction therewith, shall be provided for the use of the workmen, and their exclusive use strictly enforced.

13. PERMITS AND LICENSES

With the exception of Pennsylvania Department of Transportation, Pennsylvania Department of Environmental Resources, and Railroad crossing permits, which will be obtained by the Owner, the Contractor shall procure all necessary permits and licenses, pay all charges and fees, therefore, and shall give all notices necessary and incident to the proper and lawful prosecution of the work. The cost thereof shall be included in the prices bid for the various items scheduled in the Proposal.

Where work is to be done by the Contractor in placing any pipe or other construction under or within the right-of-way of the Pennsylvania Department of Transportation, Pennsylvania Department of Environmental Resources or railroad company, the Contractor shall be guided by the requirements of the agency or company involved, and shall consult with the officials thereof, relative to the installation. If the agency or railroad company requires any of their personnel to be on hand for supervisory duties in connection with the work, all charges relative to payment for such services shall be borne by the Contractor.

14. PATENTS AND ROYALTIES

The Contractor agrees to indemnify and save harmless the Owner from all suits or actions of every nature and description brought against him, for or on account of the use of patented appliances, products, or processes, or the infringement of any patent, trademark, or copy-right, and the Contractor shall pay all royalties and license fees in connection therewith.

15. NO WAIVER OF LEGAL RIGHTS

Neither the Owner nor the Engineer shall be precluded or stopped by any measurements, estimate or certificate made or given by them or by their agents or employees, under any provisions or provision of the Contract at any time, either before or after the completion and acceptance of the work and payment thereof pursuant to any measurements, estimate or certificate, from showing the true and correct amount and character of the work performed and materials furnished by the Contractor or from showing at any time, that any such measurement, estimate or certificate is untrue or incorrectly made in any particular,

or that the work or materials or any part thereof, do not conform in fact to the Contract Documents. The Owner shall have the right to reject the whole or any part of the aforesaid work or materials, should the said measurements, estimate, certificate of payments be found, or be known to be inconsistent with the terms of the Contract, or otherwise improperly given, and the Owner shall not be precluded and stopped, notwithstanding any such measurements, estimate, certificate and payment in accordance therewith and from demanding and recovering from the Contractor or his Surety such damages as the Owner may sustain by reason of the Contractor's failure to comply with the terms of the Contract Documents or on account of any overpayment made on any estimate or certificate. Neither the acceptance by the Owner, the Engineer, or any of their agents or employees, nor any certificate by the Owner for payments of money, nor any payments for, or acceptance of the whole or any part of the work by the Owner or Engineer, nor any extension or remission of time, nor any possession taken by the Owner or his employees shall operate as a waiver of any portion of the Contract or any power herein reserved by the Owner, or any right to damages herein provided, nor shall any waiver of any breach of the Contract be held to be a waiver of any other or subsequent breach. All remedies provided in this Contract shall be taken and construed as cumulative; that is, in addition to each and every other remedy provided.

16. CARE OF PUBLIC AND PRIVATE PROPERTY

The Contractor shall take all necessary precaution to prevent damage to all overhead and underground structures and to protect and preserve property within or adjacent to the Project and shall be responsible for damage thereto. Special care must be used by the Contractor in the prosecution of the work in order to avoid interference or damage to any operating utilities or plants. However, where there is a possibility of such interference or damage, the Contractor shall make satisfactory arrangements with responsible officers or with the Owners of the utilities or plants, covering the necessary precautions to be used as safeguards during the performance of the work by the Contractor.

Such arrangement shall be made before work is started and shall be subject to the approval of the Engineer which approval will not be considered as releasing the Contractor from any responsibility for the acts of himself or his employees or representatives. The Contractor shall protect all land monuments and property markers, which will be affected by the construction until they have been correctly referenced. Monuments and markers, which are disturbed by the Contractor during the construction of the Project or otherwise, shall be satisfactorily reset by him at his expense when and as directed. The Contractor shall make good any damage or injury to public or private property and shall promptly make restitution for, or proceed to repair or otherwise restore such damage or injury to property as may be deemed necessary by the Engineer. The Contractor will be held responsible for the protection of or damage done to trees to be left standing and if any are damaged, the Contractor shall have them promptly repaired at his own expense by a qualified tree surgeon, or replaced as required.

17. PRELIMINARY INSPECTION

Unless the requirement is waived by the Engineer, prior to the start of actual construction operations, the Contractor or his authorized representative shall go over the project accompanied by the Engineer or his designated representative and shall observe for himself, with the approved Drawings before him, all pertinent conditions relative to the Contract, including the status of rights-of-way and structures, obstructions, or other objects to be removed, altered or changed.

18. SAFETY AND PROTECTION: EMERGENCIES

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

- A. All employees on the work and other persons who may be affected thereby.
- B. All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and
- C. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He will erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection, including posting danger signs and other warnings against hazards and promulgating safety regulations. He will notify owners of adjacent utilities when prosecution of the work may affect them. When the use or storage of explosives or other hazardous materials is necessary for the prosecution of the work, the Contractor will exercise the utmost care and will carry on such activities under the supervision of properly qualified personnel. All damage, or loss to any property referred to above caused, directly or indirectly, in whole or in part, by the Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, will be remedied by the Contractor, except damage or loss attributable to the fault or drawings or specifications or to the acts or omissions of the Owner or the Engineer or anyone employed by either of them or for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

The Contractor will designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be in the Contractor's superintendent unless otherwise designated in writing by the Contractor to the Owner and the Engineer.

In emergencies affecting the safety of persons or the work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, is obligated to act, at his discretion, to prevent threatened damage, injury or loss. He will give the Engineer prompt written notice of any significant changes in the work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved. If the Contractor believes that additional work done by him in an emergency, which arose from causes beyond his control, entitles him to an increase in the Contract Price or an extension of the Contract Time, he may make a claim therefore, as provided in Article 27.

19. VIOLATION OF CONTRACT

The Owner, upon written notice from the Engineer, or other satisfactory proof, and after having given written notice to the Contractor and his Surety of delay, neglect, or default on the part of the Contractor, shall have full power and authority, without violating the

Contract, to declare the Contractor in default on any of the following counts:

- A. Failure to begin work within the time specified in the Notice to Proceed;
- B. Failure to perform the work with sufficient properly skilled workmen and/or proper equipment, or with sufficient materials to insure the completion of said work in accordance with the terms of the Contract;
- C. Neglect or refusal to remove materials or perform anew such work as may be rejected as defective or unsuitable;
- D. Halting prosecution of the work without approval of the Engineer;
- E. Insolvency or bankruptcy, or committing any act of bankruptcy or insolvency;
- F. Allowing a final judgment to stand unsatisfied for a period of forty-eight (48) hours;
- G. Making an assignment for the benefit of creditors;
- H. Failure or refusal, within ten (10) days after written notice, by the Owner, to make payment or show cause why payment should not be made, of any amounts due for labor or materials;
- I. Failure to protect, repair, or make good any damage or injury to property as provided in Article 16;
- J. If a receiver or liquidator shall be appointed for the Contractor or for any of his property and shall not be dismissed within twenty (20) days after such appointment or the proceedings in connection therewith shall not be stayed on appeal within the said twenty (20) days after such appointment;
- K. If the Contractor shall refuse or fail to prosecute the work or any part thereof with such diligence as will insure its completion within the period herein specified (or any duly authorized extension thereof) or shall fail to complete the work within said period; or
- L. If the Contractor should fail or refuse to regard laws, ordinances or the instruction of the Engineers, or otherwise be guilty of a substantial violation of any provisions of this Contract;
- M. If the Contractor should fail to maintain the Insurance required under Article 17 of the Instructions to Bidders for the life of the Contract.

After the Owner has declared the Contractor in default, and given him three (3) days written notice, the Owner shall have authority to take the prosecution of the work out of the hands of the Contractor, and appropriate or use any materials and equipment of the Contractor assembled for the Project, and may enter into a contract for the completion of the work.

Should the Owner elect to take the prosecution of the work out of the hands of the Contractor, the Owner may at its option, notify and require the Surety to complete the Contract according to Contract terms, or the Owner may, at its option, complete the Contract with its own forces, in which case the Owner may take all right, title and interest in and to the equipment and materials owned by the Contractor and assembled for use in the execution of the Contract.

If the completion of the Contract by any of the methods described above results in financial loss to the Owner, the Owner may dispose of any of the remaining equipment and materials taken over without further legal processes. Any equipment or materials not required for completion or recoupment of loss or for legal charges against the Contract, or any balance remaining from the disposition of materials and equipment, after deducting losses by the Owner, shall be turned over to the party legally or equitably entitled thereto.

20. CONTRACTOR'S RIGHT OF TERMINATION

If, after Notice to Proceed is given, the work is stopped by order of the Owner for a continuous period of sixty (60) days for any cause other than weather conditions or any act of the Contractor, the Contractor shall have the right to terminate this Contract after seven (7) days' written notice to the Owner of such action, provided that order to resume work is not issued by the Owner within such period of seven (7) days. Failure by the Owner to make payment to the Contractor within fifteen (15) days after expiration of the time allowed for such payment by the Contract Documents shall give the Contractor the right to suspend work until payment is made, or at his option, after seven (7) days' notice in writing, should the Owner, continue in default, to terminate this Contract. The Owner shall be barred from making any claim against the Contractor for delay in completion of the work due to the suspension or failure to pay.

In the event of such Contract termination, the Contractor shall be paid as provided in the Contract for all work done and completed in accordance therewith and he shall also be paid, as determined by the Engineer for all extra costs incurred by him due to termination of the Contract, but shall not be paid any amount for loss of anticipated profit on any work not done or not completed.

21. RESPONSIBILITY OF CONTRACTOR

The Contractor shall be responsible for the entire Project determined by the Contract Documents, from the date of the starting of the work until it is accepted as evidence by approval of the Completion Certificate by the Owner. He shall be responsible for removals, and replacements due to action of the elements and all other causes except as otherwise provided in the Contract Documents. The Contractor shall keep the Contract under his own control and it shall be his responsibility to see that the work is properly supervised and carried on faithfully and efficiently. The Contractor shall supervise the work personally or shall have a competent superintendent or representative, who shall be on the site of the Project at all working hours to receive orders and directions from the Engineer and who shall be clothed with full authority by the Contractor to execute such orders without delay and make arrangements for all necessary materials, equipment and labor.

Renewals or repairs necessitated because of defective materials or workmanship, or due to action of the elements or other natural causes, including fire and flood, prior to the acceptance as determined by the Completion Certificate, shall be done anew in accordance with the Contract Documents at the expense of the Contractor.

22. CONTRACT TIME

The Contract time for completion of the work based either upon consecutive calendar days or a definite calendar date, shall be as specified in the Agreement.

If a number of calendar days is specified, Sundays and legal holidays shall not be included in the computation of the number of consecutive calendar days used in completion of the Contract.

On the basis either of calendar days or of date of completion, in computing the time spent in the execution of the work, no allowance will be made for days or parts of days on which work was suspended or delayed in consequence of an act or omission, such as the non-delivery of materials, or breakdowns of equipment, or failure of the Contractor to obtain or employ sufficient labor or equipment to prosecute the work, or other such reasons or causes which are the responsibility of the Contractor.

Adjustments or extensions of the calendar days or the date of completion will be granted only as hereinafter specified.

If the Engineer in writing suspends the work wholly or in part, as set forth in Article 24 of this Section, but not for reasons, which are the responsibility of the Contractor, the time for completion of the work may be extended by the Engineer. After such suspension of work has expired the Contractor shall have a sufficient time to complete the work remaining to be done, at the rate of progress originally determined by the Owner for the performance of the work and extension of contract item may be made accordingly. In the event working time is extended as aforesaid, such action shall not be construed as relieving the Contractor from his responsibility for lack of satisfactory progress prior to such suspension period. In the event the working time is extended as aforesaid and the Contractor was ahead of the schedule, as estimated by the Engineer, at the time work was suspended, due credit will be given for such advanced progress in computing the extension.

If the Contractor shall be delayed in the completion of the work by reason of unforeseeable or inevitable causes beyond his responsibility, without his fault or negligence, the period specified for completion of the work may be extended by such time as shall be determined by the Engineer, provided that application for extension be made, in writing by the Contractor, not later than two (2) weeks following the dates for which said extension is claimed.

The question of whether or not there is a justifiable cause for granting an extension of time as herein provided shall be determined by the Engineer on the basis of the conditions encountered or leading to such causes. No additional payment will be allowed for damage to or reconstruction of work, previously performed by the Contractor, by or on account of such causes. No extensions of time shall be deemed a waiver by the Owner of any obligations of the Contractor under the terms of the Contract nor as relieving the Contractor from full responsibility thereunder.

Suspension of work due to unsuitable weather or unfavorable conditions will be considered as valid causes for extension of the contract working time, with written approval of the Engineer.

23. LIQUIDATED DAMAGES

For each calendar day, with the exception of Sundays and legal holidays, that any work shall remain uncompleted after the time specified for the completion of the work provided for by the Agreement, the sum per calendar day specified in the Agreement, shall be deducted by the Owner from monies due the Contractor, not as a penalty but as liquidated damages. Extensions may be made by the Engineer, at his discretion, over the period specified for the completion of the work, for causes for which the Contractor is not

responsible and which must delay the completion of the work, and in such case the Contractor shall become liable for liquidated damages for delays commencing from the date on which the extended period shall expire.

Liquidated damages when charged as provided herein, shall be deducted from the Final Estimate amount payable to the Contractor or his Surety. If the total amount chargeable as liquidated damages exceeds the amount payable to the Contractor or the Surety, then such excess shall be paid to the Owner by the Contractor or his Surety.

24. TEMPORARY SUSPENSION OF WORK

The Engineer shall have authority to suspend the work wholly or in part, due to unsuitable weather, or such other conditions as are considered unfavorable for the suitable prosecution of the work, or due to the failure on the part of the Contractor to carry out orders given or to perform any provisions of the Contract, or due to unforeseen conditions which had not been provided for in estimating the Contract time required for completion of the work. No claim for damages or loss of profit may be advanced by the Contractor by reason for such temporary suspension.

If the Engineer suspends the work in part, he shall have authority to direct the Contractor to perform such other parts or items of work which, in his opinion, may be performed with favorable results and advantageously for the time of completion of the Project, and shall notify the Contractor accordingly in writing.

If it should become necessary to suspend work for a sustained or an indefinite period, the Contractor shall store all materials satisfactorily, and he shall take every precaution to prevent damage or deterioration of the work performed. The Contractor shall resume work after such suspension upon written notice from the Engineer. All of the work outlined in this article shall be performed at the Contractor's expense.

25. CONTRACTOR'S SUPERVISION AND SUPERINTENDENCE

The Contractor will supervise and direct the work efficiently and with his best skill and attention. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. Before undertaking the work he will carefully study and compare the Contract Documents and check and verify all figures shown thereon and all field measurements. He will at once report in writing to the Engineer any conflict, error or discrepancy which he may discover. The Contractor will be responsible to see that the finished work complies accurately with the Contract Documents.

The Contractor will keep on the work at all times during its progress a resident superintendent satisfactory to the Engineer. The superintendent shall not be replaced without the consent of the Engineer except under extraordinary circumstances. The superintendent will be the Contractor's representative at the site and shall have authority to act on behalf of the Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor.

The Contractor will provide competent, suitably qualified personnel to survey and layout the work and perform construction as required by the Contract Documents. He will at all times maintain good discipline and order among his employees at the site.

The Engineer will not be responsible for the acts or omissions of the Contractor, or any subcontractors, or any of his or their agents or employees or any other persons performing any of the work.

26. NONCOMPLIANCE OF CONTRACTOR

In addition to the elective measures the Owner may take for violation of the Contract as provided in Article 19, he shall also have the discretionary right to take any or all of the following actions if the Contractor fails, neglects, or refuses to comply with the requirements of Articles 7, 16, 18, 24, 32 or 33.

- A. He may shut down the work until the requirements of the violated articles are met by the Contractor. In such event no remission will be made in working time for the period for which the work is shut down.
- B. He may withhold payment of estimates for work completed until the requirements of the violated article are met by the Contractor.
- C. He may enter upon the Project and perform such work as may be necessary to meet the requirements of the article violated and deduct the cost thereof from monies due or which may become due the Contractor or the Surety, or in the absence of any monies due the Contractor or the Surety, he shall be fully reimbursed for such costs by the Contractor or the Surety.

However, if the Contractor fails to comply with the requirements of Article 24, the Owner shall not proceed as provided herein until three days after written notice to the Contractor and his Surety that such action will be taken.

27. CHANGES IN WORK AND CONTRACT PRICE

A. Change in Work

Without invalidating the Agreement, the Owner may, at any time or from time to time, order additions, deletions or revisions in the work. These will be authorized by Change Orders. If any Change Order causes an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, an equitable adjustment will be made as provided in (B) following.

Additional work performed by the Contractor without authorization of a Change Order will not entitle him to an increase in the Contract Price, except in the case of an emergency affecting the safety of persons or the work or property at the site or adjacent thereto. In such cases the Contractor, without special instruction or authorization from the Engineer or Owner, is obligated to act, at his discretion, to prevent threatened damage, injury or loss. He will give the Engineer prompt written notice of any significant changes in the work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved. If the Contractor believes that additional work done by him in an emergency which arose from causes beyond his control entitles him to an increase in the Contract Price or an extension of the Contract Time, he may make a claim therefore as provided in (B) below.

It is the Contractor's responsibility to notify his Surety of any changes affecting the general scope of the work or change in the Contract Price and the amount of the applicable bonds shall be adjusted accordingly. The Contractor will furnish proof of such adjustment to the Owner upon request.

B. Change in Contract Price

The Contract Price constitutes the total compensation payable to the Contractor for performing the work. All duties, responsibilities and obligations assigned to or undertaken by the Contractor shall be at his expense without change in the Contract Price. The Contract Price may only be changed by a Change Order.

If the Contractor is entitled by the Contract Documents to make a claim for an increase in the Contract Price, his claim shall be in writing delivered to the Owner and the Engineer within 7 days of the occurrence of the event giving rise to the claim. All claims for adjustments in the Contract Price shall be determined by the Engineer if the Owner and Contractor cannot otherwise agree on the amount involved. Any change in the Contract Price resulting from any such claim shall be incorporated in a Change Order.

The value of any work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

- (1) Where the work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.
- (2) Where the Contract has been awarded for a lump sum price or where a significant portion of the Contract Price is based on a lump sum price by application of unit prices resulting from the breakdown of the lump sum Contract Price as required by Article 30.
- (3) Where the change in work is not covered by unit prices available from (1) or (2) above, the following methods in the order given shall then apply:
 - a. By mutual acceptance of a lump sum amount.
 - b. By cost and a percentage of these costs to cover overhead and profit. Costs shall only include labor (payroll, payroll taxes, fringe benefits, workman's compensation, etc.) materials, equipment, and other incidentals directly related to the work involved. The addition for overhead and profit shall not exceed twenty (20) percent of these costs.

28. MEASUREMENT

All work completed under this Contract shall be measured by the Engineer according to the United States Standard measures. No extra or customary measurements of any kind shall be allowed in measuring any work, only the actual lengths, areas, solid contents, weights, or numbers, shall be considered and the lengths shall be measured on center lines of the work, whether the same be straight or curved, unless specified differently.

29. PRESENTATION OF CONTRACTOR'S CLAIMS

Neither the Contractor nor the Surety shall be entitled to present any claims to the Owner or the Board of Arbitration, either during the prosecution of the work or upon completion of the Contract, for additional compensation for work performed or any other cause, unless the Contractor or Surety shall have given the Owner notice of intention to present such claims within (10) ten days from the happening of the event, thing, or occurrence giving

rise to the alleged claim. However, the Contractor or Surety shall not be denied the right to present any claim, which is based on differences in measurements or errors of computations which were not disclosed until preparation of the Final Estimate.

30. PAYMENTS TO CONTRACTOR

Partial payments on the Contract will be made during the progress of the work based on the value of the work done except as provided in Article 29, and in accordance with the provisions of the Agreement. These partial payments are merely estimates and subject to correction in any succeeding estimate or in the final payment, and shall not bind the Owner to the acceptance of any materials furnished or work done. Completed additional or extra work which has been approved by the Engineer will be included in partial payments. On lump sum contracts, the Contractor shall prepare an itemized breakdown of the value of the several classes of work, which after approval will be used by the Engineer on computing the value of work done and amounts due on current estimates.

Certain material stored but not yet incorporated into the work may be included in partial payments only when the Contractor provides invoices to show that such material has been received by the Contractor and delivered to an approved location, and when said material will not be stored for more than ninety (90) days. The Contractor may be paid 100% of the cost of the material, less the pro-rata share of the retainage provided that the cost does not exceed ninety percent (90%) of the Contract Price for the contract item and the cumulative costs do not exceed twenty-five percent (25%) of the current Contract amount.

The cost of surplus stored material, which payment previously has been made to the Contractor but has not been incorporated in the final measured work, will not be included in the final payment. Surplus stored material is the property of the Contractor.

Once each month, the Contractor shall prepare and submit to the Engineer an estimate of the value of work completed to the end of the period covered by the estimate. Ninety percent (90%) of such value less the aggregate of previous payments will be normally paid to the Contractor within thirty (30) days following the date of the Owner's regular meeting.

However, in situations where the Project is being funded through state and/or federal funds such as the Community Facilities Program or the Community Development Block Grant Program, the Contractor will be paid at the time when such funding is disbursed to the Owner from the federal or state agency.

When construction is fifty percent (50%) complete, periodic payments will be increased to ninety-five percent (95%) of the value of the work completed less the aggregate of previous payments.

Upon substantial completion of the work and operational and beneficial occupancy has been attained, as determined by the Engineer, the retained amounts shall be reduced to an amount necessary to assure completion of the work as determined by the Engineer.

Upon completion of all work under the Contract, the Engineer will determine whether final payment is in order. Upon such determination by the Engineer, a Final Estimate will be prepared by the Contractor with payment being made in accordance with the procedure and requirements of Article 31.

31. ACCEPTANCE AND FINAL PAYMENT

Unless otherwise provided in the Agreement, upon notification by the Contractor that he has completed the work under the Contract, the Engineer shall make an inspection to determine whether the work is fully completed. The Contractor shall at his own expense, provide the Engineer with all labor, tools or equipment that may be required by the Engineer in making such inspection.

As soon as practicable after such inspection and after the Engineer is satisfied that the work is fully completed, the Contractor will compute the entire amount of each item of work performed and the Contract value thereof, the amount and value of all additions, and the amount and value of all deductions, if applicable; and will from this, prepare a Final Estimate and present it to the Engineer.

The Engineer shall either approve the Final Estimate or request that the Contractor revise the Final Estimate.

Unless the Owner rejects the Final Estimate, payment will be made to the Contractor based on this Final Estimate normally within thirty (30) days of the Owner's regular meeting at which the Final Estimate is presented to the Owner. However, in situations where the Project is being funded through state and/or federal funds such as the Community Facilities Program or the Community Development Block Grant Program, the Contractor will be paid at the time when such funding is disbursed to the Owner from the federal or state agency.

If liquidated damages have been determined by the Owner to be applicable to this Contract and are to be deducted from the amount due the Contractor under the Final Estimate, the Owner shall inform the Contractor in writing of the deductions to the amount due and of the net amount to be paid, and payment of the net amount will be made to the Contractor.

In the event that the Owner rejects the Final Estimate, the Owner will direct the Contractor to revise the Final Estimate and resubmit it to the Engineer.

In the event mutual agreement on the Final Estimate between the Owner and Contractor cannot be obtained, arbitration procedures in accordance with Article 5 will be used.

The Owner may withhold final payment pending receipt of:

- A. A written statement in a form satisfactory to the Owner and under seal from the Surety that payment of the amount shown in the Final Certificate to the Contractor shall not relieve the Surety of any obligations to the Owner as set forth in the Surety's bonds.
- B. An affidavit and such other satisfactory evidence as may be required that all labor, material, and indebtedness arising out of performance of the Contract have been paid; and that all other claims against the Contractor or subcontractors arising out of performance of the Contract either have been paid or that the Contractor has in force such Public Liability and Property Damage Insurance as will fully protect him and his subcontractors from any such claims as may be pending or that may there after arise; and
- C. A satisfactory Maintenance Bond.

The action of the Owner by which the Contractor is to be bound and work concluded, according to the terms of the Contract, shall be evidenced by payment of the Final Certificate. All prior certificates or estimates upon which payments have been made being partial payments and subject to correction in the final payment.

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor for all things done or furnished in connection with this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations under this Contract or the Performance, Labor and Material Payment or Maintenance Bonds.

32. PAYMENT TO CONTRACTOR AND INDEMNIFICATION

All work covered by partial payment made shall thereupon become the sole property of the Owner, but his provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the owner to require the fulfillment of all terms of the Contract Documents.

The Contractor will indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, material, men, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the work. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived.

If the Contractor fails to do so the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor, his Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Owner shall be considered as a payment made under the Contract documents by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for any such payments made in good faith.

If the Owner fails to make payment within thirty (30) days after approval by the Engineer and the Owner, or within seven (7) days after the Owner receives payment from the state and/or federal funding services, whichever is later, in addition to other remedies available to the Contractor there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.

33. CONTRACTOR'S GUARANTEE

The Contractor shall guarantee his work, and shall remedy without cost to the Owner any defects which may develop therein during the guarantee period. The guarantee period shall be for two (2) years from the date as certified by the Engineer when the Project's construction is substantially complete for the Project to be utilized for the purpose for which it is intended. In the event that the date of substantial completion precedes the date upon which the Owner initiates utilization of the Project, the guarantee period will then commence upon the date which the Owner utilizes the project or the date of final payment, whichever comes first.

Upon written request by the Contractor, the Engineer will consider establishing separate dates of substantial completion and guarantee period for separate parts of the Project which will be utilized prior to other parts of the Project.

If after written notice to the Contractor and his surety, the Contractor fails to remedy such defects, the Owner may declare the Contractor in default and may notify and require the surety to remedy such defects under the terms of the Maintenance Bond.

34. SUBCONTRACTS

The Contractor shall, as soon as practicable after the signing of the Contract, notify the Owner through the Engineer in writing of the names of any subcontractors proposed for the principal parts of the work and for such others as the Engineer may direct, and shall not employ any that the Engineer may, within a reasonable time, object to as incompetent or unfit.

The Engineer shall, on request of any subcontractor, furnish to that subcontractor, wherever practicable, evidence of the amounts certified in his account.

The Contractor agrees that he is as fully responsible to the Owner for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him. Nothing contained in the Contract Documents shall create any contractual relation between any subcontractor and the Owner.

35. RELATIONS OF CONTRACTOR AND SUBCONTRACTORS

The Contractor agrees to bind every subcontractor and every subcontractor agrees to be bound by the following provisions of this article, unless specifically noted to the contrary in a subcontract approved in writing as adequate by the Owner.

A. The subcontractor agrees:

- 1) To be bound to the Contractor by the terms of the Contract Documents and to assume toward him all the obligations and responsibilities that he, by these Contract Documents, assumes towards the Owner.
- 2) To submit to the Contractor applications for payment in such reasonable time as to enable the Contractor to apply for payment.
- 3) To make all claims for extras, for extensions of time and for damages for delays or otherwise, to the Contractor in the manner provided in these Contract Documents for like claims by the Contractor upon the Owner, except that the time for making claims for extra cost is one (1) week.

B. The Contractor agrees:

- 1) To be bound to the subcontractor by all the obligations that the Owner assumes to the Contractor under the Contract Documents and by all the provisions thereof affording remedies and redress to the Contractor from the Owner.
- 2) To pay the subcontractor, upon the issuance of certificates, the amount allowed to the Contractor on account of the subcontractor's work to the extent of the subcontractor's interest therein.
- 3) To pay the subcontractor, upon the issuance of certificates, so that at all times the total payments shall be as large in proportion to the value of the work done by the subcontractor as the total amount certified to the

Contractor is to the value of the work done by the latter.

- 4) To pay the subcontractor to such extent as may be provided by the Contract Documents or the subcontract, if either of these provides for the earlier or larger payments than the above.
- 5) To pay the subcontractor on demand for his work or materials as far as executed and fixed in place, less the retained percentage, at the time the certificate should issue even though the Engineer fails to issue it for any cause not the fault of the subcontractor.
- 6) To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specifically named in the subcontract.
- 7) That no claim for services rendered or materials furnished by the Contractor to the subcontractor shall be valid unless written notice thereof is given by the Contractor to the subcontractor during the first ten (10) days of the calendar month following that in which the claim originated.

C. The Contractor and subcontractor agree:

- 1) That nothing in this Article shall create any obligation on the part of the Owner to pay, or to see to the payment of, any sums to any subcontractor.

36. USE OF LANDS

The Owner shall provide the lands upon which the work under this Contract is to be done except that the Contractor shall provide all necessary additional land required for the erection of temporary construction facilities and storage of materials, together with right of access thereto. The Contractor shall conduct no operations outside the lines of the property leased or owned or authorized for such use by the Owner without permission of the Owner.

37. WORKING CONDITIONS

- A. No night, Sunday, or holiday work requiring the presence of the Engineer or his representative will be permitted except in cases of emergency, and then only with the written consent of the Engineer and to such an extent as he may judge necessary.
- B. No work shall be done under this Contract when in the opinion of the Engineer, the weather is unsuitable for good and careful work to be performed. Should the severity of the weather continue such that the work cannot be prosecuted successfully, the Contractor, upon order of the Engineer, shall cease all such work until directed to resume the same. In the latter case, suitable extension of time shall be allowed to compensate for time actually lost as provided for in Article 22.
- C. The Contractor shall arrange for and be responsible for a sufficient amount of illumination at all times, subject to the direction of the Engineer, to carry on all phases of the work.

38. PROGRESS CHARTS

Unless the requirement is waived by the Engineer, the Contractor shall, within seven (7) days after issuance of Notice to Proceed, prepare and submit to the Engineer for approval,

a practicable and feasible schedule showing the order in which the Contractor proposes to carry on the work, the dates on which he will start the several salient features (including procurement of equipment) and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale so as to appropriately indicate the percentage of work completed at any time. The Contractor shall enter the actual progress at the end of each month and shall immediately deliver to the Engineer three (3) copies of the same.

39. NOTICE

The service of any notice by the Owner or Engineer to the Contractor or by either party of the Contract to the Engineer or other party of the Contract, shall be considered accomplished upon completion of any one of the following procedures.

- A. When delivered, in writing, to the person in charge of the office used by the addressee to conduct business as given in the Proposal or Agreement;
- B. When delivered, in writing, to the addressee or any of his authorized agents in person;
- C. When delivered, in writing, to the addressee or any of his agents at the office used by the addressee to conduct the business of this Contract or near the Site of the work;
- D. When deposited in the United States Mail, postpaid, and addressed to the party intended for such service at his office used for conducting the business of this contract at the site of the work, or his last known place of business; or
- E. When filed at any company operated office of the Western Union Telegraph Co. and addressed to the party intended for such service at his last known place of business or for conducting the business of this Contract at the site of the work.

40. CLEANING SITE

The Contractor shall at all times keep the Project Site free from accumulations of waste material or rubbish caused by the work. Before the work will be considered as having been completed, the Contractor shall clean and remove from the Project and adjacent property all surplus and discarded materials, equipment and temporary structures, and restore, where applicable, to the extent as required by other sections of these Contract Documents.

41. PUBLIC CONVENIENCE AND SAFETY

The Contractor shall conduct the work so as to insure the least obstruction to pedestrian and vehicular traffic. The convenience of the general public and of residents adjacent to the Project shall be provided for in an adequate and satisfactory manner. Unless otherwise directed, sidewalks and crossings shall be kept open for pedestrians. Streets shall not be unnecessarily obstructed and unless the Engineer authorizes the complete closing of a street, road, or alley, the Contractor shall provide for the maintenance of traffic thereon at his own expense.

The Contractor shall construct and maintain without compensation such adequate and approved temporary bridges over excavations as may be necessary or directed for the accommodation of pedestrians and vehicles.

Where fire hydrants are adjacent to the work they shall be at all times readily accessible to fire apparatus, and no material or other obstruction shall be placed within fifteen (15) feet of any such hydrant.

42. PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon application of either party, the Contract shall forthwith be physically amended to make such insertion.

43. LIENS

No liens shall be allowed for labor or materials furnished.

44. RIGHT OF PROPERTY IN MATERIALS

Nothing in this Contract shall be considered as vesting in the Contractor any right of property in materials used, after they shall have been attached to or incorporated in the work, nor in materials which have been estimated for partial payment, but all such materials, upon being so attached, incorporated or estimated, shall become the property of the Owner.

45. ADVERTISING

No advertising will be permitted on any part of building, scaffolding, fences, materials, obstructions, barricades, or work.

46. OMITTED

47. COMPLIANCE WITH REGULATORY BODIES

Compliance with the regulations of any State, County, or Municipal Authority or of any Public Utilities such as the railroad, power and telephone companies shall not constitute the basis for additional compensation because of such compliance.



COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer) _____

Address _____

City _____ State _____ Zip Code _____

Contractor O

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above date, our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired post January 1, 2013 are authorized to work in the United States.

It is also agreed to that all public works contractors/subcontractors will utilize the federal EVP to verify the employment eligibility of each new hire within five (5) business days of the employee start date throughout the duration of the public works contract. Documentation confirming the use of the federal EVP upon each new hire shall be maintained in the event of an investigation or audit.

I, _____, authorized representative of the company above, attest that the information contained in this verification form is true and correct and understand that the submission of false or misleading information in connection with the above verification shall be subject to sanctions provided by law.

Authorized Representative Signature

NONDISCRIMINATION/SEXUAL HARASSMENT CLAUSE

During the term of this Contract, the Contractor agrees as follows:

- a. In the hiring of any employee(s) for the manufacture of supplies, performance of work, or any other activity required under the contract or any subcontract, the Contractor, each subcontractor, or any person acting on behalf of the Contractor or subcontractor shall not discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of the Pennsylvania Human Relations Act (PHRA) and applicable federal laws, against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.
- b. Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of the PHRA and applicable federal laws, against or intimidate any employee involved in the manufacture of supplies, the performance of work, or any other activity required under the contract.
- c. Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of the PHRA and applicable federal laws, in the provision of services under the contract.
- d. Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate against employees by reason of participation in or decision to refrain from participating in labor activities protected under the Public Employee Relations Act, Pennsylvania Labor Relations Act of National Labor Relations Act, as applicable and to the extent determined by entities charged with such Acts' enforcement, and shall comply with any provision of law establishing organizations as employees' exclusive representatives.
- e. The Contractor and each subcontractor shall establish and maintain a written nondiscrimination and sexual harassment policy and shall inform their employees in writing of the policy. The policy must contain a provision that sexual harassment will not be tolerated and employees who practice it will be disciplined. Posting this Nondiscrimination/Sexual Harassment Clause conspicuously in easily-accessible and well-lit places customarily frequented by employees and at or near where the contracted services are performed shall satisfy this requirement for employees with an established work site.
- f. The Contractor and each subcontractor shall not discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of PHRA and applicable federal laws, against any subcontractor or supplier who is qualified to perform the work to which the contract relates.
- g. The Contractor and each subcontractor represents that it is presently in compliance with and will maintain compliance with all applicable federal, state, and local laws, regulations and policies relating to nondiscrimination and sexual harassment. The Contractor and each subcontractor further represents that it has filed a Standard Form 100 Employer Information Report ("EEO-1") with the U.S. Equal Employment Opportunity Commission ("EEOC") and shall file an annual EEO-1 report with the EEOC as required for employers' subject to Title VII of the Civil Rights Act of 1964, as amended, that have 100 or more employees and employers that have federal government contracts or first-tier subcontracts and have 50 or more employees. The Contractor and each subcontractor shall, upon request and within the time periods requested by the Commonwealth, furnish all necessary employment documents and records, including EEO-1 reports, and permit access to their books, records, and accounts by the contracting agency and the Bureau of Diversity, Inclusion and Small Business Opportunities for purpose of ascertaining compliance with provisions of this Nondiscrimination/Sexual Harassment Clause.
- h. The Contractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subcontract so that those provisions applicable to subcontractors will be binding upon each subcontractor.
- i. The Contractor's and each subcontractor's obligations pursuant to these provisions are ongoing from and after the effective date of the contract through the termination date thereof. Accordingly, the Contractor and each subcontractor shall have an obligation to inform the Commonwealth if, at any time during the term of the contract, it becomes aware of any actions or occurrences that would result in violation of these provisions.
- j. The Commonwealth may cancel or terminate the contract and all money due or to become due under the contract may be forfeited for a violation of the terms and conditions of this Nondiscrimination/Sexual Harassment Clause. In addition, the agency may proceed with debarment or suspension and may place the Contractor in the Contractor Responsibility File.

Sign: _____

Date: _____

**CERTIFICATE OF COMPLIANCE WITH THE PENNSYLVANIA STEEL PRODUCTS
PROCUREMENT ACT**

This Certificate is supplied by _____ (“Bidder”) to
HANOVER TOWNSHIP (the “Owner”) this _____ day of _____, 20_____.

W I T N E S S E T H :

WHEREAS, Bidder wishes to contract with the Owner relative to the Vehicle Storage Building (the “Contract”); and

WHEREAS, the Pennsylvania Steel Products Procurement Act, 72 P.S. §1881 et. seq. (“Steel Procurement Act”) requires that if a product contains foreign and United States steel, such product shall be determined to be a United States steel product only if at least 75% of the cost of the articles, materials, and supplies have been mined, produced or manufactured, as the case may be, in the United States; and

WHEREAS, Bidder has represented to the Owner that any and all products Bidder will supply to the Owner pursuant to the Contract will be United States steel products as defined in Steel Procurement Act and Bidder does and will in all fashion and manner comply with the Steel Procurement Act and the Contract in performance of the Contract.

NOW, THEREFORE, INTENDING TO BE LEGALLY BOUND HEREBY, Bidder does represent and promise to the Owner as follows:

1. The above recitals are binding between the parties and are legally enforceable as if set forth in their entirety herein.
2. Bidder will, pursuant to the Contract, meet the definition of United States steel products as set forth in the Steel Procurement Act and will in all manner and fashion otherwise comply with the Steel Procurement Act and the Contract.
3. Bidder acknowledges that its representations and promises are a material consideration to the Owner with regard to considering Bidder for and possibly awarding the Contract to Bidder.
4. Bidder does hereby promise to indemnify and save harmless the Owner, its officers, agents, servants, and employees from and against any and all suits, actions, legal proceedings, claims, demands, damages, costs, expenses and attorneys’ fees resulting from the breach of any representation, covenant or promise contained in this Certificate.

Intending to be legally bound hereby Bidder does hereby supply this Certificate the _____ day of _____, 20_____.

ATTEST:

(Bidder’s Company Name)

By: _____

Title: _____

Date: _____

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project Name:	Hanover Township Police Department Vehicle Storage Building
General Description:	This project involves the provision of labor and materials to construct an approximately 2,470 square foot x 7 foot 6 inch tall wood frame structure for the purpose of storing Vehicles for the Police Department.
Project Locality	Hanover Township, 11 Municipal
Awarding Agency:	Hanover Township Board of Supervisors
Contract Award Date:	6/20/2026
Serial Number:	26-04713
Project Classification:	Building
Determination Date:	5/12/2026
Assigned Field Office:	Pittsburgh
Field Office Phone Number:	(412)565-5300
Toll Free Phone Number:	(877)504-8354
Project County:	Washington County

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 26-04713 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	8/1/2024		\$43.40	\$29.51	\$72.91
Asbestos & Insulation Workers	8/1/2025		\$45.10	\$30.31	\$75.41
Boilermakers	6/1/2016		\$40.90	\$27.61	\$68.51
Bricklayer	6/1/2025		\$41.50	\$26.09	\$67.59
Bricklayer	12/1/2025		\$42.00	\$26.59	\$68.59
Bricklayer	6/1/2026		\$42.65	\$26.94	\$69.59
Carpenters - Piledriver/Welder	1/1/2025		\$43.38	\$22.72	\$66.10
Carpenters - Piledriver/Welder	1/1/2026		\$44.63	\$23.47	\$68.10
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2024		\$41.49	\$19.93	\$61.42
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2025		\$43.34	\$19.93	\$63.27
Cement Masons	7/1/2024		\$34.57	\$25.09	\$59.66
Cement Masons	6/1/2025		\$35.52	\$25.64	\$61.16
Drywall Finisher	1/1/2025		\$34.01	\$24.63	\$58.64
Drywall Finisher	6/1/2025		\$35.16	\$25.98	\$61.14
Electricians & Telecommunications Installation Technician	12/27/2024		\$50.86	\$32.69	\$83.55
Electricians & Telecommunications Installation Technician	12/26/2025		\$53.11	\$33.72	\$86.83
Elevator Constructor	1/1/2025		\$61.07	\$40.05	\$101.12
Elevator Constructor	1/1/2026		\$63.71	\$40.89	\$104.60
Glazier	9/1/2024		\$37.06	\$31.89	\$68.95
Glazier	9/1/2025		\$38.70	\$33.75	\$72.45
Iron Workers	6/1/2024		\$39.89	\$36.47	\$76.36
Iron Workers	6/1/2025		\$41.50	\$37.36	\$78.86
Laborers (Class 01 - See notes)	1/1/2025		\$27.32	\$19.96	\$47.28
Laborers (Class 01 - See notes)	1/1/2026		\$27.82	\$20.46	\$48.28
Laborers (Class 02 - See notes)	1/1/2025		\$27.47	\$19.96	\$47.43
Laborers (Class 02 - See notes)	1/1/2026		\$27.97	\$20.46	\$48.43
Laborers (Class 03 - See notes)	1/1/2025		\$30.47	\$19.96	\$50.43
Laborers (Class 03 - See notes)	1/1/2026		\$30.97	\$20.46	\$51.43
Landscape Laborer (Skilled)	1/1/2025		\$25.79	\$18.78	\$44.57
Landscape Laborer (Skilled)	1/1/2026		\$26.79	\$19.03	\$45.82
Landscape Laborer (Tractor Operator)	1/1/2025		\$26.09	\$18.78	\$44.87
Landscape Laborer (Tractor Operator)	1/1/2026		\$27.09	\$19.03	\$46.12
Landscape Laborer	1/1/2025		\$25.37	\$18.78	\$44.15
Landscape Laborer	1/1/2026		\$26.37	\$19.03	\$45.40
Millwright	6/1/2020		\$41.68	\$20.32	\$62.00
Operators (Class 01 - see notes)	6/1/2024		\$41.69	\$24.39	\$66.08
Operators (Class 01 - see notes)	6/1/2025		\$42.72	\$24.79	\$67.51
Operators (Class 01 - see notes)	6/1/2026		\$43.74	\$25.29	\$69.03
Operators (Class 02 -see notes)	6/1/2024		\$35.62	\$24.39	\$60.01
Operators (Class 02 -see notes)	6/1/2025		\$36.67	\$24.79	\$61.46
Operators (Class 02 -see notes)	6/1/2026		\$37.67	\$25.29	\$62.96
Operators (Class 03 - See notes)	6/1/2024		\$32.83	\$24.39	\$57.22

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 26-04713 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Class 03 - See notes)	6/1/2025		\$33.88	\$24.79	\$58.67
Operators (Class 03 - See notes)	6/1/2026		\$34.88	\$25.29	\$60.17
Painters Class 6 (see notes)	6/1/2024		\$32.14	\$24.93	\$57.07
Painters Class 6 (see notes)	6/1/2025		\$34.16	\$25.81	\$59.97
Pile Driver Divers (Building, Heavy, Highway)	1/1/2025		\$62.82	\$22.72	\$85.54
Pile Driver Divers (Building, Heavy, Highway)	1/1/2026		\$64.70	\$23.47	\$88.17
Piledrivers	1/1/2025		\$41.88	\$22.72	\$64.60
Piledrivers	1/1/2026		\$43.13	\$23.47	\$66.60
Plasterers	6/1/2024		\$33.14	\$21.04	\$54.18
plumber	6/1/2025		\$54.95	\$25.87	\$80.82
plumber	6/1/2026		\$58.05	\$25.87	\$83.92
plumber	6/1/2027		\$61.15	\$25.87	\$87.02
Plumbers and Steamfitters	6/1/2025		\$41.47	\$27.71	\$69.18
Plumbers and Steamfitters	6/1/2026		\$42.92	\$28.45	\$71.37
Pointers, Caulkers, Cleaners	6/1/2025		\$40.66	\$21.99	\$62.65
Pointers, Caulkers, Cleaners	12/1/2025		\$41.50	\$22.50	\$64.00
Pointers, Caulkers, Cleaners	6/1/2026		\$42.20	\$22.80	\$65.00
Roofers	6/1/2025		\$39.91	\$20.76	\$60.67
Roofers	12/1/2025		\$41.21	\$21.46	\$62.67
Roofers	6/1/2026		\$42.00	\$23.17	\$65.17
Sheet Metal Workers	7/1/2024		\$43.00	\$33.96	\$76.96
Sheet Metal Workers	7/1/2025		\$45.00	\$35.16	\$80.16
Sign Makers and Hangars	7/15/2024		\$32.32	\$25.82	\$58.14
Sign Makers and Hangars	7/15/2025		\$33.48	\$26.41	\$59.89
Sprinklerfitters	4/1/2024		\$46.45	\$28.62	\$75.07
Sprinklerfitters	4/1/2025		\$49.75	\$29.21	\$78.96
Sprinklerfitters	4/1/2026		\$52.82	\$30.56	\$83.38
Steamfitters	6/1/2024		\$48.15	\$29.57	\$77.72
Steamfitters	6/1/2025		\$50.20	\$31.02	\$81.22
Stone Masons	6/1/2025		\$43.60	\$24.72	\$68.32
Stone Masons	12/1/2025		\$44.10	\$25.22	\$69.32
Stone Masons	6/1/2026		\$44.70	\$25.62	\$70.32
Terrazzo Finisher	6/1/2025		\$41.73	\$19.03	\$60.76
Terrazzo Finisher	12/1/2025		\$42.75	\$19.51	\$62.26
Terrazzo Finisher	6/1/2026		\$43.82	\$19.94	\$63.76
Terrazzo Mechanics	6/1/2025		\$41.13	\$21.28	\$62.41
Terrazzo Mechanics	12/1/2025		\$42.15	\$21.76	\$63.91
Terrazzo Mechanics	6/1/2026		\$43.22	\$22.19	\$65.41
Tile Finisher	6/1/2025		\$33.24	\$18.36	\$51.60
Tile Finisher	12/1/2025		\$33.99	\$18.71	\$52.70
Tile Finisher	6/1/2026		\$34.82	\$18.98	\$53.80
Tile Setter	6/1/2025		\$40.15	\$22.80	\$62.95
Tile Setter	12/1/2025		\$40.80	\$23.25	\$64.05
Tile Setter	6/1/2026		\$41.66	\$23.49	\$65.15

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 26-04713 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Truckdriver class 1(see notes)	1/1/2025		\$36.43	\$23.21	\$59.64
Truckdriver class 1(see notes)	1/1/2026		\$37.93	\$23.71	\$61.64
Truckdriver class 2 (see notes)	1/1/2025		\$36.89	\$23.52	\$60.41
Truckdriver class 2 (see notes)	1/1/2026		\$38.39	\$24.02	\$62.41
Window Film / Tint Installer	10/1/2019		\$25.00	\$2.63	\$27.63

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 26-04713 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter	1/1/2025		\$41.35	\$22.09	\$63.44
Carpenter	1/1/2026		\$42.60	\$22.84	\$65.44
Carpenter Welder	1/1/2025		\$42.85	\$22.09	\$64.94
Carpenter Welder	1/1/2026		\$44.10	\$22.84	\$66.94
Carpenters - Piledriver/Welder	1/1/2025		\$43.38	\$22.72	\$66.10
Carpenters - Piledriver/Welder	1/1/2026		\$44.63	\$23.47	\$68.10
Cement Finishers	1/1/2024		\$35.14	\$26.30	\$61.44
Cement Finishers	1/1/2025		\$35.94	\$27.50	\$63.44
Cement Masons	1/1/2020		\$32.84	\$21.10	\$53.94
Electric Lineman	6/2/2025		\$57.10	\$31.63	\$88.73
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2024		\$39.89	\$36.47	\$76.36
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2025		\$41.50	\$37.36	\$78.86
Laborers (Class 01 - See notes)	1/1/2025		\$33.70	\$26.00	\$59.70
Laborers (Class 01 - See notes)	1/1/2026		\$34.70	\$27.00	\$61.70
Laborers (Class 02 - See notes)	1/1/2025		\$33.86	\$26.00	\$59.86
Laborers (Class 02 - See notes)	1/1/2026		\$34.86	\$27.00	\$61.86
Laborers (Class 03 - See notes)	1/1/2025		\$34.25	\$26.00	\$60.25
Laborers (Class 03 - See notes)	1/1/2026		\$35.25	\$27.00	\$62.25
Laborers (Class 04 - See notes)	1/1/2025		\$34.70	\$26.00	\$60.70
Laborers (Class 04 - See notes)	1/1/2026		\$35.70	\$27.00	\$62.70
Laborers (Class 05 - See notes)	1/1/2025		\$35.11	\$26.00	\$61.11
Laborers (Class 05 - See notes)	1/1/2026		\$36.11	\$27.00	\$63.11
Laborers (Class 06 - See notes)	1/1/2025		\$31.95	\$26.00	\$57.95
Laborers (Class 06 - See notes)	1/1/2026		\$32.95	\$27.00	\$59.95
Laborers (Class 07 - See notes)	1/1/2025		\$34.70	\$26.00	\$60.70
Laborers (Class 07 - See notes)	1/1/2026		\$35.70	\$27.00	\$62.70
Laborers (Class 08 - See notes)	1/1/2025		\$36.20	\$26.00	\$62.20
Laborers (Class 08 - See notes)	1/1/2026		\$37.20	\$27.00	\$64.20
Millwright	6/1/2024		\$47.59	\$23.72	\$71.31
Millwright	6/1/2025		\$49.72	\$23.72	\$73.44
Operators (Class 01 - see notes)	1/1/2024		\$38.59	\$24.03	\$62.62
Operators (Class 01 - see notes)	1/1/2025		\$40.39	\$24.23	\$64.62
Operators (Class 01 - see notes)	1/1/2026		\$41.96	\$24.66	\$66.62
Operators (Class 02 -see notes)	1/1/2024		\$38.33	\$24.03	\$62.36
Operators (Class 02 -see notes)	1/1/2025		\$40.13	\$24.23	\$64.36
Operators (Class 02 -see notes)	1/1/2026		\$41.70	\$24.66	\$66.36
Operators (Class 03 - See notes)	1/1/2024		\$34.68	\$24.03	\$58.71
Operators (Class 03 - See notes)	1/1/2025		\$36.48	\$24.23	\$60.71
Operators (Class 03 - See notes)	1/1/2026		\$38.05	\$24.66	\$62.71
Operators (Class 04 - See notes)	1/1/2024		\$34.22	\$24.03	\$58.25
Operators (Class 04 - See notes)	1/1/2025		\$36.02	\$24.23	\$60.25
Operators (Class 04 - See notes)	1/1/2026		\$37.59	\$24.66	\$62.25
Operators (Class 05 - See notes)	1/1/2024		\$33.97	\$24.03	\$58.00

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 26-04713 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Class 05 - See notes)	1/1/2025		\$35.77	\$24.23	\$60.00
Operators (Class 05 - See notes)	1/1/2026		\$37.34	\$24.66	\$62.00
Operators Class 1-A	1/1/2024		\$41.59	\$24.03	\$65.62
Operators Class 1-A	1/1/2025		\$43.39	\$24.23	\$67.62
Operators Class 1-A	1/1/2026		\$44.96	\$24.66	\$69.62
Operators Class 1-B	1/1/2024		\$40.59	\$24.03	\$64.62
Operators Class 1-B	1/1/2025		\$42.39	\$24.23	\$66.62
Operators Class 1-B	1/1/2026		\$43.96	\$24.66	\$68.62
Painters Class 1 (see notes)	6/1/2022		\$34.45	\$22.82	\$57.27
Painters Class 2 (see notes)	6/1/2024		\$38.09	\$24.93	\$63.02
Painters Class 2 (see notes)	6/1/2025		\$40.36	\$25.81	\$66.17
Painters Class 3 (see notes)	6/1/2024		\$40.66	\$24.93	\$65.59
Painters Class 3 (see notes)	6/1/2025		\$43.68	\$25.81	\$69.49
Painters Class 4 (see notes)	6/1/2019		\$28.20	\$20.06	\$48.26
Painters Class 5 (see notes)	6/1/2019		\$22.91	\$20.06	\$42.97
Pile Driver Divers (Building, Heavy, Highway)	1/1/2025		\$62.82	\$22.72	\$85.54
Pile Driver Divers (Building, Heavy, Highway)	1/1/2026		\$64.70	\$23.47	\$88.17
Piledrivers	1/1/2025		\$41.88	\$22.72	\$64.60
Piledrivers	1/1/2026		\$43.13	\$23.47	\$66.60
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2022		\$48.43	\$40.28	\$88.71
Truckdriver class 1(see notes)	1/1/2025		\$36.43	\$23.21	\$59.64
Truckdriver class 1(see notes)	1/1/2026		\$37.93	\$23.71	\$61.64
Truckdriver class 2 (see notes)	1/1/2025		\$36.89	\$23.52	\$60.41
Truckdriver class 2 (see notes)	1/1/2026		\$38.39	\$24.02	\$62.41

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EXTERIOR LIGHTING.....16500-1 to 16500-6
INTERIOR LIGHTING.....16510 - 1 to 16510-12

SECTION 01001

SPECIAL PROVISIONS

PART 1 - GENERAL

1.1 Section Includes:

- A. Special Provisions related to the Technical Specifications.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 Scope of Work.

- A. The Contractor shall furnish all labor, materials, equipment, machinery, apparatus and tools, and perform all operations necessary to install, equip and put into satisfactory operation, the work specified herein and shown on the Drawings.

All work shall be done in accordance with applicable portions of the Specifications. Any labor, materials, equipment, or apparatus not specifically mentioned herein or shown on the Drawings, which may be necessary for the proper completion of the entire work or of the individual items thereof, within the intent of these Specifications and Drawings, shall be furnished by the Contractor without additional compensation.

3.2 Specifications Incorporated By Reference.

Per contract document or as noted

3.3 Standard Drawings Incorporated By Reference.

Standard Drawings are incorporated by reference into these Technical Specifications.

3.4 Local Roads.

- A. The Contractor shall cooperate with municipal officials in maintaining safe and passable conditions on all roads, streets, and alleys affected by the work. Detours may be established only with written approval of officials having jurisdiction. A copy of such approval must be submitted to the Engineer and approved by him before becoming effective. Nothing in this section shall operate to release the Contractor from his responsibilities under his Surety Bond.

3.5 Existing Utilities.

- A. The Contractor is cautioned of the existence in the project area of underground utility lines. Every reasonable effort has been made to show the existence and location of the known utility lines in the general area of project construction. However, this information cannot be guaranteed as being accurate.

The depth and size of all existing utilities in the project area shall be verified in the field by the Contractor with a representative from the appropriate utility company. The Contractor shall be responsible for notifying all utility companies at least seventy-two (72) hours before any work commences on this project.

Pennsylvania One-Call
1-800-242-1776

3.6 Special Requirements

A. Excess Material

It is the Contractor's responsibility to obtain an approved site, and to haul and place the excess material on the approved site. The Contractor must obtain the required approvals from the DEP, and must obtain a signed agreement from the property owner. The removal and disposal of the excess material shall be done at no additional cost to the County. All liabilities associated with the disposal of the excess material shall be borne by the Contractor. Any disposal material generated during the project must be disposed of at a properly permitted, commercially available disposal facility or a NFS acquired site, provided the site and disposal complies with all applicable. Federal, State and Local environmental laws or a disposal site may be acquired to dispose of materials.

B. Time of Work

Work is only to be performed on a 40 hour work week, Monday through Friday. The workday will not start before 7am and will end no later than dusk. The Contractor will be charged for the inspection fees if he desires to work anything over 40 hours per week, including holiday time. Work shall not be permitted on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, the Day after Thanksgiving, or Christmas Day. If one of the previously mentioned holidays fall on Saturday, the Contractor shall not work on the Friday before the holiday, and if the holiday falls on a Sunday, the Contractors shall not work on the Monday after the holiday.

PART 4 - BASIS OF PAYMENT

4.1 Special Provisions – Incidental. No additional compensation.

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART I

GENERAL

1.01 Section Includes

- A. Quality assurance.
- B. Schedules of references.

1.02 Quality Assurance

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Contract Documents.
- C. Obtain copies of standards when required by Contract Documents.
- D. Should specified reference standards conflict with Contract Documents, request clarification from the Engineer before proceeding.
- E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 References

- AA Aluminum Association
818 Connecticut Avenue, N.W.
Washington, DC 20006
- 1000 Vermont Avenue, N.W.
Washington, DC 20005
- AASHTO American Association of State

REFERENCE STANDARDS

Highway and Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001

- ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219
- ADC Air Diffusion Council
230 North Michigan Avenue
Chicago, IL 60601
- AIA American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006
- AISC American Institute of Steel Construction
400 North Michigan Avenue
Eighth Floor
Chicago, IL 60611
- AISI American Iron and Steel Institute
1000 16th Street, N.W.
Washington, DC 20036
- AMCA Air Movement and Control Association
30 West University Drive
Arlington Heights, IL 60004
- ANSI American National Standards Institute
1430 Broadway
New York, NY 10018
- APA American Plywood Association
Box 11700
Tacoma, WA 98411
- ARI Air-Conditioning and Refrigeration Institute
1815 North Fort Myer Drive
Arlington, VA 22209

REFERENCE STANDARDS

ASHRAE American Society of Heating, Refrigerating
and Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329

ASME American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

AWI Architectural Woodwork Institute
2310 South Walter Reed Drive
Arlington, VA 22206

AWPA American Wood-Preservers' Association
7735 Old Georgetown Road
Bethesda, MD 20014

AWS American Welding Society
550 LeJeune Road
Miami, FL 33135

CRSI Concrete Reinforcing Steel Institute
933 Plum Grove Road
Schaumburg, IL 60195

EJMA Expansion Joint Manufacturers Association
707 Westchester Avenue
White Plains, NY 10604

FGMA Flat Glass Marketing Association
3310 Harrison
White Lakes Professional Building
Topeka, KS 66611

REFERENCE STANDARDS

FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201
IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street
IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 815 15th Street, N.W. Washington, DC 20005
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NEMA	National Electrical Manufacturers' Association 2101 L Street, N.W. Washington, DC 20037
NFPA	National Fire Protection Association

REFERENCE STANDARDS

1619 Massachusetts Avenue, N.W.
Washington, DC 20036

PennDOT Commonwealth of Pennsylvania
Department of Transportation

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

PS Product Standard
U.S. Department of Commerce
Washington, DC 20203

SDI Steel Deck Institute
Box 3812
St. Louis, MO 63122

SDI Steel Door Institute
712 Lakewood Center North
Cleveland, OH 44107

SMACNA Sheet Metal and Air Conditioning Contractors'
8224 Old Court House Road
Vienna, VA 22180

SSPC Steel Structures Paint Council
4400 Fifth Avenue
Pittsburgh, PA 15213

TAS Technical Aid Series
Construction Specifications Institute
601 North Madison Street
Alexandria, VA 22314

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

WCLIB West Coast Lumber Inspection Bureau
Box 23145
Portland, OR 97223

REFERENCE STANDARDS

PART 2	PRODUCTS
	Not Used
PART 3	EXECUTION
	Not Used
PART 4	BASIS OF PAYMENT
	Not Used

END OF SECTION

REFERENCE STANDARDS

SECTION 01150

MEASUREMENT AND PAYMENT - FOR LUMP SUM CONTRACTS

PART 1 - GENERAL

1.01 SCOPE

- A. This Section defines procedures for calculation, measurement and payment for additional or deleted work on the basis of unit prices either included in the bidder's Form of Proposal or otherwise determined in accordance with procedures set forth in the Contract Documents.

1.02 UNIT PRICES

A. Unit price requirements:

1. The Contractor, prior to execution of the Contract Agreement, shall submit a listing of unit prices for lump sum contracts, which unit prices shall be used as a basis of payment and also applied to changes in the scope of the work to arrive at the cost of added or deducted work. Appropriate adjustment in the Contract amount will be arrived at by multiplying the measured quantity of work by the agreed upon unit price. The net difference of like work items on a given change order shall apply.

B. Unit price rejection:

1. On a lump sum bid, if the Engineer perceives any of the unit prices offered by the Contractor to be unbalanced or unreasonable, he may reject such unit prices. should the scope of work be changed with regard to items so rejected, and a revised unit price be not accepted by all parties, the work shall be performed on the basis of another method of payment as provided in the General Conditions.

C. Change in scope of work:

1. Work based on a specific change in scope of work front that included in the Contract Documents shall be executed by the Contractor until complete in every respect. It shall include not only labor, materials, tools, and equipment, but also the following without limitation: preparatory work; supervision; layout; insurance; bonds; clean-up; overhead; profit; and all other items as may be necessary for completing the work as shown on the Drawings and/or specified or required by Contract Documents.
2. Measurement and payment for the foregoing items, if unit prices are acceptable, shall be made on the basis of the quantities added and/or deducted and the units specified in the Proposal Form and in accordance with Paragraph 1.03 of this Section.

1.03 MEASUREMENT AND PAYMENT

A. General:

1. This paragraph sets forth the methods to be used for measurement of and payment for work performed in addition to or deducted from the scope of work of this Project, as more fully described in the Contract Documents.
2. All additional work performed on the basis of the various unit prices shall be furnished and installed to conform to these Specifications to the extent that they relate to and address like items of work.
3. All work shall, at the discretion of the Engineer, be measured in place or be estimated from drawings and shall be described in terms of the units noted on the Proposal Form. A complete record of the work item shall be kept and, if it is a continuing item, daily progress of the work must be specifically noted in the job diary in terms of the applicable units.
4. The payment for, or Contract adjustment for, all unit price items will be calculated as the agreed total quantity of added or deducted work multiplied by the Contractor's unit price(s). In determining the total quantity, only the net difference of like items shall be used.

1.04 PROGRESS PAYMENTS

A. Certain items of equipment furnished for this Project are recognized, in their respective Sections, as having significant value in the work and as being specifically manufactured for this project. For these items only, the Contractor furnishing the item shall be entitled to progress payments in accordance with the following schedule:

1. Upon delivery and unloading of the item at the job site or protected storage area of the Contractor, the invoice price (less retainage) shall be paid provided the Contractor furnishes Certificates of Insurance and Title to the Owner for the delivered items and adequately insures and protects same.
2. Ninety-five percent (95%) of the Contractor's quoted installed price to the Owner for the particular item, reduced by any previous payments made under Items 1 above, shall be due to the Contractor furnishing the item, upon completion of installation and successful start-up services.
3. The balance of the Contractor's quoted installed price to the Owner for the particular item shall become due upon the Contractor furnishing the item; upon satisfactory demonstration of compliance with the performance requirements of these specifications; and upon furnishing to the Owner with all required documentation, reports, approvals, certificates, bonds, extended guarantees, warranties and other items as may be specifically required herein.

B. For payment for Items 1 above, the Contractor shall furnish proof of the claimed pricing in the form of manufacturer's invoices, written confirmations from the Manufacturer, and such

other documentation as may be required by the Engineer to satisfactorily prove the amount of the claimed pricing.

- C. Retainage shall be withheld from each monthly payment request in accordance with the percentages set forth within the General Conditions Item 15.01B which are part of these Contract Documents.

PART 4 – BASIS OF PAYMENT

4.01 Measurement and Payment - Incidental. No additional compensation.

END OF SECTION

SECTION 01300

SUBMITTALS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included:

1. To assure that the products furnished and methods of construction/ installation provided under the various Contracts of this Project are in conformance with the intent of the Drawings and these Specifications, each Contractor shall submit sufficient testing data; Manufacturer's data and pertinent information; certifications; installation drawings and instructions; shop drawings; samples; and/or requests for substitutions as required by and in strict conformance with the provisions of this Section.
2. The General Contractor is responsible for all scheduling for all trades. He shall not allow or direct materials of any trade to be installed prematurely or when it is obvious that such materials may be damaged by subsequent work of other trades. In case of disputes as to timeliness of any installation, the Engineer shall make the determination including any protective measures required.

B. Related Work described elsewhere:

1. It is the intent of this Section to establish minimum standards of procedure for submittals and/or substitutions regarding all products, materials and/or methods furnished or provided under the various Contracts of this Project. Therefore, the provisions of this Section shall apply equally to all other Sections of these Specifications and shall be deemed a part of all other Sections as if reproduced entirely within each Section whether or not this Section is specifically referred to therein. In certain instances, particular other Sections may specify standards of procedure covering submittals and/or substitutions, which parallel those of this Section. This duplication is not meant to impart a greater or lesser degree of importance to any of the parties involved in this Project or to provide further clarification of specific additional information required. In the event that any conflict exists between any standards of procedure established in this Section and those of any other Section, the stricter requirement shall govern.
2. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by Manufacturer's name and catalog number or by reference to recognized industry standards.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS AND SPECIFICATIONS

A. Equipment plans and specifications:

1. Prior to the fabrication of equipment to be furnished under these Contracts, the Contractors shall submit to the Engineer for approval the Manufacturer's detailed specifications and drawings covering the equipment proposed. The specifications and drawings shall show the materials and details of construction of the equipment, illustrations, scale details, sizes, dimensions, capacities, and layout in sufficient detail to indicate its relative location and/or incorporation with adjacent concrete or other facilities.
2. Such drawings shall show the principal dimensions, weight, structural and operating features, performance characteristics, control and wiring diagrams, space required, clearances, type and/or brand of finish or shop coat, grease fittings and other such items depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified in writing by the Manufacturer as correct for this Project.
3. When so specified or if considered by the Engineer to be acceptable, Manufacturer's specifications, catalog data, descriptive matter, illustrations and other products may be submitted for approval in place of shop and working drawings. In such case the requirements shall be as specified for shop and working drawings, insofar as applicable.

B. Type of prints required:

Unless otherwise specifically directed by the Engineer, all shop drawing prints shall be rendered in blue or black line on white background.

C. Number of prints required:

The Contractors shall submit three (3) copies plus the number of copies to be returned of all shop drawings, specifications, and other items submitted under this Section.

2.2 SAMPLES

A. Accuracy of sample:

Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished and shall show the maximum variations in color, texture and/or permissible defects.

B. Number of samples required:

The Contractor shall submit all samples in the quantity which is required to be returned plus one which will be retained by the Engineer. All samples shall be identified by an appropriate tag or label listing the name of the Project; the Owner's name; the Engineer and the Contractor as well as the exact identification of the sample. Tags or labels shall be large enough to provide a blank space for approval stamps.

2.3 COLORS AND PATTERNS

A. General:

Unless the precise color and pattern is specifically described in the Contract Documents and whenever a choice of color or pattern is available in a specified product, the Contractor shall submit accurate color charts and pattern charts to the Engineer for his review and selection of color and/or pattern.

B. Comparative analyses:

Unless all available colors and patterns have identical costs and identical wearing capabilities and are identically suited for the installation, the Contractor shall provide the relative costs and capabilities of each.

2.4 APPROVED EQUAL MATERIALS AND PRODUCTS

A. Engineer's approval required:

1. The various materials and products specified in the Contract Documents by name and description are provided to establish a standard of quality. It is not the intent to limit the acceptance to any one material or product specified, but rather to name or describe a material or product as a minimum standard that is desired and acceptable. Where proprietary names are used, whether or not followed by the words "or approved equal", "equal to", or "or equal" equal materials and products may be approved by the Engineer provided that the alternate meets the approved minimum.

B. Availability of specified items:

1. The Contractor shall verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work.

2. In the event specified items will not be available, the Contractor shall so notify the Engineer prior to the opening of bids.

3. Costs of delays because of non-availability of specified items, when the Engineer determines that such delays could have been avoided by the Contractor, will be charged to the Contractor as necessary and shall not be

borne by the Owner. When such delays could not have been avoided by the Contractor, an appropriate extension of Contract Time will be granted to the Contractor. There shall be no additional costs charged to the Owner by the Contractors for such time extensions.

2.6 OPERATION AND MAINTENANCE INSTRUCTIONS AND MANUALS

The various Sections of these Specifications require submittal of three (3) or more copies of various installation, operation and maintenance instructions and other data relative to the equipment and other items requiring any degree of operation and/or maintenance.

PART 3 - EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

The Contractor shall completely identify each submittal and resubmittal by showing at least the following information:

- A. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.
- B. Name of Project as it appears on these Specifications and the Contract Name and Number to which the submittal applies.
- C. Drawing number and Specifications Section number to which the submittal applies.
- D. Whether this is an original submittal or a resubmittal.

3.2 COORDINATION OF SUBMITTALS

A. General:

Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:

- 1. Determine and verify all field dimensions and conditions, materials, catalog numbers, and similar data.
- 2. Coordinate as required with all trades and with all public agencies involved.
- 3. Secure all necessary approvals from public agencies and others and signify by stamp or other means that they have been secured.
- 4. Clearly indicate all deviations from the Contract Documents.
- 5. Submittals shall be marked with the date, the checker's name and stamped "Approved for Submittal," or bear some other indication of the Contractor's approval. Submittals not marked in this manner will be returned for correction without action by the Engineer.

B. Grouping of Submittals:

Unless otherwise specifically permitted by the Engineer, the Contractor shall make all submittals in groups containing all associated items. The Engineer may reject partial submittals as not complying with the provisions of the Contract Documents.

3.3 TIMING OF SUBMITTALS

A. General:

1. The Contractor shall make all submittals far enough in advance of scheduled dates of installation to provide all required time for reviews, for securing all necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
2. No material shall be purchased or fabricated especially for this Project until the required shop and working drawings have been submitted and approved by the Engineer as conforming to the Contract requirements. All materials and Work involved in the construction shall then be as represented by said drawings.
3. The Engineer's approval of shop and working drawings will follow a general check made to ascertain conformance with the design concept and functional result desired of the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the Work of all trades.
4. The Engineer's review will be made as soon as practical following receipt of each submittal. In scheduling, at least ten (10) full working days shall be allowed for the Engineer's review following his receipt of each submittal.

B. Delays:

Costs of delays occasioned by tardiness of submittals may be backcharged as necessary and shall not be borne by the Owner.

3.4 CERTIFICATIONS AND TESTS

Certifications and reports of tests, when required under the various sections of these Specifications, shall be submitted in the same quantities as specified for shop drawings in 2.2-C above.

PART 4 – BASIS OF PAYMENT

- 4.1 Submittals and Substitutions – Incidental. No separate payment will be made for Submittals and Substitutions.

END OF SECTION

SUBMITTALS AND SUBSTITUTIONS

SECTION 01500

MOBILIZATION

PART 1 GENERAL

1.1 Section Includes

- A. Mobilization.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 This work is the assembly and set-up to comply with the contract and with local and state laws and regulations. Includes contractor's offices, shops, plants, storage areas, and sanitary or other facilities, if required. The work includes obtaining the required permits, insurance, bonds, and any other initial items required for the start of the work.

3.2 Provide adequate material and furnishings required. These material and furnishings will not be considered a part of the other completed contract items.

PART 4 - BASIS OF PAYMENT

- 4.1 Special Provisions – Incidental. No additional compensation

END OF SECTION

SECTION 01505

CONSTRUCTION STAKE-OUT

- PART 1 GENERAL
- 1.01 Section Includes
- A. Construction Stake-Out
- 1.02 Submittals
- A. Submit proof of professional registration of the Professional Engineer or Registered Surveyor employed or subcontracted to perform construction stake-out services.
- B. Submit one copy of all field notes to the Engineer.
- PART 2 PRODUCTS
- Not Used.
- PART 3 EXECUTION
- 3.01 Using generally-accepted surveying methods, stake-out all horizontal and vertical elements as required by the Plans and prepare grade sheets as required.
- PART 4 BASIS OF PAYMENT
- 4.01 Construction Stake-Out - Incidental

END OF SECTION

CONSTRUCTION STAKE-OUT

SECTION 01700

CONTRACT CLOSE-OUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section describes the general requirements and documents necessary to complete the Project and/or to effect Contract Close-Out for each prime Contractor performing Work on this Project.
- B. The requirements specified herein are general and are provided solely for the convenience of the Contractors to serve as a basic reference check-list of the minimum requirements for Project completion and Contract Close-Out. This Section is not intended to eliminate or supersede other requirements which may be specified in the various and several other Sections of these Specifications nor to waive any of the specific requirements set forth therein. All such requirements shall be compiled with and all documents must be submitted as specified prior to Project completion and Contract Close-Out.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

- A. In addition to the prints furnished for construction and for public bodies, each Contractor will be furnished, without charge, one set of Blue Prints for record purposes.
- B. These prints shall be marked "Record Set" and shall be maintained at the Project Site. Each Contractor shall record on these prints all deviations from the Contract Drawings, at the time that such deviation is made. All changes made in process, sewer and water lines; equipment; utilities; partitions; doors; or in arrangements or construction of the Project, as well as a complete record of the exact manner in which mechanical and electrical work items are installed, shall be recorded on these prints. Dimensions shall be included where necessary to accurately locate piping and other items which will be concealed in the finished work and which may later be necessary to locate for service, including underground piping and electrical facilities.

PART 3 - EXECUTION

3.01 FINAL CLEAN-UP

In addition to the various requirements of the General Conditions and Division 1 of these Specifications and the requirements for special cleaning in the various trade sections of these Specifications, the General Contractor shall perform final cleaning as follows:

- A. Sweep and, if necessary, wash and buff resilient floors and bases.

- B. Dust and, if necessary, wash all plumbing and electrical fixtures and remove all tags and stickers except those giving operating instructions or safety precautions.
- C. Clean all surfaces.
- D. Clean, polish and wax, as required, all finished products that are not specified to be cleaned, etc., under the various trade sections of these Specifications.
- E. Remove smears and paint and wash all glass.
- F. Final cleaning shall be performed after the work of all trades is completed and immediately before turning the Work over to the Owner.
- G. Cleaning materials shall be free from harmful abrasives and shall be acceptable to the manufacturers of the materials, equipment and/or surfaces on which they are used.

3.02 CLOSE-OUT DOCUMENTS

- A. Before approval of the final payment and issuance of the certificate of completion, each Contractor shall be required to submit to the Engineer the following documents, completed and executed in every detail as required:
 - 1. The "Record Set" of prints.
 - 2. Statement of Surety Company.
 - 3. Contractor's Release.
 - 4. Contractor's Affidavit.
 - 5. Maintenance Bond.
 - 6. Other bonds and warranties as specified in the various Sections of these Specifications.
 - 7. Certificates of Approval from all governing approval agencies if required (Plumbing, Building, Electrical, Pressure Vessel, Underwriters, etc.).
 - 8. Spare parts and tools.
 - 9. Such additional items as may be required in the various Sections of these Specifications.

PART 4 – BASIS OF PAYMENT

- 4.01 Contract Close-Out – Incidental. No additional compensation.

END OF SECTION

SECTION 02100

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 Section Includes

- A. Clearing and grubbing.

PART 2 PRODUCTS

Not Included

PART 3 EXECUTION

3.01 Clearing and grubbing

- A. The Contractor shall not proceed with clearing and grubbing prior to the Engineer's review of the construction stake-out.
- B. Clearing and grubbing shall consist of the removal of all trees, brush and other vegetation, old structures, fences, walls, guiderail posts, guiderail, signs, direction markers, sidewalks, curbs and pavement from site of the work, which will be required to be removed so that the planned construction may be made. The Contractor shall dispose of all such material. All live trees shall be protected and not removed unless permitted or ordered by the Engineer. The method of clearing, including the use of bulldozers, shall be at the option of the Contractor. However, he will not be permitted to cover up brush and similar debris with earth. All work under this heading shall be done sufficiently ahead of topsoil removal and excavation so as not to interfere with those operations. The Contractor shall remove stumps and large roots and refill the depression with suitable compacted earth fill where necessary to bring the grade back to its original elevation or final grade.
- C. All brush, stumps, roots, etc., cleared or grubbed from the site shall be burned or otherwise disposed of in a manner satisfactory to the Engineer. Burning if permitted by the Engineer, shall be conducted under guard at all times, and each Contractor shall exercise every possible precaution to prevent fires from getting out of hand and destroying adjacent property, or from causing unnecessary smoke

CLEARING AND GRUBBING

nuisance and/or hazards. Burning will not be permitted where local ordinances or State or Federal laws prohibit same. When in the opinion of the Engineer, weather is not conducive to non-nuisance or non-hazardous burning, burning operations shall be suspended at his discretion until conditions are satisfactorily improved. Regardless of whether the Engineer has or has not suspended such operations, any and all damages resulting from burning shall be the Contractor's responsibility.

- D. The Contractor shall remove all salvageable surface items, over the area to be excavated; and he shall properly separate, classify, store, protect and preserve such materials and items for use in backfilling, resurfacing, replanting or otherwise replacing the area of construction to its original condition prior to construction, except as may hereinafter be noted.
- E. For all cultivated, landscaped areas, all shrubbery, hedges and small trees in the area of construction shall be carefully removed, stored, and preserved for reuse upon completion of construction, unless otherwise authorized by the Engineer. Large trees which cannot be safely transplanted or reasonable replaced shall be left standing unless permission is specifically granted by the Engineer to remove the tree. Where trees are to be permanently removed, the Contractor shall be responsible for the complete removal of the tree.
- F. For all cultivated, landscaped areas, the lawn sod shall be cut and removed for the width of expected excavation within the right-of-way. The topsoil in these areas of excavation shall be stripped off to a depth of at least eight (8) inches and replaced upon completion of backfilling. All grass areas not to be excavated shall be protected from permanent damage.
- G. All fencing, mailboxes, drainage pipes, doghouses, clothespost, steps, ornamental lawn fixtures and the like which may be in the way of construction shall be carefully removed and placed temporarily in a place convenient to the property owner until construction is completed and then replaced in their original condition and location.
- H. All property corners in the line of work shall be properly referenced before excavation begins. As soon as the backfilling and compaction operations have been completed, the property corners shall be replaced in the exact position of the original corner, utilizing an equal or better marker than the original.

CLEARING AND GRUBBING

PART 4

BASIS OF PAYMENT

4.01

Clearing and Grubbing - Incidental

END OF SECTION

CLEARING AND GRUBBING

02100-3

SECTION 02200

EXCAVATION, BACKFILLING AND GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included:

Excavating, backfilling and grading required for this Work includes, but is not necessarily limited to: excavating, filling and backfilling for structures, footings, foundations, slabs, utilities, drainage, etc.; trenching and trench backfilling; rough and finish grading of the site; restoration of disturbed surfaces; dewatering; furnishing and installing all required shoring, sheeting and bracing; furnishing and installing granular cushion or fill under all interior and exterior concrete slabs; furnishing of sub-base and base courses for paving; furnishing and installing rip-rap; and such other Work as shown on the Drawings, as required by these Specifications, or as may be reasonably inferred there from.

B. Classification:

The Contractor shall make a personal examination of the sites in which the improvements are to be installed and determine for himself the extent and character of any Work that may be required. All excavation shall be unclassified and no additional payment shall be made for hand excavation or for removal of rock, shale, masonry or other materials encountered in this Project.

C. Underground utilities:

1. Attention is directed to the fact that there may be underground utilities located in the vicinity of the Work. Some of these have been indicated on the Drawings; however, the completeness and accuracy of the information presented therein or elsewhere in these Specifications is not guaranteed.
2. The Contract shall comply with Pennsylvania Act 287-1974 which requires the Contractor to notify all utilities serving the site three (3) days before starting to excavate. The utilities, in turn, are required to respond within two (2) days of receipt of notification and give the location of their lines.

D. O.S.H.A.:

The Contractor shall perform his Work so as to comply fully with the regulations of O.S.H.A. (Occupational Safety and Health Administration) of the U.S. Department of Labor, latest revision.

1.02 QUALITY CONTROL

- A. Testing and inspection of fill materials and compaction Work shall be performed in accordance with the provisions of these Specifications.
- B. Test results shall be submitted to the Engineer in accordance with the provisions of Section 01300 of these Specifications.

1.03 JOB CONDITIONS

- A. Dust control:
 - 1. The Contractor shall use all means necessary to control dust on or near the Work and on or near all off-site borrow areas, if such dust is caused by the Contractor's operations during performance of the Work or if results from the condition in which the Contractor leaves the site.
 - 2. The Contractor shall thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other Work on the site.
- B. Protection:
 - 1. The Contractor shall use all means necessary to protect all materials of this Section before, during, and after installation and to protect all objects designated to remain.
 - 2. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 FILL MATERIAL, GENERAL

- A. All fill material shall be in accordance with these Specifications and subject to approval of the Engineer.
- B. For approval or imported fill material, the Contractor shall notify the Engineer at least four (4) working days in advance of his intention to import material; designate the proposed borrow area; and shall have the approved testing laboratory analyze samples as necessary from the borrow area and make sufficient acceptance tests to prove the quality of the material.

2.02 FILL MATERIAL

- A. In general, unless other material is indicated on the Drawings or required by these Specifications, material from the excavation may be used for backfilling trenches and around structures provided that it meets the applicable requirements set forth herein. Materials needed in addition to that available from construction operations

shall be obtained from approved borrow pits or deposits at no additional cost to the Owner.

- B. All backfill material shall be generally well-graded from fine to coarse and free from large clods; roots; cinders; vegetation; ashes; refuse; boulders, large rock, shale pieces or lumps larger than 6 inches in any dimension with no more than 15 percent of the rocks or lumps larger than 2-1/2 inch in any dimension; organic material or any other deleterious substances. Backfill material shall not be frozen or excessively wet so as to impair proper field compaction. All backfill material shall be of such nature that, after it has been placed and compacted, it will make a dense, stable fill.
- C. Where layers of crushed stone, screened gravel or sand are called for on the Drawings or required by these Specifications for granular cushion beneath certain structures, slabs pipes or other facilities, material conforming to the following particle size gradation shall be provided.

Percent Passing by Weight

<u>Square Mesh Sieve Size</u>	<u>Crushed Stone or Screened Gravel</u>	<u>Sand</u>
1-1/2 inch	100	100
1 inch	90-100	100
3/4 inch	---	100
1/2 inch	25-60	100
Number 4	0-15	95-100
Number 8	0-5	80-100
Number 16	1	50-85
Number 30	---	25-60
Number 50	---	10-30
Number 100	---	2-10
Number 200	---	0-5

- D. Other types of fill materials will be considered by the Engineer for use on a case-by-case basis provided that the Contractor submits sufficient evidence as to the suitability and acceptability of the particular materials for the intended application.
- E. Suitable or selected fill materials shall be kept separated from unsuitable materials and shall not be permitted to be contaminated therewith. Contaminated materials shall not be used for trench or structural backfill and shall be removed from the site or used for site grading as required herein.
- F. Imported fill materials shall conform to Paragraph 2.02 (B) above and, in addition, shall be predominantly granular with max. particle size of two inches and a plasticity index of 12 or less. Imported cohesionless materials shall conform generally to the gradation requirements listed above for sand.

- G. All fill material placed within 3 feet of the base of buildings, footings and/or slabs shall conform to Paragraph 2.02 (F) above and, shall have a plasticity index of 15 or less.

2.03 RIP-RAP

Rip-rap where called for on the Drawings shall conform to the requirements of these Specifications.

2.04 OTHER MATERIALS

All other materials not specifically described but required for proper completion of the Work of this Section shall be as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Prior to all Work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the Work falling within this Section.
- B. The Contractor shall not allow or cause any of the Work performed or installed to be covered up or enclosed by Work of this Section prior to all required inspections, tests and approvals. Should any of the Work has been completely tested, inspected and approved, the Contractor shall restore the Work by enclosing or covering as required, all at no additional cost to the Owner.
- C. Before beginning excavation and/or filling Work, the topsoil from all areas to be affected shall be stripped to a depth of 6 inches and shall be stored at a location designated by the Engineer. After completion of the major construction Work, the topsoil shall then be replaced as the upper layer of backfill to a depth of not less than six (6) inches so that the final grade shall be as required by the Drawings. If additional topsoil over and above that salvage from the site is required in order to maintain the 6 inches of depth specified, the Contractor shall furnish and install same at no cost to the Owner.
- D. Backfill around all structures and in all trenches shall be carried to the grade indicated on the Drawings and/or specified herein.
- E. All open excavation, piles of material, freshly backfilled or uncompacted areas which present hazards to personnel or equipment on the construction site shall be adequately barricaded and posted with battery-operated warning lights, signs and other safety-related items as required by any local, state, or federal regulations governing same or, in the absence of any such regulation, to the satisfaction of the Owner.

- F. Backfill under structures or pavements shall, in general, be compacted to 95 percent of Standard Proctor Density, and all other backfill shall be compacted to 90 percent of Standard Proctor Density unless otherwise noted herein.
- G. All excavation materials not used in backfill or final grading operations shall be disposed of by the Contractor on the WWTP site at his own expense.
- H. No blasting shall be permitted to be performed in relation to this Work.

3.02 FINISH ELEVATIONS AND LINES

For setting and establishing finish elevations and lines, the Contractor shall secure the services of a qualified engineer or surveyor acceptable to the Engineer and shall carefully preserve all data and all monuments set by such engineer or surveyor and, if displaced or lost, immediately replace them to the satisfaction of the Engineer and at no additional cost to the Owner.

3.03 SHEET PILING, SHORING AND BRACING

- A. The Contractor shall furnish, install and maintain such sheeting, shoring and bracing as may be required to facilitate dewatering; to support the sides of the excavations; to prevent the movement of earth which could in any way diminish the width of the excavation below that necessary for construction or otherwise injure persons in or about the Work; endanger adjacent structures; cause excavations to extend beyond the Owner's property lines; or delay Work.
- B. Whenever possible, sheeting shall be driven ahead of the excavation to avoid loss of material from behind the sheeting. If it is necessary to excavate below the sheeting, care shall be taken to avoid trimming behind the face along which the sheeting will be driven. Care should be taken to prevent voids outside the sheeting, but if voids are formed, they shall be filled immediately with sand and compacted.
- C. The Engineer may require that sheeting, shoring and/or bracing installed for excavation be left in place in order to protect adjacent facilities or structures. Where such is not required in these Specifications or shown on the Drawings, the Contractor will be reimbursed as stipulated in the General Conditions of these Specifications. All other sheeting may be salvaged when the removal of same will not present a hazard to the adjacent facilities or to the safety of the Contractor's personnel.
- D. All sheeting, shoring and bracing not to be left in place shall be carefully removed in such a manner as not to present a hazard to the safety of the workmen or to endanger the construction of other structures. All voids left or caused by withdrawal of sheeting shall be immediately backfilled and well-compacted. The Contractor shall be fully responsible and liable for any bodily injury or property damage resulting from any improper or premature removal of sheeting, shoring or bracing.

3.04 DEWATERING

- A. At all times during construction the Contractor shall provide, place, operate and maintain ample means and devices with which to remove promptly, and dispose properly all water entering trenches and other excavations, or water that may flow along or across the site of the Work and shall keep said excavations dry until the structures and appurtenances to be built therein have been completed to such extent that they will not be damaged by the discontinuance of dewatering operations. At that time, such temporary means and devices shall be removed.
- B. The Contractor shall provide, install and operate pumping equipment of suitable capacity as necessary to maintain all excavations free of surface and subsurface water. He shall dispose of pumped water in accordance with approved E & S plan. Standby pumps will be required to be maintained at the site of the Work of this Section.

3.05 EXCAVATION NEAR EXISTING STRUCTURES/FACILITIES

- A. The Drawings show those underground utility lines and appurtenances for which such location information was either made available to the Engineer or was observed by the Engineer in the field. Neither the number of such underground facilities nor their respective types, sizes and/or locations can be assured or guaranteed. It is therefore the responsibility of the Contractor to obtain such additional information as is required to properly complete the Work in compliance with these Specifications and to contact the owners of the various utilities in the area prior to starting and to maintain communications with these owners during performance of the Work.
- B. The location of all power and telephone poles along the route of the Work and the overhead lines supported by all such poles shall be observed and located by the Contractor prior to commencement of the Work.
- C. The Contractor shall be completely and solely responsible and liable for any and all property damages, bodily injuries, financial losses and interruption of service that result from or are attributable to his construction activities and that affect gas lines, electric lines, telephone lines, drain lines and storm sewer lines, and all appurtenances and service facilities connected thereto. Restoration of all damaged or disturbed facilities shall be accomplished immediately after such facilities have been found to be damaged or disturbed, in accordance with the directions of the respective utility company or private owner and at no cost to the Owner.
- D. Gas, power and telephone service shall be maintained with a minimum of interruption throughout the construction of the Project. No such service shall be intentionally interrupted without the approval of the respective utility company concerned and without first giving due warning to any affected parties.
- E. The proposed Work is in proximity to overhead power lines which transmit electric current at high voltages and which, if disturbed or contacted during construction, would be hazardous to construction personnel and/or other persons. The

Contractor shall therefore properly protect such wire, pole supports, or other power line appurtenances to avoid disturbances to those facilities, and shall operate all machinery and conduct all other construction activities in a manner which will assure protection of all construction personnel and other person against said hazards. Work in the vicinity of the existing underground gas lines and appurtenances is also hazardous because, under certain conditions, such materials are flammable and/or explosive, and the Contractor shall avoid disturbance and/or displacement of those facilities and shall provide all temporary and permanent supports and other required protection to prevent exposure of same to construction personnel and/or other persons. Where such lines are exposed during construction and leakage is detected, construction Work in those areas shall be immediately suspended, the owner or owners of the affected lines shall be immediately advised of the condition, and the construction Work shall not resume until all repairs have been properly completed.

- F. The Contractor shall thoroughly instruct all his personnel and those of any subcontractor or materialsman involved in the Work so that appropriate and complete safety Work practices are observed at all times. He shall also provide all personnel with all tools, clothing, protective glasses, mechanical air blowing equipment to ventilate manholes and other chambers, explosive atmosphere detectors, ladders, harnesses and other safety-related equipment. No Work shall be performed under any unsafe conditions and, if same is detected at any time, the Contractor shall suspend operations immediately and not resume his activities until remedial measures have been taken or until the unsafe situation has otherwise been completely overcome.
- G. The Contractor's attention is directed to the fact that some of the proposed Work may interfere with existing underground utilities. The Contractor shall provide all temporary and permanent supports and other required protection or relocate these utilities. The Contractor shall be completely responsible for the cost of protection, relocating, repairing, or the reconstruction of all existing underground piping and utilities, regardless of size, that are disturbed because of his construction activities. There shall be no extra cost to the Owner for any relocation, reconstruction or repair of existing underground piping and utilities.
- H. After the appropriate utility companies and the Owner have located their lines, ducts, conduits, structures and other facilities in the field, the Contractor shall locate precisely the position, orientation and depth of all lines, ducts, conduits and other facilities that might conflict with his Work. Any unexpected conflict that becomes evident shall be immediately reported to the Engineer. Failure of the Contractor to notify the Engineer of such interference's far enough in advance will render the Owner not liable for any additional expenses incurred by the Contract while the utility is being relocated.
- I. The cost of supporting or protecting conflicting lines or other obstructions shall be at the Contractor's expense whether performed by him, the utility or the Owner.
- J. As the excavation approaches pipes, conduits, or other underground structures, digging by conventional trenching machine methods shall be done with extreme

care. No extra compensation shall be given if manual excavation is necessary to locate or construct utilities and/or underground structures.

3.06 PROTECTION OF EXISTING STRUCTURES/FACILITIES

- A. The Contractor shall maintain in place or remove and replace all interfering pipes, manholes, poles, wires, curbing, property line markers, survey monuments and other structures of facilities throughout the performance of the Work.
- B. If such structures and/or utilities are preserved in place, they shall be carefully supported and protected from injury or damage by the Contractor. In the event they are injured or damaged, the Contractor shall notify the appropriate party so that acceptable steps may be taken to repair any and all damage due to temporary provisions, or if not properly restored by him, the Owner may have the repairs made at the expense of the Contractor.
- C. If, due to the nature of their installation or policy, any utility requires the restoration Work to be done by its own forces, the cost of such Work shall be at the Contractor's expense.
- D. In addition to temporary support of utilities and structures, the Contractor shall provide for permanent support of these items by backfilling and thorough compacting with special material. This fill shall be placed and compacted to a height which will insure the stability of the pipe or obstruction to be supported.
- E. In an emergency affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization by or from the Owner, is obligated to act immediately to prevent such threatened damage, injury or loss. If the Contractor believes that the additional Work done by him in such an emergency, which arose from causes beyond his control, entitles him to an increase in the Contract Price and/or an extension of the Contract Time, he may make a claim therefore as provided in the General Conditions of these Specifications.
- F. In the event of bodily injury to anyone due to the Contractor's Work, he shall secure prompt medical assistance. In the event of property damage, or an evident hazard of possible property damage the Contractor shall act without notice immediately to restore the damaged property or service or to act to prevent the damage whenever property is damaged or imperiled or important services are interrupted or imperiled.
- G. If the Contractor is notified by the Owner to correct such service disruptions or to act to prevent an apparent possible interruption, which notification shall be confirmed in writing, he shall so act immediately. If the Contractor fails to so act within three (3) working days after any such notice, the Owner may act to restore such important service or to prevent the disruption of a service and charge the cost thereof to the Contractor if the situation is due to his Work.
- H. The Contractor shall notify the Owner immediately, for his review and

determination of treatment, in any of the following events:

1. Discovery of an unforeseen obstruction.
2. The occurrence of the need to make permanently stable any nearby or adjacent pipe, pole, manhole, structure, or other facility.
3. The failure of any temporary support of a pipe, pole, manhole, structure, or other facility.
4. The discovery of a particular area where undesirable settlement may occur.

3.07 EXCAVATION AND BACKFILL FOR STRUCTURES

A. General Description of Work:

The Work under this item shall include the furnishing of all materials, labor, supervision, tools and equipment necessary to perform all excavation, backfill and disposal or storage, as required, of all surplus material or material required for the proper execution of Work. This Work will include but not necessarily be limited to the following:

1. Removal of existing construction and facilities where necessary.
2. Clearing and grubbing.
3. The loosening, loading, removing, transporting and disposing of all existing structures designated to be removed and wet or dry materials necessary to be removed for the purpose of construction.
4. The construction of ditches required for collection and drainage of surface and subsurface water.
5. All excavation and backfill Work incidental to the proper construction of structures.
6. Furnishings and installation of required sheeting, shoring and bracing; all pumping, bailing and removing of water; and any and all protective Work required.
7. Disposal of excess excavated material and/or spoil.
8. Rough and finish grading of the site.

B. Excavation for Structures:

1. Cut limits:
 - a. The excavation for all structures shall be to the lines, grades, and

limits as shown on the Drawings and/or as required for proper installation of construction, and shall be sufficient to allow for construction and removal of all formwork; for dewatering purposes; and for other construction needs. No additional compensation will be allowed for additional excavation or backfill that might be necessary to eliminate stoppages or the Work caused by slides due to the nature of the excavated materials, due to movement of equipment, or such other conditions. The Contractor must determine the extent of excavation and backfill required for execution of the Work.

- b. The Contractor will be permitted to machine excavate to within three (3) inches of the bottom of footings, floors and foundations, but shall excavate to final grade by the use of hand shovels in order to insure undisturbed final grade. Any foundation areas which are overcut, disturbed or made unsuitable as a result of the Contractor's operations shall be repaired as required below, at no additional cost to the Owner.

2. Unsuitable Bottom:

In the event that the material encountered at the bottom of the excavation is not suitable for foundations or other Work, as determined by the Engineer, the excavation shall be carried to such additional depth as ordered by the Engineer. The Contractor will be reimbursed for such additional Work as stipulated in the General Conditions of these Specifications, provided that the unsuitable nature of the bottom material did not result from the Contractor's operations.

3. Overcutting:

- a. The Contractor shall excavate to the exact elevations necessary unless otherwise directed by the Engineer.
- b. If excavated below the elevations shown for footings, pilings, foundation walls and other structures, the excavation may, subject to the discretion and advance approval of the Engineer on a case-by-case basis, be backfilled with select fill materials as described under Paragraph 2.02 (C) of this section or Class C concrete. In some cases, the structure design may be revised in order that it bear on undisturbed soil.
- c. Any increase in cost resulting from backfilling or increasing the size of the footings or foundations because of overcutting shall be borne by the Contractor.

4. Slabs on earth:

- a. Where slabs occur on earth, all loose, shattered or spongy materials and all loam, organic or other undesirable materials shall be removed to a depth sufficient to encounter solid material of suitable load-bearing capacity.
 - b. Where slabs on fill occur, the fill shall be placed in accordance with Paragraph 3.07 (C) below.
- C. Backfilling for Structures:
- 1. General:
 - a. Placement and compaction of material shall be only after permission has been given by the Engineer. No material shall be placed or compacted when it is too wet or frozen or when the subgrade of previously placed material is too wet or frozen. The Engineer shall determine when conditions are suitable for placing and compacting material. All loam, topsoil and other material judged to be unsuitable by the Engineer shall be removed before any material is placed and compacted.
 - b. Where excavated material or any portion thereof is deemed unsuitable for use as backfilling material, the Contractor shall procure and place approved "special" backfill materials, such as crushed stone, screened gravel or sand. The backfill around structures shall be placed in layers not exceeding six (6) inches in thickness, each of which shall be thoroughly compacted by mechanical means sufficient to prevent subsequent settlement. Machine backfilling will not be permitted.
 - 2. Structural Fill:
 - a. Structural fill material shall be compacted by suitable power equipment sufficient to bring the field density, as determined by "Test for Density of Soil in Place by the Sand Cone Method" (ASTM D1556-64), to within the following percentage of the maximum density as determined by the "Tests for Moisture-Density Relations of Soils, Using 10 lb. Rammer and 18-inch Drop" (ASTM D1557-70 Modified Proctor Compaction Test).
 - 1. Soil - Not less than 95 percent.
 - 2. Granular Material - Not less than 97 percent.
 - 3. The moisture content of the material at the time of compaction shall not be more than 2 percentage points above the optimum moisture content.
 - b. Material which is deposited in one day shall spread, shaped, brought

to optimum moisture content and compacted the same day unless otherwise directed by the direct by the Engineer.

- c. In the event inclement weather or unforeseen circumstances render impractical the spreading and compaction of the material during the first 24-hour period, the material shall be spread and scarified as directed by the Engineer.

3. Backfill around structures:

- a. The placement of material shall be carried out symmetrically around structures in lifts not to exceed eight (8) inches of loose material, which shall be maintained as nearly horizontal as is possible to avoid differential or non-uniform loading of exterior walls. In this regard, the maximum permissible differential elevation of backfill at any given time will be four (4) feet.
- b. Compaction of material shall be at a moisture content equal to or slightly above optimum as determined by the Modified Proctor Compaction Test. It shall be done by mobile mechanical equipment not closer to the structure than the depth of the structure below finished grade unless otherwise approved by the Engineer.
- c. Each layer of material shall be compacted to an in-place density greater than 95 percent of the maximum as determined by the Modified Proctor Compaction Test.
- d. At points which cannot be reached by mobile mechanical equipment, suitable power-driven tampers shall be used to achieve the same degree of compaction. Backfilling around concrete structures shall start only after the concrete has reached the specified 28-day compressive strength and finishes have been applied and appropriately cured.
- e. Backfill against structure foundation walls shall begin only after the top slab is in place and has obtained sufficient strength to give support to the walls.

4. Testing:

- a. The optimum moisture content and the maximum density of each type of material used for structural fill and backfill shall be determined by "Tests for Moisture Density Relations of Solid, Using 1-0lb. Rammer and 18-inch Drop" (ASTM D1557-70 or AASHTO T-180-60).
- b. The field moisture content of materials being compacted shall be determined by "Laboratory Determination of Moisture Content of Soil" (ASTM D2216-71). The field density of compacted material shall be determined by either "Test for Density of Soil in Place by

the Sand-Cone Method" (ASTM D1556-64) or "Test for Density of Soil by the Rubber Balloon Method" (ASTM D2167-66).

- c. The Contractor shall perform field density and field moisture content tests on each lift of material to insure to the satisfaction of the Engineer that the requirements of this Section of these Specifications are being complied with. Field compaction test including reference tests in number not to exceed one (1) compaction test per 2000 square feet
 - d. Reports verifying these test results shall be submitted to the Engineer and the Contractor shall notify the Engineer when and where the tests are to be made so that the Engineer can observe the tests.
5. All structures designed to contain water shall be tested for water-tightness, using standard approved procedures, before any backfill is placed above the respective footings.

3.08 EXCAVATION AND BACKFILL FOR PIPE LINES

A. Open excavation:

- 1. Unless otherwise indicated on the Drawings, all pipe lines shall be laid in open trenches. The depth of such trenches shall be such that the pipe, in its installed position, will comply with the lines and grades shown on the Drawings, or with the lines and grade established by the Engineer in the field. Unless otherwise indicated on the Drawings, the minimum cover for pipe lines conveying liquids shall be four (4) feet. Minimum cover for gas lines shall be two (2) feet.
- 2. The Contractor shall make personal examination of the locations in which the pipe lines are to be constructed to determine for himself the extent and character of any rock which may be encountered. The Contractor shall not at any time a misunderstanding in regard to depth or character of the excavation to be made or in the nature of the materials to be encountered. All excavation shall be classified and no extra payment will be made for hand excavation or for rock, masonry, paving, boulders, shale, timbers or other natural or artificial materials encountered in the trenching operations.
- 3. Where excavation is to be made along roads or traveled ways, the Contractor shall familiarize himself with the requirements of the governing body having jurisdiction of said property and shall pattern his operations accordingly. In the event that the governing body has established no requirements, the Contractor shall limit his trench excavation to the limits hereinafter described. He shall schedule his operations so that at least one lane of traffic is always open unless he is specifically permitted to do otherwise by both the governing body having jurisdiction over the roadway and the Engineer. Where the flow of traffic must be restricted, or rerouted

due to activities of the Contractor, the Contractor shall be responsible for providing all barriers, signage, temporary traffic surfaces and traffic control personnel necessary to insure the safe movement of traffic around the site of the Work and sufficient to the requirements of any governing body of jurisdiction.

4. The Contractor shall shape trenches which are located adjacent to existing above-ground or underground structures and/or facilities or in other confined areas so that such structures and facilities are properly protected against damage or disturbance resulting from settlement or displacement. Adequate sheeting, shoring and/or bracing shall be installed and maintained to provide such protection and the Contractor shall be responsible for all damages resulting to such structures and/or facilities as the result of his failure to use adequate supports as well as those resulting from any other construction activities.
5. Should the Contractor's operations imperil foundations for new or existing structures, he shall provide concrete underpinning piers or supports for such structures at no additional cost to the Owner. Concrete used for underpinning piers shall consist of materials as described in Division 3 of these Specifications.
6. Any excavation where the depth of a trench with vertical sides is four (4) feet or greater or which presents a hazard to personnel working in the trench because of embankments, stockpiling of excavated materials along the top of the trench or other such condition, the Contractor shall provide adequate and suitable means of shoring, sheeting and/or bracing to prevent the trench walls from collapsing and to protect his personnel working in the trench. The system of shoring shall be as required in Paragraph 3.03 of this Section.
7. In excavation for all pipelines where made in open cut and where space permits, the banks of the trench from the ground surface to a depth not closer than 1 foot above the top of the pipe may be excavated to non-vertical and non-parallel planes. In no case shall the side walls of the trench in the pipe zone, defined as all that trench area below a point of 12 inches above the top of the pipe in its installed position, be permitted to be other than vertical and parallel planes equidistant from the pipe centerline.

The horizontal distance between the vertical planes shall be no greater than the outside diameter of the pipe plus 24 inches. The Contractor is cautioned that if the pipe zone trench widths are exceeded, he shall install the pipe in a concrete cradle or provide other special trench backfilling procedures which will result in a final installation equal to that specified, subject to the approval of the Engineer.

8. Where the available space does not permit where the trench is through paved areas or where existing or proposed above ground or underground structures may be endangered, the sides of the trench above the pipe zone

shall be excavated to vertical and parallel planes. The horizontal distance between the vertical planes shall be no greater than necessary to permit construction of the pipeline with all required sheeting, shoring and bracing in place.

9. No pipe shall be installed under any circumstances which bears on rock or a rock projection. All bell holes shall be excavated before the pipe is lowered in the trench. Bell holes shall be no larger than required to permit proper jointing.
10. For all pipelines, the bottom of the trenches shall be excavated and overcut a minimum of six (6) inches below the bottom of the outside of the pipe as determined from the finished grade shown on the Drawings or established in the bottom of the pipe barrel with sand, crushed stone or other similar material approved by the Engineer. In all other respects, the requirements of this Section shall apply.
11. Where muck, quicksand, soft clay, swampy or other material is encountered in the trench bottom which, in the opinion of the Engineer, is unsuitable for pipe foundation subgrade or backfill, such material shall be removed to a depth satisfactory to the Engineer. The trench shall then be backfilled to grade with acceptable material and mechanically compacted in successive layers of not greater than four (4) inches. For the removal and replacement of such unsuitable materials to a depth greater than six (6) inches below the bottom of the pipe, and when authorized by the Engineer, the Contractor shall be reimbursed in accordance with the General Conditions.
12. Materials excavated from trenches shall be stored or deposited within the rights-of-way established for this Work unless the Contractor secures permission in writing from adjacent property owners to use their property for this purpose.
13. The Contractor shall schedule his excavation and backfill operations so that no more than 100 feet of trench remains open at one time. All such open trench and piles of deposited materials and all freshly backfilled or uncompacted trench areas shall be adequately barricaded and posted with suitable battery-operated warning lights, signs and other safety-related equipment provided in accordance with local, state or federal governmental requirements, or in the absence of same, to the satisfaction of the Engineer.

B. Excavation in paved areas:

1. The Contractor shall at all times care not to excavate beyond the temporary construction lines where such are shown on the Drawings unless otherwise authorized by the Engineer.
2. When it is necessary during trenching for pipe laying to cut and remove paving, the removal shall be done by or under the direction of the Contractor responsible for replacing the paving.

3. The pavement to be removed shall be saw-cut through the wearing and base courses if bituminous, and through the concrete course if concrete. The removal of pavement and disposal of spoil shall be accomplished before and not coincidentally with the excavation Work.

C. Concrete cradle and/or encasement:

1. Concrete cradle and/or encasement is required to be furnished and installed at the locations shown on the Drawings and under all sewer pipe within the excavated areas around manholes and other structures or where the specified trench widths are exceeded. Said cradle and encasement material shall consist of concrete as described in Division 3 of these Specifications. Care shall be exercised in placing encasement or cradle to provide adequate anchorage for the sewer pipe lines in order to preclude flotation and/or displacement of the pipe.
2. The Contractor shall provide and install all reinforcing steel that may be required or shown on the Drawings to assure adequate strength for concrete cradle or encasement.

3.09 PIPE BEDDING AND EMBEDMENT

A. Pipe bedding:

All pipe lines shall be supported on a granular bedding material approved by the Engineer. The minimum thickness shall be six (6) inches at the bottom of the pipe, and it shall be installed for the full width of the trench, beginning at a minimum of six (6) inches below the bottom of the pipe and along the sides of the pipe to the horizontal centerline of the pipe. This bedding material shall be placed on both sides of the pipe simultaneously for the full width of the trench and shall be mechanically tamped in layers not to exceed four (4) inches, to not less than 97 percent of the maximum density as specified under Paragraph 3.07 (C) of this Section.

B. Flexible water pipe (PVC and ABS/PVC composite pipe) shall have Class I bedding, as described in ASTM D-2321 and modified here:

1. All water pipe shall be supported on an embedded in granular bedding material as described in Part 2.02 of this section. The bedding and embedment shall be deposited in four (4) inch layers on both sides of, six (6) inches below and to 12 inches above the top of the pipe and carefully compacted. Tamping within 12 inches of the pipe shall be by hand tamping. Subsequent compaction shall be performed with mechanical tampers which have a zone of influence less than the depth from the point of usage to the top of the pipe. In no case shall compactors of the hydrohammer type be

utilized within 48 inches of the pipe surface and shall be utilized more than such distance from the pipe surface only if pipe embedment has previously been compacted to at least 85% of Standard Proctor Density.

Bell holes in the bedding shall be provided at each joint to permit proper assembly of the joint while maximizing uniform pipe support.

In cold or freezing weather, the max. size of aggregate in the special materials shall be 3/4-inch.

2. Embedment and backfill shall be such that diametric deflection of the pipe due to the pressure of backfill shall not exceed 7.5 percent of the actual inside pipe diameter for PVC pipe and 5 percent of the actual inside pipe diameter for PVC pipe and 5 percent of same for ABS/PVC composite pipe. Due to the importance of proper bedding and embedment of PVC and ABS composite pipe, the Contractor shall lay and backfill not less than 200 feet of pipe and test it for compliance with the max. 7.5 percent for PVC pipe and 5 percent for ABS/PVC composite pipe allowable vertical ring deflection. This procedure will demonstrate if the Contractor's bedding and embedment procedure is adequate. The Contractor shall furnish the pipe Manufacturer's written approval of his method of installation as developed from his initial installation.

C. Pipe Zone backfill:

Backfill in the pipe zone above the pipe bedding material to an elevation of one (1) foot above the top of the respective pipe shall be of selected excavated and compactable material free from rocks, boulders, and stones greater than 3/4 inch in maximum dimension. The material shall be uniformly placed on both sides of the pipe in 4-inch layers for the full trench width and shall be mechanically tamped in place. If necessary to achieve thorough compaction, the material shall be moistened during the tamping process.

D. Backfill above the pipe zone:

1. Insofar as is practical, the material excavated during the trenching operations shall be utilized as backfill above the pipe zone to an elevation equal to the bottom of top soil or other special surface treatments. The Engineer shall determine whether material is unsuitable and, upon the Engineer's notice, unsuitable material shall be disposed of and suitable selected fill materials shall be brought in from an outside source, at no additional cost to the Owner.
2. Those trenches which are located along or across traveled ways, or in the berms of streets, roads, parking areas or other traffic use area which must be made safe for vehicular traffic as soon as possible, shall be backfilled above the pipe zone with compactable material, free from rocks or boulders greater than four (4) inches in

maximum dimension. The materials shall be placed and tamped with mechanical tampers in successive layers not to exceed four (4) inches in vertical depth. Where permanent type pavement is required, a temporary fill shall be placed thereon prior to paving.

3. Where excavation is made through planted, cultivated, lawned or similar areas, the topsoil shall be removed and separately stored. Backfill material and placement shall be the same as previously specified, except that the backfill shall be carried to within six inch of the final grade. The topsoil salvaged from the excavation (or brought in from an outside source) shall then be placed to approximately one (1) inch above the adjacent grade, rolled with a light roller, and seeded or planted to a condition equivalent to that existing before the commencement of construction.
4. Trenches which are located in areas not specified in these Specifications or noted on the Drawings to be seeded or sodded, or for which surface settlement is not important in the opinion of the Engineer, may be filled above the pipe zone with a compatible material free from rocks or boulders larger than eight (8) inches in maximum dimension. However, the Contractor shall place the material in layers no greater than 12 inches in vertical depth and shall tamp as required to assure that no excessive voids are present in the backfill. He shall carry the backfill in this manner to grade. He shall then add backfill neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation. Future settlements within a period of one year following Contract close-out shall immediately rectified by adding material to bring the surface to a little above the grade.
5. The Contractor shall make up all deficiency in backfill material at his own expense.
6. In the event that the Contractor desires to attain compaction by flooding the backfill, such methods may be approved by the Engineer, subject to demonstration by the Contractor that satisfactory end results can be achieved. In any event, any trench settlements occurring within one (1) year after the date of Contract close-out shall be required to be rectified by the Contractor at no extra cost to the Owner.
7. Particular care shall be exercised by the Contractor in backfilling trenches located along or crossing roadways, roadway berms, parking areas, and other traveled ways, such that the resumption of normal traffic patterns will occur reasonably soon after the pipe in those areas has been installed.

3.10 DISPOSAL OF UNSATISFACTORY AND/OR EXCESS EXCAVATED MATERIAL

Where the Contractor encounters boulders, rocks, spongy or swampy materials, old paving materials, masonry, debris, or other materials determined by the Engineer to be unsatisfactory for use as backfill or backfill becomes excessively wet, frozen, or otherwise unsuitable, the same shall be disposed of at the WWTP site by the Contractor at no extra cost to the Owner. All excess material remaining after completion of trench backfilling and all excavated material replaced by special backfill shall be similarly disposed of by the Contractor in the same manner at no extra cost to the Owner.

3.11 ROUGH AND FINISH GRADING OF THE SITE:

- A. Fill material shall be installed up to subgrades to accommodate finish grades as shown on the Drawings for pavements, grass or other surface treatments. Prior to placing the fill, the area shall be compacted in the manner described under Part 3.07 of this Section.
- B. The fill material shall be spread in 6 inch layers. Each layer shall be compacted using equipment such as vibrating rollers, equipment with caterpillar treads having traction lugs, or sheepsfoot rollers. Hand air tampers are acceptable in confined quarters. The compacted area shall be covered at least twice by the equipment.

3.12 INSTALLATION OF RIP-RAP

Rip-rap shall be furnished and installed where shown on the Drawings, in accordance with the provisions of these Specifications.

PART 4 – BASIS OF PAYMENT

- 4.01 Excavation, Backfilling and Grading – Incidental. No additional compensation will be provided for Excavation, Backfilling and Grading. The cost associated with Excavation, Backfilling and Grading shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 02270

SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 Section Includes

A. Soil Erosion and Sedimentation Control

1.02 Submittals

A. Submit manufacturer's certifications of materials to the Engineer.

PART 2 PRODUCTS

2.01 All materials shall meet the requirements of the latest edition of the Erosion and Sediment Pollution Control Program Manual published by the Commonwealth of Pennsylvania Department of Environmental Resources, Office of Resources Management, Bureau of Soil and Water Conservation, Division of Soil Resources and Erosion Control.

PART 3 EXECUTION

3.01 Construct and maintain all measures required by the Soil Erosion and Sedimentation Control Plan attached to these Specifications and as indicated in the Plans. Approved Soil Erosion and Sedimentation Control Plans are to be kept on site at all times during construction.

PART 4 BASIS OF PAYMENT

4.01 Soil Erosion and Sedimentation Control - Incidental

END OF SECTION

SOIL EROSION AND SEDIMENTATION CONTROL

SECTION 02480

LANDSCAPING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, materials, tools, equipment and products for final grading, application of topsoil, soil and amenders, fertilizer, mulch, seeding and/or sodding as shown on the Drawings and/or herein specified.
- B. The Contractor shall furnish all labor, materials, tools, supervision, equipment and services necessary to complete fully this portion of the work as shown on the drawings or herein specified or both, as follows:
 - 1. Finish Grading - Removal of trash and stones, grading to specified slope and contour, and furnishing and applying topsoil.
 - 2. Preparation of Planting Areas - Furnishing and applying lime, fertilizer, and physical conditioning materials and incorporating same into the soil.
 - 3. Planting Materials - Supplying plant materials of quality and species and/or varieties specified. Planting shall be performed in an approved manner and maintenance shall be supplied for a specified period.
- C. Related Work described elsewhere:
 - 1. Erosion and Sedimentation Control Measures Section 01060
 - 2. Demolition, Clearing and Grubbing Section 02100
 - 3. Excavation, Backfilling, and Grading Section 02200

1.02 QUALITY ASSURANCE

The Contractor shall procure from the local Agricultural Agent a pH analysis of the topsoil to be applied to the site and his recommendations as to the amount of limestone (agricultural) screenings, if any, needed to bring the pH of the soil up to a value between 6 and 8. The sample of the topsoil submitted to the Agricultural Agent shall be a composite of not less than 10 site samples.

PART 2 - PRODUCTS

2.01 TOPSOIL AND SOIL CONDITIONING MATERIALS

- A. Topsoil shall be natural surface soil from well-drained areas of loam or sandy loam nature containing less than 30% silt and less than 12% clay. It shall be free of weeds, roots, sticks, stones or other extraneous matter.

- B. Fertilizers shall be delivered to site in original bags and protected at all times prior to application against mechanical or weather damage.
 - 1. Superphosphate shall be of standard quality containing not less than 20% available phosphate.
 - 2. Basic fertilizer shall be a 0-20-20 analysis: 20% available phosphate derived from superphosphate and 20% water-soluble potash derived from muriate of potash.
 - 3. Starter fertilizer shall be 10-5-5 complete analysis fertilizer with 10% nitrogen having 35% or more of the total nitrogen as water-insoluble nitrogen. Nitrogen may be derived from a natural organic material or a ureaform compound (38% N, Minimum Availability Index = 45). The 5% available phosphate shall be derived from superphosphate and 5% water-soluble potash derived from muriate of potash.
- C. Lime shall be standard ground limestone containing a minimum of 50% lime oxides (calcium oxide plus magnesium oxide), 98% passing a 20 mesh sieve and a minimum of 40% passing a 100 mesh sieve.
- D. Reed-Sedge Peat or Sphagnum Moss Peat shall have an organic matter content of 80% minimum and a water holding capacity of 400% minimum.
- E. Mushroom manure shall be composed of well-rotted cattle or stable manure with an admixture of 15% to 30% topsoil and shall have been used for the commercial growing of at least one crop of mushrooms. It shall be free of sawdust, refuse, shavings and harmful chemicals.
- F. Wood chips shall be the by-product of twigs and branches that have been processed through a chipper.
- G. Straw shall be either wheat or oat straw, clean and free of weeds and other extraneous matter.

2.02 SEED

- A. In seeding operations conducted as part of the Work of this Section, the Contractor shall use seed exclusively which conforms to the Pennsylvania Seed Act of 1965, Act No. 187, and applicable regulations of the Pennsylvania Department of Agriculture, Bureau of Plant Industry.
- B. In selecting seed to be used in this Work, the Contractor shall adhere to the following requirements:
 - 1. Have the Pennsylvania Department of Agriculture, Bureau of Plant Industry, conduct purity and germination analysis, following the current Rules for Testing Seeds of the Association of Official Seed Analysis.

2. Use certified Crownvetch, Kentucky Bluegrass, Perennial Rye Grass, Pennsylvania Red Fescue, or Red Fescue seed.
 3. Use Penngift crownvetch seed, pretested by the Pennsylvania Department of Agriculture, in 10-pound (net) waterproof containers, with a tag attached to each bag showing a Pennsylvania Department of Transportation number to verify pretesting and conformance to specifications.
 4. Use a premixed seed with an inspection tag stamped, dated and signed by the Department of Agriculture inspector and sewn into the inside top of each bag. Seed from containers that are not sealed or that have been stored with herbicides or seed which has a test date older than nine months shall not be used. Seed to be used in the Work of this Section shall have been inspected and sampled as specified, or sampled by individual species and lot number and mixed on the Project site under Department supervision.
- C. Seed inoculation employed by the Contractor shall be a standard acceptable commercial product for treating leguminous seed and shall consist of a suitable carrier containing a culture of nitrogen-fixing bacteria specific for the seed to be inoculated. Inoculant containers shall be kept sealed until they are empty. At all times, suitable storage at a moderate temperature must be provided. The Contractor shall not use inoculant after the expiration date shown on the container.

PART 3 - EXECUTION

3.01 GENERAL

- A. All areas shall be tilled to a depth of four (4) inches prior to placement of topsoil. The entire subgrade shall be raked and all stones and debris over 1-1/2 inches in maximum dimension must be removed.
- B. Topsoil as specified shall be placed to a minimum depth of four (4) inches and brought to grades indicated on the Drawings. Trash, lumps and stones exceeding 1-1/2 inches in maximum dimension shall be removed from all areas prior to seeding or sodding.
- C. Peat as specified (2-1/2 cubic yards per 1000 sq. ft.), lime (65 pounds per 1000 sq. ft.) and basic fertilizer (50 pounds per 1000 sq. ft.) shall be thoroughly incorporated into the soil to a depth of five (5) inches.
- D. Starter fertilizer (25 pounds per 100 sq. ft.) shall be applied and worked to a depth of one (1) inch. All areas shall be fine-graded and firmed with a light roller.
- E. Seeding shall be done at such time of the year when climatic conditions of temperature and moisture are suitable for growth within the following seeding dates:

Spring

March 15 - June 1

Fall

August 15 - October 15

If required, the Engineer may modify these dates upon receipt of a written request from the Contractor.

- F. Seed shall be Blue Tag Certified. It shall have been tested for germination and purity by acceptable methods within a period of 9 months prior to delivery. Seed tag shall show date of germination test, germination and purity as indicated below:

SPECIES	% MIX	APPLICATION RATE lbs/100 sq. yd.
Kentucky Bluegrass (use 2 or more varieties)	60%	4
Creeping Red Fescue	40%	
Ryegrass	55%	

- G. Seed for each area shall be divided into two equal parts, each area to be seeded in two passes, with the second seeding to be over the first at a right angle to it.
- H. If a distributor is used which deposits seed on the surface, the seed shall be covered by smoothing harrow, hand rake or cultipacker.
- I. Unless a cultipacker seeder has been employed, areas shall be firmed after seeding by light rolling or cultipacking.
- J. Straw mulch as specified shall be applied uniformly at a rate of 100 pounds per 1000 sq. ft.
- K. Seeded areas shall be maintained by watering, weeding, reseeding, mowing and other operations for at least 45 days and as much longer as necessary to establish a close stand of grass at an average height of 2-1/2 inches.

3.02 INOCULATING LEGUMES

The Contractor shall inoculate leguminous seed with the proper cultures in accordance with the Manufacturer's directions. Prior to sowing, inoculated seed shall be protected from prolonged exposure to sunlight. Seed not sown within 24 hours shall be reinoculated. When seed is applied by hydraulic seeders, four (4) times the Manufacturer's recommended rate shall be utilized.

3.03 WEED CONTROL

Approved herbicide shall be applied at a rate recommended by the Manufacturer after the grass is planted as soon as a new growth of weeds appears.

3.04 MAINTENANCE

The Contractor shall water, weed, mow, prune and otherwise promote healthy growth, maintain and protect seeded and sodded areas, until final acceptance by the Owner.

3.05 REPLACEMENTS

At the beginning of the next planting season after that in which the permanent grass crop is sown, the seeded and sodded areas will be inspected. If grass growth is unacceptable over one-fourth or more of the total area, the total unacceptable area shall again be prepared and reseeded or sodded as described above and maintained by watering and mowing through the planting periods.

PART 4 – BASIS OF PAYMENT

- 4.01 Landscaping – Incidental. No additional compensation will be provided for Landscaping. The cost associated with Landscaping shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 02602

SUBGRADE

PART 1 - GENERAL

This work is preparation of the structural foundation(s) subgrade and roadbed subgrade areas.

PART 2 – PRODUCTS

Not Used.

PART 3 - CONSTRUCTION

3.01 General:

Form subgrade to the established subgrade elevation and compact to specified density requirements, using equipment specified in PennDOT Form 408 Specifications latest edition.

3.02 Density Requirements:

Compact subgrade to not less than 95% of the determined dry-weight density. Dry-weight density for material in place in the field will be determined, in accordance with PTM No. 106 or ASTM D-1557 (Modified Proctor). In-place density or compaction will be determined based on non-movement of material under compaction equipment specified in PennDOT Form 408 Specifications, latest edition. Field compaction test including reference tests in number not to exceed one (1) compaction test per 8" layer per 2000 square feet.

At the time of compaction, maintain the subgrade material's moisture content not more than 2 percentage points above optimum moisture for that material. However, on subgrades displaying pronounced elasticity or deformation under rolling, maintain a moisture content to greater than optimum at the time of compaction or at the time of placing the overlaying construction. When the specified stability cannot be obtained, excavate material in the area to a depth that, when replaced and recompacted at a moisture content not exceeding optimum, the subgrade will have required stability.

3.03 Subgrade Requirements:

Protect subgrade sufficiently in advance of the succeeding operation. Prior to placement of pavement or concrete structures, promptly and satisfactorily reshape and recompact, or remove and replace, damaged or unsatisfactory areas.

Check subgrade for grade and slope. However, where subgrade is constructed using an automatic grading machine which cuts the subgrade and is controlled by reference line or lines, templates for checking grade and slope will not be required.

Test the finished surface for irregularities by using approved measuring instruments. Test the cross section for surface irregularities at intervals of not more than 25 feet.

Correct all surface irregularities exceeding 1 inch by loosening the surface and removing or adding material as required. Compact the corrected area and surrounding surface by rolling.

PART 4 – BASIS OF PAYMENT

4.1 Special Provisions – Incidental. No additional compensation

END OF SECTION

SECTION 02604

SUBBASE

PART 1 - GENERAL

1.1 Section Includes

A. Subbase

PART 2 - PRODUCTS

2.1 Subbase shall conform to the latest edition of the Pennsylvania Department of Transportation Publication 408 Specifications (PennDOT Publication 408), Section 350 "Subbase."

PART 3 - EXECUTION

3.1 Subbase shall be constructed in accordance with PennDOT Publication 408, Section 350 "Subbase."

PART 4 - BASIS OF PAYMENT

4.1 Subbase – Incidental.

END OF SECTION

SECTION 02825

TOPSOIL, SEEDING, MULCHING, AND MAINTENANCE

PART 1 - GENERAL

1.1 Section Includes

- A. Topsoil
- B. Seeding
- C. Mulching
- D. Maintenance

1.2 Applicable Standard Tables

- A. Seeding Restoration Table (attached)

1.3 References

- A. Commonwealth of Pennsylvania, Department of Transportation, Publication 408 Specifications current edition with all supplements. (PennDOT Publication 408)
- B. Pennsylvania Seed Act of 1965, Act 187, as amended.
- C. Agricultural Liming Materials Act of 1978, P.L.15, No. 9 (3P.S.132.1), as amended.
- D. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended.
- E. Rules for Testing Seeds of the Association of Official Seed Analysts.
- F. AASHTO T194.

1.4 Definitions

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 Regulatory Requirements

- A. Comply with regulatory agencies for seed mixture, fertilizer, and herbicide composition.

1.6 Quality Assurance

- A. Provide seed mixture in containers showing percentage of seed mix, date of production, net weight, date of packaging, and location of packaging.
- B. The Contractor has the option of using soil testing to justify decreasing lime and fertilizer

rates. When soil testing is selected by the Contractor, the soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer. The Contractor shall collect soil samples under the direction of the Engineer.

If soil tests are performed to justify decreased liming and fertilizer rates, the Contractor shall submit certified soil sample analysis, including the laboratory's recommended soil supplement formulation.

PART 2 - PRODUCTS

2.1 Topsoil

- A. Having a pH of between 6.0 and 7.0, containing not less than 2% nor more than 10% organic matter as determined by AASHTO T194.
- B. Fertile friable loam, sand loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.
- C. Free of clods, grass, roots, or other debris harmful to plant growth.
- D. Free of pests, pest larvae, matter toxic to plants, and weeds.
- E. Topsoil removed under Section 02300-Earthwork may be reincorporated into this work. Additional topsoil, as required, shall be furnished by the Contractor at no additional cost to the Owner.

2.2 Seed

- A. Fresh, clean, dated material from the last available crop and within the date period specified with a date of test not more than 9 months prior to the date of sowing. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance. All seeds will be subject to analysis and testing.

TABLE 1 - GRASS AND AGRICULTURAL SEEDS

Species	Minimum Guaranteed Purity (%)	Maximum Weed Seed (%)	Minimum Guaranteed Germination (%)
Kentucky Bluegrass (<i>Poa pratensis</i>) Domestic Origin; min. 21 lb. per bushel	90	0.20	80
Perennial Ryegrass (<i>Lolium perenne</i> , var. Pennfine)	95	0.15	90
Kentucky 31 Fescue (<i>Festuca elatior arundinacea</i>)	98	0.25	85
Pennlawn Red Fescue (<i>Festuca rubra</i> , var. Pennlawn)	98	0.25	90
Annual Rye Grass (<i>Lolium multiflorum</i>)	95	0.15	90
Timothy (<i>Phleum pratense</i>)	98	0.25	95

2.3 Seed Mixtures

- A. See "Seeding Restoration Table" at end of this Section.

2.4 Inoculant

- A. Inoculant leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.
- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect Inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

2.5 Fertilizer

- A. Basic Dry Formulation Fertilizer
 - 1. Analysis 0-20-20 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.
- B. Starter Fertilizer
 - 1. Analysis 10-5-5 or 12-6-6 as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.

2.6 Lime

- A. Raw ground limestone conforming to Section 804.2(a), of PennDOT Publication 408.

2.7 Mulching Materials

- A. Mulches for seeded areas shall be one, or a combination of, the following:
 - 1. Hay
 - a. Cured to less than 20% moisture content by weight.
 - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
 - c. Timothy hay or mixed clover and timothy hay.
 - 2. Straw
 - a. Cured to less than 20% moisture content by weight.
 - b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
 - c. Wheat or oat straw.
 - 3. Wood Cellulose
 - a. No growth or germination inhibiting substances.
 - b. Green, air dried. Packages not exceeding 100 pounds.
 - c. Requirements:
 - Moisture Content: $12\% \pm 3\%$
 - Organic Matter: $98.6\% \pm 0.2\%$ on the oven dry basis.
 - Ash Content: $1.4\% \pm 0.2\%$
 - Minimum Water-Holding Capacity: 1,000%
 - 4. Mushroom Manure
 - a. Organic origin, free of foreign material larger than 2" and substances toxic to plant growth.

- b. Organic Matter: 20% minimum
- c. Water-Holding Capacity: 120% minimum
- d. pH: 6.0

2.8 Accessories

- A. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.
- B. Erosion Fabric: Jute matting, open weave.
- C. Stakes: Softwood lumber, chisel pointed.
- D. String: Inorganic fiber.

PART 3 - EXECUTION

3.1 Preparation of Subgrade

- A. "Hard pan" or heavy shale
 1. Plow to a minimum depth of 6".
 2. Loosen and grade by harrowing, discing, or dragging.
 3. Handrake subgrade. Remove stones over 2" in diameter and other debris.
- B. Loose loam, sandy loam, or light clay
 1. Loosen and grade by harrowing, discing, or dragging.
 2. Handrake subgrade. Remove rocks over 2" in diameter and other debris.

3.2 Placing Topsoil

- A. Place topsoil and spread over the prepared subgrade to obtain the required depth and grade elevations. Final compacted thickness of topsoil not less than 3 1/2". Compact with a roller weighing not over 120 pounds per foot width of roller or by other acceptable means, as directed.
- B. Handrake topsoil and remove all materials unsuitable or harmful to plant growth.
- C. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry.
- D. Do not handle topsoil when frozen or muddy.

3.3 Tillage

- A. After seed bed areas have been brought to proper compacted elevation, thoroughly loosen to a minimum depth of 5" by discing, harrowing, or other approved methods. Do not work topsoiled areas when frozen or excessively wet.
- B. Liming
 1. Distribute limestone uniformly at a rate of 100 pounds per 1,000 square feet.
 2. Thoroughly incorporate into the topsoil to a minimum depth of 4".
 3. Incorporate as a part of the tillage operation.

- C. Basic Fertilizer
 - 1. Distribute basic fertilizer uniformly at a rate of 50 pounds per 1,000 square feet.
 - 2. Incorporate into soil to a depth of 4" by approved methods.
 - 3. Incorporate as a part of the tillage operation.
- D. Liming and Fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

3.4 Finish Grading

- A. Remove unsuitable material larger than 2" in any dimension.
- B. Uniformly grade surface to the required contours without the formation of water pockets.
- C. Rework areas which puddle by the addition of topsoil and fertilizer. Rerake.
- D. Distribute starter fertilizer at the following rates:
 - 10-5-5: 50 pounds per 1,000 square feet.
 - 12-6-6: 33 pounds per 1,000 square feet.
- E. Incorporate starter fertilizer into the upper 1" of soil.

3.5 Seeding

- A. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder, or hand-operated seeder or by hand. Do not seed when winds are over 15 mph.
- B. Upon completion of sowing, cover seed to an average depth of 1/4" by hand raking or approved mechanical methods.

3.6 Mulching

- A. Mulch within 48 hours of seeding.
- B. Place hay and straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
 - 1. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper, or plastic nets.
 - 2. Emulsified asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.
 - 3. Apply approved chemical mulch binders at the manufacturer's recommended rate.
- C. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.
- D. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards.
 - 1. Incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.

- E. Spread mushroom manure uniformly to a minimum depth of 1/2" or to the depth indicated on the drawings.
- F. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% of the mulch is 6" or more in length. For cut mulches applied by the blowing methods, achieve a loose depth in place of not less than 2".
- G. When mulching by the asphalt mix method, apply the mulch by blowing. Spray the asphalt binder material into the mulch as it leaves the blower. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.
 - 1. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
 - 2. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.
 - 3. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

3.7 Seed Protection

- A. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- B. Lay fabric smoothly on surface, bury top end of each section in 6 inch (150 mm) deep excavated topsoil trench. Provide 12 inch (300 mm) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- C. Secure outside edges and overlaps at 36 inch (900 mm) intervals with stakes.
- D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

3.8 Maintenance

- A. Maintenance includes watering, weeding, cleanup, edging and repair of depressions, washouts or gullies.
- B. Those areas which do not show a prompt catch of grass within 14 days of seeding shall be reseeded until complete grass catch occurs.

PART 4 - BASIS OF PAYMENT

- 4.1 Topsoil, Seeding, Mulching, and Maintenance – Incidental.
No separate payment will be made for topsoil, seeding, mulching, and maintenance.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 Description.

A. Work includes:

The erection of forms for all cast-in-place concrete indicated on the Drawings and the subsequent removal of all such forms except those earth forms described in this Section.

B. Related Sections:

1. Section 03200 – Concrete Reinforcement
2. Section 03300 – Cast-In-Place Concrete

1.2 Quality Assurance.

In addition to complying with all pertinent codes, standards and regulations, the Contractor shall comply with all pertinent recommendations contained in "Recommended Practice for Concrete Formwork", ACI 347, and "Specifications for Structural Concrete", ACI 301.

PART 2 - PRODUCTS

2.1 Form Materials.

Form sheathing for exposed surfaces may be composed of tongue and groove lumber, ship lap, plywood, concrete form board or steel. Steel lining on wood lagging will not be permitted.

Tongue and groove ship lap when used shall conform to the American Lumber Standards for No. 2 boards. Plywood used for sheathing or lining shall be Grade B-B, exterior or better, as described in U.S. Product Standard PS1-74 of the American Plywood Association. The forms used shall produce a concrete surface with "abrupt" irregularities less than 1/4 inch in 5 feet and gradual irregularities less than 1/2 inch in 5 feet. All form sealers shall be first quality of their respective kinds and subject to the approval of the Engineer.

2.2 Ties and Spreaders.

A. All form ties shall be of a type which does not leave an open hole through the concrete and which permits neat and solid patching at every hole. All concrete form ties shall be of the water stop design.

B. Embedded metal rods of a design approved by the Engineer shall be used for internal form-ties. They shall be so designed and arranged that when the forms are removed, no metal shall be within 3/4 inch of any concrete surface. The ties used shall be manufactured in such a way that installation will not necessitate a hole in the form larger than the tie rod. Waterstops are required for all form-ties used in wall construction of all structures designed to hold water. Ordinary wire ties, wood spreaders and ties that require removal from the concrete will not be permitted.

2.3 Waterstops.

A. Premolded waterstops shall be of polyvinyl chloride and comply with U.S. Corps of Engineers Specification Number CRD-C572. The stop shall be of the serrated fin

type with large end projections and shall be at least 6 inches in width and 3/8 inch in thickness.

- B. Where indicated on the Drawings, Waterstop RX101 manufactured by American Colloid Company, Arlington Heights, Illinois, or approved equal, shall be used. A minimum of 3 inches of concrete cover shall be provided to the waterstop.

2.4 Other Material.

All other materials not specifically described but required for proper completion of concrete formwork shall be as selected by the Contractor subject to the advance approval of the Engineer.

PART 3 - EXECUTION

3.1 Construction of Forms.

- A. Forms shall be constructed in accordance with ACI 301 and shall conform to the shape, lines, grades, and dimensions of the concrete as indicated on the Drawings. All lumber used for forms shall be thoroughly cleaned and treated with an approved form oil. Lumber used in forms for surfaces requiring a rubbed finish shall be dressed to a uniform thickness; shall be free from loose knots or other defects; shall be faced with coated plywood; and shall be used only one time for forming surfaces requiring a rubbed finish. For surfaces not requiring a rubbed finish and for rough Work, undressed lumber, free of nails and clean of hardened concrete or other foreign material, may be used.
- B. Forms shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain the desired position and shape during and after placement of concrete and so they will not tremble or distort in a high wind. Chamfer strips, placed in the corners of forms to produce beveled edges on permanent exposed surfaces, shall have a minimum dimension of 3/4 inch unless otherwise shown on the Drawings.
- C. Temporary openings shall be provided at the base of wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.
- D. The Contractor shall exercise particular care in the layout of forms to avoid necessity for setting of concrete after it is in place; shall make proper provision for all openings, offsets, recesses, anchorage, blockage, embedded items and other features of the Work as shown on the Drawings or required for Work of other trades and do all cutting and repairing of forms required to permit such installation. The Contractor shall carefully examine the Drawings and Specifications and consult with other trades as required relative to provision for openings, reglets, chases, and other items in the forms.
- E. The Contractor shall set all required sleeves, frames, angles, grilles, bolts, inserts, waterstops and other such items required to be anchored in the concrete before the concrete is placed. Waterstops shall be installed in all construction, expansion or any other joints (where there is exposure to hydrostatic pressure) and as shown on the Drawings. Joints shall be made by heating the material ends until they melt or by applying a compatible adhesive to the ends and then pressing the two sections neatly together forming a continuous water stop. All corners shall be made by cutting mitered corners and joining together or by the use of preformed corners.

Bending of the waterstop at corners will not be permitted. Tee intersections shall be formed by use of preformed tees.

- F. The forms shall be properly braced and tied together so as to maintain position and shape and to ensure safety to personnel. Forms shall be properly spaced apart with spreaders or spreader ties that provide accurate spreading. The Contractor shall construct all bracing, supporting members and centering of ample size and strength to safely carry all dead and live loads to which they may be subjected, without deflection in any form member in excess of one in 360 where the concrete surfaces are exposed, or in excess of one in 240 elsewhere.
- G. The Contractor shall construct all forms straight, true, plumb and square, within a tolerance horizontally of one in 200 and a tolerance vertically of one in 500.
- H. All forms shall be sufficiently wetted or coated with an approved form oil in accordance with the Manufacturer's recommendations before concrete is placed.

3.2 Plywood Forms.

Plywood form panels shall be nailed directly to studs and applied in a manner to minimize the number of joints. The Contractor shall make all panel joints tight butt joints with all edges true and square.

3.3 Reuse of Forms.

- A. Reuse of forms shall be subject to advance approval of the Engineer. Lumber once used in forms shall have nails withdrawn, and surfaces to be in contact with concrete shall be thoroughly cleaned before being used again.
- B. Except as specifically approved in advance by the Engineer, reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new and shall in no way impart less structural stability to the forms nor less acceptable appearance to finished concrete.
- C. Reuse of forms will not be permitted for forming surfaces requiring a rubbed finish.

3.4 Removal of Forms.

- A. No form or form support shall be removed from the formed surface for at least 24 hours. Forms shall be removed in such a manner as to insure the complete safety of the structure. Vertical wall forms may be removed only after the compressive strength of the concrete has reached a minimum of 70% of its design compressive strength. (i.e. 70% X 4000 psi or 2800 psi).
- B. Responsibility for the removal of forms shall be with the Contractor; however, the following minimum requirements shall be adhered to:
 - 1. In cold or inclement weather the requirement for removal of forms shall be as specified in Section 03300-Cast-in-Place Concrete under "Placing Concrete in Cold or Hot Weather".
 - 2. Forms for supporting weight of concrete shall not be removed nor form supports slackened for a period of 14 days or until the concrete has attained 70% of the specified 28-day compressive strength based on testing of field cured cylinders. The cost of all compressive tests shall be the responsibility of the General Contractor. Testing of the concrete shall be performed at an independent laboratory as directed by the Engineer that is PennDOT

approved.

3. Portions of the structure which will be subject to construction loads or backfill shall have attained sufficient strength to withstand these loads before being so loaded. No construction loads exceeding the structural design loads shall be supported upon any unshored portion of the structure under construction.
- C. The Contractor shall cut nails and tie wires or form ties off flush, and leave all surfaces smooth and clean. The Contractor shall remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.
 - D. The Contractor shall flush with water all holes resulting from the use of spreader rods and sleeve nuts and the solidly pack throughout the wall thickness with cement grout applied under pressure by means of a grouting gun immediately after removing forms. Grout shall be one part Portland Cement to 2 1/2 parts sand.
 - E. In case the Contractor shall remove any form or slacken any supports before the above conditions have been met, the concrete elements may be condemned even though there is no apparent defect.

PART 4 – BASIS OF PAYMENT

4.1 Concrete Formwork – Incidental.

Concrete Formwork is considered incidental to cast-in-place concrete and will not be paid for separately.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 Description.

A. Work includes:

The Contractor shall furnish and install all reinforcement and associated items required and/or indicated on the Drawings for all cast-in-place concrete.

B. Related Sections:

1. Section 03100 – Concrete Formwork
2. Section 03300 - Cast-In-Place Concrete

1.2 Quality Assurance.

In addition to complying with all pertinent codes, standards and regulations, the Contractor shall comply with all standards referenced in these Specifications and applicable portions of the following standards:

- A. "Manual of Standard Practice for Detailing Reinforced Concrete Structures", ACI 315.
- B. "Manual of Standard Practice", Concrete Reinforcing Steel Institute (CRSI).
- C. "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement", ASTM A-615.
- D. "Standard Specification for Cold-Drawn Steel Wire for Concrete Reinforcement", ASTM A-82.
- E. "Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement", ASTM A-185.
- F. "Building Code Requirements for Reinforced Concrete", ACI 318.

1.3 Submittals.

- A. Before any concrete reinforcement materials are delivered to the job site, shop drawings shall be submitted in accordance with Section 01300-Approved Equal Materials and Products and Submittals of these Specifications.
- B. The Contractor shall provide certified mill tests of the reinforcing steel in accordance with the standards referenced in these Specifications sufficient to demonstrate compliance with the requirements set forth herein.

PART 2 - PRODUCTS

2.1 Concrete Reinforcement

All concrete reinforcement materials shall be new and free from rust and shall comply with the following standards:

- A. Bars for reinforcement - ASTM A-615, Grade 60.
- B. Wire Fabric - ASTM A-185.
- C. Dowels - Richmond Dowel Bar Splices.

2.2 Other Materials.

All other materials, not specifically described but required for a complete and proper installation of concrete reinforcement, shall be as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 Fabrication.

- A. Reinforcement shall be accurately formed to the dimensions required. Stirrups, ties, bars and hooks shall be bent around a pin and shall have a minimum bend diameters in accordance with ACI 318. All bars shall be bent cold.
- B. Metal reinforcement shall not be straightened or rebent in a manner that will injure the material. Bars with kinks, or with bends not shown on the Drawings, shall not be used. Heating of the reinforcement will not be permitted.

3.2 Placement.

- A. Metal reinforcement shall be placed in accordance with ACI 318, except as otherwise noted herein, and accurately positioned in accordance with the information on the Drawings. Protective concrete cover and tolerances shall be as required by ACI 318 except as modified herein. Reinforcement shall be secured against displacement by using annealed iron wire ties or suitable clips at intersections and shall be supported by concrete or metal supports, spacers, or metal hangers.
- B. Metal reinforcement before being positioned shall be free from loose mill scale, rust, mud, oil or coatings, including ice, any of which may destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be reinspected and cleaned when necessary.
- C. Clear space shall be preserved between bars of not less than 1-1/2 times the nominal diameter of round bars. In no case shall the clear distance be less than 1-1/2 inches nor less than 1-1/3 times the maximum size of aggregate. Concrete deposited against earth shall have minimum of 3 inches concrete cover between the reinforcement and the earth. Unless otherwise noted, reinforcement shall be placed and maintained at the minimum clear distances given in ACI 318.
- D. Place bars in horizontal members with minimum laps at splices sufficient to develop the strength of the bars. Bars may be wired together at laps except at points of support of the member, at which points the clear space described above shall be preserved. Wherever possible, the splices of adjacent bars shall be staggered, with splices of 30 bar diameters minimum unless otherwise specified on Drawings.
- E. All laps of wire mesh shall be one width of wire spacing, and adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each two running feet. At laps, wires shall be staggered and tied in such a manner that they cannot slip.
- F. The Contractor shall make only those splices that are indicated on the approved shop drawings or specifically approved by the Engineer.

PART 4 – BASIS OF PAYMENT

4.1 Concrete Reinforcement – Incidental. No additional compensation.

Concrete Reinforcement is considered incidental to cast-in-place concrete and will not be paid for separately.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 Description.

A. Work Includes:

Cast-in-place concrete required for the Work is indicated on the Drawings and includes, but is not necessarily limited to: footings and foundations; slabs on grade; concrete equipment bases; etc.; and such other concrete as shown on the Drawings and/or as required by these Specifications or as may be reasonably inferred from either.

1.2 Quality Assurance.

In addition to complying with all pertinent codes, standards and regulations, the Contractor shall comply with all standards referenced in these Specifications and applicable portions of the following standards:

- A. "Specifications for Structural Concrete", ACI 301.
- B. "Recommended Practice for Measuring, Mixing and Placing Concrete", ACI 304.
- C. "Recommended Practice for Hot Weather Concreting", ACI 305.
- D. "Recommended Practice for Cold Weather Concreting", ACI 306.
- E. "Building Code Requirements for Reinforced Concrete", ACE 318.
- F. "Standard Specification for Portland Cement", ASTM C-150.
- G. "Standard Specification for Concrete Aggregates", ASTM C-33.
- H. "Test for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing", ASTM C-88.
- I. "Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate", ASTM C-88.
- J. "Test for Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine", ASTM C-131.
- K. "Standard Specification for Air-Entraining Admixtures for Concrete", ASTM C-260.
- L. "Standard Specification for Chemical Admixtures for Concrete", ASTM C-494.
- M. Deleted.
- N. "Standard Specification for Ready-Mixed Concrete", ASTM C-94.
- O. "Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction", ASTM D-1752.
- P. "Method for Making and Curing Concrete Test Specimens in the Field", ASTM C-31.
- Q. "Test for Compressive Strength of Cylindrical Concrete Specimens", ASTM C-39.
- R. "Method of Sampling Fresh Concrete", ASTM C-172.
- S. "Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete", ASTM C-42.

1.3 Submittals.

A. Materials List.

Before any concrete is delivered to the job site, the Contractor shall submit concrete mix design proportions; certified test results for the proposed mix; a complete list of all materials proposed to be furnished and installed under this portion of the Work, showing Manufacturer's name and catalog number of all items such as admixture and membrane; the name and address of the transit-mix concrete supplier; and sufficient additional evidence that the proposed concrete mix of mixes will meet the requirements set forth herein.

B. Transit-mix delivery slips.

A record shall be kept at the job site showing outdoor temperature, time and place of each pour of concrete, together with transit-mix delivery slips certifying the contents of the pour and that all materials conform to the requirements of these Specifications. The delivery slip shall indicate the mix; maximum size of aggregate; amount of mix water; design strength of the concrete; the time when the mix was made and such other information as may be required by the Engineers. Failure to render such slip to the General Contractor job superintendent shall automatically be cause for rejection of the concrete. The General Contractor's job superintendent shall write on the back of the slip: 1) the time of arrival of the truck mixer on the site; 2) the time of deposit of the concrete from the truck mixer; and 3) the place of deposit of the concrete from the truck mixer. This record shall be made available to the Owner for his inspection upon request. Upon completion of each portion of the Work, the Contractor shall deliver the record and the delivery slips to the Owner. Repeated failure to deliver this information to the Owner may be cause for the Owner to reject the deposited concrete at any time and to require that it be removed and replaced at the Contractor's expense.

PART 2 - PRODUCTS

2.1 Materials.

A. Cement shall be Portland Cement, conforming to ASTM C-150, Type IA, or in the event that field conditions require, and where approved, high-early strength Portland Cement, Type IIIA. All cement shall be obtained from one source. Cement used in the Work shall correspond to that upon which the selection of concrete proportions was based.

B. Aggregates shall conform to ASTM C-33, except as revised herein. Aggregates failing to meet the aforementioned standard, but which have been shown by special test or actual service to produce concrete of adequate strength and durability, may be used when specifically approved by the Engineer. Additional specific requirements for aggregates are as follows:

1. Fine aggregates shall be clean, hard, natural sand. When tested in accordance with ASTM C-117, the weight removed by the test shall not exceed 3%. The amount of coal and clay shall not exceed 0.25% and 1% respectively.
2. Coarse aggregates shall consist of crushed stone or crushed gravel. When tested in accordance with ASTM C-88, the loss shall not exceed 10%, and when tested in accordance with ASTM C-131, the loss shall not exceed 45%.

3. The nominal maximum size of coarse aggregate shall not be larger than one-fifth the narrowest dimension between sides of forms; nor one-third the depth of slabs; nor three-fourths the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, or prestressing tendons or ducts. In no case shall the maximum size exceed 1-1/2 inches. For section of 12 inch thickness or less, the maximum size shall not exceed 1 inch. Coarse aggregate gradations shall conform to ASTM C-33 for the types of concrete being used in this Work as described hereafter.
- C. Water used in mixing and curing concrete shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, organic matter or other deleterious substances. Water shall be approved for human consumption.
 - D. Admixtures to be used in concrete shall be subject to prior approval by the Owner. Air-entraining admixtures shall conform to ASTM C-260. Water reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and retarding admixtures, and water-reducing and accelerating admixtures shall conform to ASTM C-494. Fly ash will not be permitted on this Project. Other pozzolans such as plasticizers used as admixtures shall conform to ASTM C-618. Admixture proportions shall be in strict accordance with the Manufacturer's recommendations and must approved by the Engineer prior to using same.

2.2 Concrete.

- A. For the purposes of this Project, the following minimum criteria for the various classes of concrete shall be established:

<u>Class of Concrete</u>	<u>Compressive Strength</u>	<u>Coarse Aggregate ASTM C-33 Size No.</u>	<u>Bags of Portland Cement Per CY of Concrete</u>
Class A	4,000 psi	No. 467 or 57	6 1/2 Bag Mix

- B. Proportions of materials for concrete shall be established to provide adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement under conditions of placement to be employed without excessive segregation bleeding; to provide resistance to freezing and thawing and other aggressive actions; and to provide conformance with the strength requirements as established by these Specifications. Methods of determining proportions and design mixes shall conform to ACI 318. All concrete, unless otherwise approved, shall be transit-mixed in accordance with ASTM C-94. Concrete shall, unless otherwise specified or approved, be air-entrained conforming to ACI 318. The slump of the concrete mix shall not in any case exceed 3 inches for heavy sections or suspended or at-grade floors, or 4 inches elsewhere.
- C. The use of admixtures will be considered provided that the Contractor submits sufficient evidence that the concrete produced will meet the requirements of these Specifications and that such admixtures are capable of maintaining essentially the same composition and performance throughout the Work as the project used in establishing concrete proportions. Admixtures containing chloride ions shall not be used in concrete containing aluminum embedments if their use will produce a deleterious concentration of chloride ions in the mixing water. The use of fly ash will not be permitted in concrete for this Project.
- D. Concrete shall be Class A at all locations unless otherwise specified. Class B

CAST-IN-PLACE CONCRETE

concrete shall be used in walls and slabs 6 inches or less in thickness; and for closing openings in walls around pipes. Class C concrete shall be used for pipe cradle backfill or as shown on the Drawings.

2.3 Membranes.

- A. All vapor barrier membrane under concrete slabs shall be 6-mil weight sheet plastic in sheet as wide as possible to minimize joints.
- B. All curing membrane shall be sheet plastic as specified for vapor barrier, a combination sheet plastic and paper, or an equal approved in advance by the Engineer.
- C. All cement or tape used for sealing membrane joints shall be only as recommended by the Manufacturer of the membrane being joined.

2.4 Other Materials.

- A. Preformed expansion joint filler shall be a self-expanding cork conforming to ASTM D-1752, Type III as manufactured by Servicised Products Division, W.R. Grace & Co., Sonoflex Cork as manufactured by Sonneborn-Contech, or approved equal.
- B. Epoxy bonding compounds shall be Sikastik 370 as manufactured by Sika Chemical Corporation; Concrevice 1001-LPL or 1180 as manufactured by Adhesive Engineering Company; Sonobond as Manufactured by Sonneborn-Contech; or approved equal. Products shall be suitable for use on horizontal or vertical surfaces as required for the Work and applied in accordance with the Manufacturer's recommendations.
- C. Premixed non-shrink grout shall be Vibro Foil as manufactured by W.R. Grace & Co.; Embeco 636 as manufactured by Master Builders; or approved equal.
- D. Materials for repair of existing concrete surfaces shall be Colma Dur LV, Colma Dur Gel and/or Colma Fix LV as manufactured by Sika Chemical Corporation, similar products as manufactured by American Metaseal Company, or approved equal, and shall be installed in accordance with the Manufacturer's recommendations and the requirements of this Section.
- E. All other materials not specifically described but required for a complete and proper installation of cast-in-place concrete shall be as selected by the Contractor subject to the approval of the Engineer. Materials identified on the Drawings by Manufacturer or product name shall conform to the standard specifications for the particular manufactured product.

PART 3 - EXECUTION

3.1 Preparation.

Preparation of equipment and place of deposits of concrete shall conform to ACI 318 and ACI 614. The Contractor shall notify the Engineer at least 48 hours before placing concrete.

3.2 Mixing and Placing Concrete.

- A. Mixing and placing concrete shall be done in accordance with appropriate portions of ASTM C-94, ACI 318 and/or ACI 304, except as modified or revised by these Specifications.
- B. Before deposition of concrete, all debris shall be removed from the space to be

occupied by the concrete. Forms, if constructed of lumber, shall be thoroughly wetted except in freezing weather. Reinforcement, pipe sleeves and other materials to be embedded in the concrete shall be thoroughly secured in position and cleaned of ice or other deleterious substances. Water shall be removed from the space to be occupied by the concrete before concrete is deposited.

- C. Forms for walls or thin sections of considerable height shall be provided with openings or other devices that will prevent segregation and accumulation of hardened concrete on the forms or on the metal reinforcement above the level of the concrete.
- D. Where concrete is conveyed to chutes, the equipment shall be of such size and design as to insure a continuous flow in the chute. The chutes shall be of metal, or metal-lined, and if two or more lengths are used, they shall have approximately the same slope. The slope shall not be less than one vertical to three horizontal nor more than one vertical to two horizontal and shall be such as to prevent the segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate to prevent segregation. If the distance of the discharge end of the chute above the surface of the concrete is more than 3 times the thickness of the layer being deposited, or more than 4 feet above the surface of the concrete, a spout or "elephant trunk" shall be used, and the lower end maintained as near to the surface of deposit as practical. When the operation is intermittent, the chute shall discharge into a hopper. The chute shall be thoroughly cleaned before and after each run and the debris from any water used shall be discharged outside the forms.
- E. Before depositing new concrete on or against concrete which has hardened and to which it is to bond, the forms shall be re-tightened. The surface of the hardened concrete shall be roughened in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance, and saturated with water. To insure an excess of mortar at the juncture of the hardened and newly deposited concrete, the cleaned and saturated surface, including inclined surfaces, shall be first thoroughly covered with a coating of mortar or neat cement grout against which the new concrete shall be placed before the grout has attained its initial set. Epoxy bonding compound shall be used where new concrete is to be deposited on or against existing concrete surfaces and/or where indicated on the Drawings. It shall be applied in accordance with the Manufacturer's recommendations.
- F. Concrete during and immediately after deposition shall be thoroughly compacted by means of vibration. The number of vibrators used shall at all times be subject to the approval of the Engineer. The concrete shall be thoroughly worked around the reinforcement, around embedded fixtures, and into the corners of the forms. The accumulation of water on the surface of the concrete due to water gain, segregation, or other causes during placement and compacting shall be prevented as far as possible by adjustments in the mixture. Provision shall be made for the removal of such accumulated water so that under no circumstances will concrete be placed in such accumulation.
- G. To minimize the formation of laitance, great care shall be exercised to disturb the concrete as little as possible while it is being deposited. Upon completion of a section of concrete, all laitance shall be entirely removed before Work is resumed.

The Contractor shall submit to the Engineer, prior to start of Work, the details of procedures he proposes to use to minimize and control the development of shrinkage cracks.

- H. Sufficient time must elapse after depositing concrete in the walls for the walls to obtain sufficient strength before depositing concrete in beams, girders, or slabs supported thereon. Beams and girders shall be considered as part of the floor system and shall be placed monolithically therewith.

3.3 Sampling and Testing Requirements.

- A. The Contractor shall provide and pay for sampling and testing of the concrete incorporated into the Work by an approved Independent Testing Laboratory (ITL). All test results must be furnished to the Engineer within five (5) days following the date of testing. Failure to submit test results in accordance with this provision will be deemed sufficient cause for the Engineer to reject the respective concrete incorporated in the Work.
- B. One test shall be made for each pour and each 25 cubic yards of concrete placed. The laboratory shall maintain records showing brands of cement, brand and quality of admixtures, time and location of the batch form which the test was made, air content, slump and compressive strength. The laboratory shall supply the test cylinders, slump cones, field technicians and all equipment necessary for performance of field and laboratory testing specified herein.
- C. One strength test shall consist of four field specimens, one (1) specimen for testing at seven (7) days, one (1) specimen for testing at fourteen (14) days, and two (2) specimens for testing at twenty-eight (28) days. The samples for strength tests shall be taken in accordance with ASTM C0-172. Cylinders for acceptance tests shall be molded and laboratory cured in accordance with ASTM C-31 and tested in accordance with ASTM C-39. Each strength test result shall be the average of two cylinders from the same sample tested at seven (7), fourteen (14), and twenty-eight (28) days.
- D. When the frequency of testing will provide less than five strength tests for a given class of concrete, test shall be made from five randomly selected batches or from each batch if fewer than five are used. When the total quantity of a given class of concrete is less than 50 cubic yards, the strength tests may be waived by the Engineer if, in his judgment, adequate evidence of satisfactory strength is provided.
- E. Strength tests of specimens cured under field conditions in accordance with ASTM C-31 may be required by the Engineer to check the adequacy of curing and protection of the concrete in the structure. Such specimens shall be molded at the same time and from the same samples as the laboratory-cured acceptance test specimens. Procedures for protecting and curing the concrete shall be improved when strength of field-cured cylinders at the test age designated for measuring specified strength (f_c) is less than 85% of that of the companion laboratory-cured cylinders. When the laboratory-cured cylinder strengths are appreciably higher than specified strength (f_c) the field-cured cylinder strengths need not exceed f_c by more than 500 psi, even though the 85% criterion is not met.

- F. Non-compliance and/or non-satisfactory strength test results shall be determined by the Engineer and/or Contractor and such information will be relayed expeditiously to the concrete supplier and confirmed promptly in writing. Test results of concrete furnished subsequent to such notification shall comply or a second warning will be issued. Non-compliance after two warnings will be sufficient cause to refuse additional concrete from the non-complying concrete supplier.
- G. Reinstatement of a disqualified concrete supplier may be permitted only upon certification by an independent qualified engineer, retained by the concrete supplier and acceptable to the Engineer, attesting to the fact that adequate corrective measures have been taken. Failure after this point will result from the job. Any additional cost resulting therefrom will be the responsibility of the General Contractor.
- H. Should individual test of laboratory-cured specimens produce strengths more than 500 psi below specified strength (f_c), or should tests of field cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. If the likelihood of low strength concrete is confirmed and computations indicate that the load-carrying capacity may have been significantly reduced, tests of cores drilled from the area in question may be required in accordance with ASTM C-42. Three cores shall be taken for each cylinder test more than 500 psi below specified strength (f_c).

If the concrete in the structure will be dry under service conditions, the cores shall be air-dried (temperature 60°F to 80°F., relative humidity less than 60%) for 7 days before the test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and then tested wet.
- I. Concrete represented by the core tests will be considered structurally adequate if the average of the three cores is equal to at least 85% of specified strength (f_c) and if no single core is less than 75% of f_c . To check testing accuracy, locations represented by erratic core strengths may be retested. If these strength acceptance criteria are not met by the core tests, and if structural adequacy remains in doubt, the Engineer may order load tests for the questionable portion of the structure, or take other appropriate action, which may include the complete replacement of the defective portion.
- J. Costs of all sampling and testing as specified herein shall be paid for by the Contractor.

3.4 Placing Concrete in Cold or Hot Weather.

- A. When the temperature of the surrounding air is below 40°F or above 90°F, concrete placement shall be performed in accordance with the provisions of ACI 306 or ACI 305, respectively, except as modified or revised by these Specifications.
- B. During cold weather, the concrete shall be maintained at a temperature of 55°F for Class B concrete and 50°F for Class A or Class C concrete for a minimum of five days after placing. During this period concrete and adjacent form surfaces shall be kept moist at all times. When heated enclosures are to be provided, care shall be taken to provide adequate space around the other edges and top of the concrete structure to permit circulation of the heated air, so that neither freezing nor excessive heating of these extremities can occur. All facilities for protection and

heating must be on hand before the concrete is placed.

- C. After the required protection period is over, the heat shall be removed gradually and uniformly so that there will be a temperature differential of no more than 40°F over any 24-hour period.
- D. Forms shall not be removed from the concrete surface during the protection period of three (3) days during those seasons of the year when the difference between the daily high and low temperatures may reasonably be expected to exceed 40°F.
- E. At air temperatures of 90°F or above, concrete should be kept as cool as possible during placing and curing. Concrete surfaces shall be kept continuously moist by wet-curing for at least 24 hours after the concrete has been placed and water shall be applied to formed surfaces while forms are still in place. After the period of wet curing, a suitable heat-reflecting plastic membrane or white-pigmented curing compound may be used.

3.5 Defective Concrete.

- A. Defective concrete is defined as concrete, in place which does not conform to the strength, shapes, alignments or elevations as shown on the Drawings and/or which presents faulty surface areas.
- B. All defective concrete shall be removed and replaced in a manner meeting with the approval of the Engineer or, should only surface imperfections occur, may be patched at the discretion of and in a manner satisfactory to the Engineer; however, permission to patch the Work shall not be considered as a waiver of the Owner's right to require complete removal and replacement of such defective concrete should the patching fail to satisfactorily restore the required quality and/or appearance of the surface.
- C. Surface defects that require replacement or repair are those that consist of honeycomb; damage due to stripping forms; loose pieces of concrete; surface holes caused by bolts and ties; excessive ridges at form joints; and bulges due to movement of the forms. Ridges and bulges shall be removed by chipping, tooling or grinding on finished surfaces. Honeycomb and other defective concrete shall be chipped out and filled with mortar, the chipped openings having sharp edges and shaped so that the mortar filling will be keyed in place. All holes shall be kept thoroughly moistened for several hours before mortar filling is placed.
- D. Imperfections, bolt and tie-rod holes, and chipped-out honeycomb areas to be repaired shall be filled with drypatching mortar composed of one part of Portland Cement to two parts of regular concrete sand (volume measurement) and just enough water so that, after the ingredients are mixed thoroughly, the mortar will stick together on being molded into a ball by slight pressure of the hands, and not exude free water. Mortar repairs shall be placed in thin layers thoroughly compacted by suitable tools. Care shall be taken in filling rod and bolt holes so that the entire depth of the hole is completely filled with compacted mortar. "Embeco", or equal, shall be added to all patching mortar in an amount as recommended by the Manufacturer for the mix to be used except for unpainted, exposed surfaces.

3.6 Construction Joints.

The Contractor shall make and locate construction joints so as not to impair the strength of the structure. The Contractor shall obtain the Engineer's approval of the locations of all

construction joints and control joints in the Work prior to the start of concrete placement.

3.7 Concrete Finishing.

- A. All concrete surfaces shall be finished as specified as soon after the placing of concrete and removal of forms as conditions will permit. All patching and pointing shall be performed immediately after the forms have been removed and rubbing of concrete surfaces shall be performed as soon as possible thereafter.
- B. All exposed formed concrete surfaces on the interior of structures or on the exterior of structures or appendages from the top to a depth of 1 foot below finished grade shall receive a rubbed finish. Unless otherwise specified, all other formed concrete surfaces shall be pointed with mortar as described herein and shall be pointed with mortar as described herein and shall have all fins and projections in excess of 1/8 inch removed. Form ties shall be removed to a depth of a least 1 inch beneath the surface and all air bubbles, cavities, stone pockets, honeycombing and tie and bolt holes shall be pointed with mortar. The mortar mix shall be determined by trial to obtain a good color match with the concrete when both the patch and concrete are cured and dry.

The amount of mixing water shall be the minimum possible consistent with the requirements for handling and placing the mortar. Fins, form marks, projections and uneven spots shall be removed by rubbing or grinding and surfaces left smooth, dense and free of grain marking and bulges or depressions more than 1/8-inch in 4 feet. When the mortar pointing has set and when rubbed finish is required, the entire exposed surface shall be thoroughly covered with water and rubbed with a carborundum brick or other approved means to remove all blemishes and provide a smooth finish of uniform texture and appearance.

- C. Unless otherwise indicated, the tops of all exposed walls or steps and all slabs or flat unformed concrete surfaces shall be struck off to establish grade and floated with a wood float until all irregularities are removed, as a minimum, to produce a relatively smooth, level and even textured surface without sharp ridges. All interior floors, platforms and flume bottoms which are exposed to view shall receive a steel trowel finish once all excess water has evaporated from the floated surface. Tolerance from finish surface lines shall be a maximum of 1/8-inch in 10 feet with maximum high and low variances not occurring in less than 20 feet and with 1/16-inch tolerances in any one running foot with no abrupt variations. Floors shall slope uniformly to floor drains where they are provided.
- D. Additional finishing shall be provided as required in Division 9 for those surfaces which are to receive paints or protective coatings, damproofing and other treatments, and be in accordance with the recommendations of the coating Manufacturer.
- E. All concrete stairs, steps, platforms, landings and sidewalks shall receive an application of 1/2-pound per square foot of silicon carbide grit. Surfaces receiving grit shall be finished with a wood float to provide a non-skid walking surface.

3.8 Concrete Curing.

- A. Protection against loss of moisture from the surface of the concrete shall be accomplished by keeping the surface continuously wet. One of the following methods shall be used: surface remaining in contact with the form; the covering

with burlap or motton mats kept continuously wet and covered with polyethylene plastic; or continuous sprinkling of the expose surfaces.

- B. No curing compounds shall be used on any surfaces to which pneumatic mortar is to be applied, or on which any other type of concrete mortar, paint or chemical waterproofing coating is to be used unless they are compatible with the intended coating and approved by the Engineer. In addition, curing compounds shall not be used on any concrete which will be used to store potable water.
- C. During cold or hot weather, curing shall be as specified under "Placing Concrete in Cold or Hot Weather".

3.9 Repair of Existing Concrete Surfaces.

- A. All existing surfaces, particularly those to be painted and/or surfaces roughened or damaged by demolition, cutting or patching shall be patched and/or repaired as required to produced a uniform surface suitable for the application of coatings and in accordance with the coating manufacturer's recommendations. Non-shrinking grout shall be used to fill all holes in existing surfaces; holes left due to the removal of existing equipment and facilities; or holes made as required for the installation of new equipment for the facilities. The methods of patching and/or repairing shall conform to the recommendations of the Manufacturer of the patching compounds or sealers used.

PART 4 – BASIS OF PAYMENT

- 4.1 Cast-in-Place Concrete – Incidental. No additional compensation will be provided for Cast-in-Place Concrete. The cost associated with Cast-in-Place Concrete shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 05500

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included:

1. All miscellaneous metal items not specifically described in other Sections of these Specifications but required for a complete and operable facility.

1.02 QUALITY ASSURANCE

A. The Contractor shall use only certified welders and the shielded arc process for all iron and steel welding performed in connection with the Work of this Section. All aluminum welding shall be done in accordance with the standards of the Aluminum Association.

B. Codes and standards:

In addition to complying with all pertinent codes and regulations, the Contractor shall comply with:

1. "Specification for the Design, Fabrication, and Erection of Structural Steel for Building" of the American Institute of Steel Construction.
2. "Code for Welding in Building Construction" of the American Welding Society.
3. Standards and Publications of the Aluminum Association:
 - a. Aluminum Standards and Data.
 - b. Designation System for Aluminum Finishes.
 - c. Standards for Aluminum Sand and Permanent Mold Castings.
 - d. Standards for Anodized Architectural Aluminum.
 - e. Welding Aluminum.
 - f. Care of Aluminum.

1.03 SUBMITTALS

A. Shop drawings:

Before any miscellaneous metal is delivered to the job site, the Contractor shall submit Shop Drawings to the Engineer for approval in accordance with Section 01300 of these Specifications and shall show all locations, markings, quantities, materials, sizes and shapes and indicate all methods of connecting, anchoring, fastening, bracing, and attaching to the Work of other trades.

B. Proof of compliance:

Upon completion of this portion of the Work, and as a condition of its acceptance, the Contractor shall deliver to the Engineer a letter signed by an official of the

miscellaneous metal fabricating and installing firm or firms certifying that all miscellaneous metal was furnished and installed in complete accordance with the Drawings and with this Section of these Specifications.

PART 2 - PRODUCTS

2.01 STEEL PRODUCTS

- A. Steel tubing - new, free from rust, and conforming to ASTM A-501 (hot formed), welder or seamless.
- B. Structural steel shapes and plates - new, free from rust, and conforming to ASTM A-36.

2.02 ALUMINUM PRODUCTS

- A. Aluminum sheet and plate - Alloy 6061-T6, mill finish.
- B. Aluminum extruded structural shapes, anchors, clips - Alloy 6061-T6, mill finish.
- C. Aluminum stop plates:

Aluminum stop plate guides shall be fabricated of Alloy 6061-T6. Guide frames shall have aluminum shop anchors welded to the frames for embedment in concrete.

2.03 FASTENINGS

- A. The Contractor shall furnish all bolts, nuts, screws, clips, washers and any other fastenings necessary for proper erection of all items provided.
- B. Fastenings shall, in general, match adjacent materials in color, finish and appearance and shall conform to the following:
 - 1. For ferrous metal - new, free from rust and conforming to ASTM A-307.
 - 2. For aluminum - Alloy 2024-T3 or 6061-T6 except concealed fasteners shall be Alloy 2024-T3 or 300 Series Stainless Steel.
- C. Where exposed screws are required, they shall be Phillips flat head and countersunk unless otherwise noted.
- D. Expansion Bolts:
 - 1. Bolts shall be "Wej-It" concrete anchors as manufactured by Wej-It Corporation, Broomfield, Colorado, or "Taper Bolt" as manufactured by U.S. Expansion Bolt Company, York, Pennsylvania, or approved equal. Self-drilling expansion anchors where called for on the plans shall be "Red Heads" as manufactured by ITT, Phillips Drill Division, Michigan City, Indiana. Contractor shall submit certified test reports establishing shear and tensile loads for the anchors used.

2. Bolts shall be the same material as the members which they support, that is, Type 2024-T6 Alloy for aluminum shapes and hot-dipped galvanizes steel for structural steel shapes. Stainless steel bolts shall be used in all process units.

2.04 MISCELLANEOUS ITEMS

- A. The Contractor shall furnish and install all miscellaneous metal items as indicated on the Drawings or as reasonably implied to provide a complete and suitable installation.
- B. Structural steel frames shall be constructed to sizes indicated using rolled shapes and/or plates as detailed. All frames shall be square, corners mitered or coped as required, all intersections fully welded and ground flush. Wall and sill anchors shall be included for construction indicated. Removable spreaders shall be provided at sill to maintain alignment and dimensions: remove after frames are securely anchored in place.

2.05 SCHEDULE OF MATERIALS

All items furnished and installed under this Section shall be steel, unless indicated otherwise on the Drawings or in these Specifications.

PART 3 - EXECUTION

3.01 FABRICATION

- A. The Contractor shall fabricate all miscellaneous metal in strict accordance with the approved Shop Drawings and the referenced standards. Insofar as possible, the Contractor shall shop-prefabricate all items complete and ready for installation.
- B. Welding:
 1. Unless otherwise indicated on the Drawings, the Contractor shall weld all shop connections. Welds shall be uniformly made and ground smooth to match and with finish of adjacent parent material.
 2. All joints and intersections of metal shall be tightly fitted and securely fastened.
 3. All Work shall be square, plumb, straight, true, rigid and neatly trimmed out. Corners and angles of exposed moldings and frames shall be mitered unless otherwise indicated.
 4. All aluminum welding shall be done by the inert gas, shielded arc or fluxless resistance techniques. Structural welds shall be made by qualified welders and shall conform to the general recommendations and regulations of the referenced

Aluminum Association publications. Dirt, grease, lubricant, or other organic material shall be removed by vapor degreasing or suitable solvent. Joints rejected because of welding defects may be repaired only by rewelding. Defective welds shall be removed by chipping or machining. Flame cutting shall not be use.

- C. The Contractor shall drill or punch all holes required for the attachment of Work of other trades and for bolted connections. Burned holes are not acceptable.

3.02 SHOP PAINTING AND PROTECTIVE COATINGS

- A. The Contractor shall thoroughly clean all metal as described in Section 09800 of these Specifications and shall provide all required protection for metal to be encased in concrete to prevent accumulation of deleterious foreign material.
- B. The Contractor shall shop prime steel except steel to be encased in concrete; surfaces to be welded; contact surfaces to be high strength bolted; and steel Work which will be concealed by interior finish. Primer paint shall be in accordance with Section 09800 of these Specifications.
- C. Galvanizing shall conform to ASTM A-123 for rolled, pressed and forged shapes, plates, bar stripe; A-153 for hardware items and A-368 for assembled steel products. Galvanizing shall also conform to ASTM A-384 and A-385 (Recommended Practices) pertaining to galvanizing assembled steel products. Unless otherwise permitted, all galvanizing must be done after fabrication, in largest sections practicable. Where galvanizing is removed by welding or other assembly procedure, touch-up abraded areas with molten zinc or zinc-rich paint.
- D. Where aluminum is placed in contact with or fastened to dissimilar metals (excepting galvanized steel, zinc, or small areas of stainless steel or nickel silver), the contact surfaces shall be treated by one of the following methods. If drainage from dissimilar metals passes over aluminum work, the dissimilar metal shall be painted as specified in Item 1 below.
 - 1. Apply prime coat of zinc chromate primer (Fed. Spec. TT-P-645) to the dissimilar metals followed by one or two coats of aluminum metal and masonry paint.
 - 2. Apply a coat of bituminous paint (Fed. Spec TT-C-494 or MIL-P-6883A) to the dissimilar metals.
 - 3. Separate contact surfaces with transparent vinyl plastic pressure tape or approved non-absorptive gaskets.
- E. Where aluminum is placed in contact with, or built with, or will receive drainage from masonry, including lime mortar, concrete or plaster, apply a heavy coat of bituminous paint (Fed. Spec. TT-C-494 or MIL-P-6883A) to the aluminum areas affected.

3.03 GENERAL REQUIREMENTS

- A. Expansion and Contraction: Work shall be so designed and anchored that there will be no objectionable distortion or serious stress of fastenings as the metal expands and contracts.
- B. Castings subject to foot or street traffic shall have bearing surfaces machined to prevent rocking and rattling.
- C. Where items must be incorporated or built into adjacent Work, they shall be delivered

to trade responsible for such Work in sufficient time that progress of Work is not delayed. The Contractor shall be responsible for proper location of such items.

- D. All dissimilar metals shall be protected from galvanic corrosion by pressure tapes, coatings or isolators as specified herein.
- E. All grouting of frames, plates, sill, bolts, and similar items shall be done with non-shrink grout.
- F. The Contractor shall get all railings and similar items shown or required to be set in sleeves or cans with molten lead or Carlstadt Anchor Cement or equal. Unless otherwise noted, sleeves shall be sized for approximately 1/4-inch clearance all around. Where railings are designated to be removable, they shall be securely set in sleeves or cans and held in place with suitable gasketed flanges which shall provide a strong, non-rocking installation firmly bolted or otherwise fastened in place. They shall be removable only in the sense that such removal will possibly be required for unusual maintenance activities and shall not be readily removable by quick disconnect devices or slip removal means. They shall be essentially vandal-proof with special keyed fastenings or similar devices.

3.04 ERECTION

- A. The Contractor shall erect and install all miscellaneous metal in strict accordance with the Drawings, the approved Shop Drawings, and the referenced standards, aligning straight, plumb, and level within a tolerance of one in 200.

PART 4 – BASIS OF PAYMENT

- 4.01 Miscellaneous Metals – Incidental. No additional compensation will be provided for Miscellaneous Metals. The cost associated with Miscellaneous Metals shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 06000

CARPENTRY AND MILLWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included:

The Contractor shall provide all labor, supervision, material and equipment necessary to furnish and install all carpentry and millwork shown on the Drawings, and as herein specified, including but not limited to the following:

1. All rough carpentry as shown, indicated, or noted on the Drawings.
2. Wood grounds, blocking and furring.
3. All framing hardware, anchors, clips and fasteners required to erect, fasten and hold all rough hardware.
4. All required drilling, tapping, or other means of fastening woodwork to metal or masonry.
5. All millwork as indicated on the Drawings.
6. Pipe enclosures.
7. Temporary enclosures.
8. Temporary protection of finished work.

1.02 APPLICABLE SPECIFICATIONS

- A. The grades of materials used under this Section shall be defined by the rules of the recognized as of lumber Manufacturers producing the materials specified herein and used in the Work. Where grades of lumber are specified, it shall mean that the best quality of that particular grade shall be required.
- B. "Grade Mark", "Trade Mark" or "Mill Identification Mark" of the Associations having jurisdiction shall appear on each piece of standard yard dimension lumber (not boards), except that shipments may be accompanied by a certificate of inspection identifying the shipment and certifying compliance with the requirements of this Specification. This certificate of inspection shall be issued by an agency authorized to grade by the Manufacturers' association recognized as responsible for the grading rules of the species involved.
- c. All millwork shall conform to the quality standards of the Architectural Woodwork Institute for Premium Grade Work. Finished woodwork shall be dressed and sanded, free from machine and tool marks, abrasions, raised grain or other defects on surfaces exposed to view in the finished work. Exposed wood surfaces shall be uniform in color and grain.

- D. Grading and general requirements for lumber shall conform to American Lumber Standards "Simplified Practice Recommendation R-16"; and Federal Specifications MM-L-751C for Lumber and Timber, Soft Woods. The grading rules of the following shall also govern:
 - 1. Southern Pine.....Southern Pine Association
 - 2. White Pine (Northern Pine).
 - 3. Idaho White Pine.....Western Pine Association
 - 4. Douglas Fir West Coast Lumberman's Assn.
 - 5. Western Hemlock West Coast Lumberman's Assn.
 - 6. Plywood, Douglas FirAmerican Plywood Assn.
 - 7. Plywood, HardwoodsU.S. Plywood Corp.
 - 8. Domestic Hardwoods.....Nat'l Hardwood Lumber Assn.
 - 9. Miscellaneous Nat'l Woodwork Mfgr's Assn.
- E. All lumbers shall conform to materials design specifications for stress grade lumber and its fastenings of the American Standards Simplified Practice Recommendations, R-16, latest edition.
- F. Plywood shall conform to grades of the Department of Commerce Publication CS 35-49.

1.03 GENERAL REQUIREMENTS

- A. Pinus ponderosa shall not be accepted as a substitute for Northern or Idaho White Pine.
- B. Trim in connection with operable walls shall be plain sawn solid stock of yellow birch - "Natural". Plywood face veneer shall be rotary cut yellow birch "Natural".
- C. All framing materials shall be No. 1 dimensioned Douglas Fir or equal. Lumber shall not contain more than 12% moisture.
- D. Interior finish lumber and millwork shall be Grade "A" all kiln dried, white pine finished as called for on finish schedule with a maximum moisture content of 12%.
- E. All construction lumber shall be air-dried to a moisture content not to exceed 19% for 90% of each shipment and not to exceed 22% for the remaining 10%. Kiln-dried lumber meeting the moisture content requirements for air-dried lumber may be used in lieu of the air-dried lumber.
- F. All materials for finished work shall be free from knots and other imperfections.

1.04 STORAGE AND PROTECTION

- A. All lumber and plywood materials, when delivered to the site, shall be piled to insure proper drainage and ventilation. Suitable provisions to prevent excessive absorption of moisture and provide protection from the elements shall be made.
- B. Millwork and finished woodwork shall be protected against dampness during and after delivery and shall be stored in well-ventilated spaces and where not exposed to extreme changes in temperature and humidity.

- C. Materials shall not be stored directly on concrete slabs or cement floors. Supports to keep material at least 6 inches above the floor. Finished or finishing material shall not be stored below grade or in unventilated spaces.

PART 2 - PRODUCTS

2.01 LUMBER

- A. Framing Lumber, joists, studs, plates and bracing shall be Western Hemlock, Douglas Fir, or Southern Pine, construction grade.
- B. Grounds shall generally be 3/4" x 2" unless otherwise shown on Details or as required.
- C. Blocking lumber:
 - 1. Lumber of blocking, nailing strips, etc. shall be No. 1 common fir or Southern Pine. Materials shall be S4S and dressed to size.
 - 2. All lumber for blocking, nailing, strips, etc., concerned with roofing work and roof openings shall be kiln dried and pressure-treated with salt preservative, chromated zinc chloride or tanalith in accordance with American Wood Preserver's Association Specification P-5 to a minimum retention of 0.35 lb. per cu. ft. of wood. Redwood and cypress need not be treated.
- D. Lumber shall be surfaced on four sides to conform to Simplified Practice Recommendation SR-16, current. Sizes stated in these Specifications are nominal sizes unless otherwise noted.

2.02 ROUGH HARDWARE

- A. General:
 - 1. All rough hardware and metal fastening, except for blocking, required for proper installation or carpentry and millwork shall be included. Nails, spikes, screws, bolts and similar items shall be of sizes and types to rigidly secure members in place.
 - 2. Miscellaneous anchors shall be best quality and of the proper size to securely anchor the Work in place.
- B. Blocking rough hardware:

Nails, bolts, connectors, etc. shall be galvanized and sized for proper fastening.

PART 3 - EXECUTION

3.01 ERECTION GENERAL

- A. The Contractor shall layout, cut, fit and erect framing for rough and finished work, blocking, nailers, furring and all other rough carpentry and cutting Work in connection with carpentry and finish for other trades. All carpentry shall be set straight, plumb, level and in true alignment. All Work shall be neatly fitted and rigidly fastened into place with sufficient nails, spikes, screws and bolts as necessary. Defects which render any piece or part unable to serve its intended purpose shall be discarded or, if in place, cut out and replaced. Joints shall be tight

and so formed as to conceal shrinkage.

- B. Workmanship shall be of the best quality and all joints shall be tight and secure. Openings shall be formed where required for other trades and all necessary blocking, nailing strips, protections, etc., shall be provided and secured.
- C. Lumber and millwork delivered to site shall be protected from the effects of heat, moisture and weather.
- D. The Contractor shall take measurements and fit the Work correctly and shall introduce filler pieces of otherwise attempt to remedy unsatisfactory installation. The Contractor shall do all Work in proper sequence and cooperate with other trades and other contractors in preparing proper surfaces for their installation, where required.
- E. The Contractor shall back prime all exposed woodwork items herein provided, both for painted and natural finish and before delivering these materials to the site and after trimming or fitting, reseal immediately so that no raw wood is left exposed. This includes cuts made in the Work for hardware items.
- F. All nailing shall be done in accordance with acceptable building practice. All trim and finished hardware shall be installed in strict accordance with the details of the Drawings. Joints shall be made in an approved manner to conceal shrinkage and be tight. Hardware shall be installed in accordance with the outlined procedures of the hardware Manufacturer.
- G. Permanent or temporary grounds shall be provided wherever required to provide proper fastening of all carpentry, forming, metal and other Work.
- H. Wood supporting or contacting all millwork, finish carpentry and custom woodwork shall be of type and dryness that will not affect the finish.
- I. The Contractor shall protect all masonry inclined to damage during Work, including edges of copings, sills, concrete steps, platforms and similar items. Such protective covering shall be removed when directed and special precautions as masonry openings and corners of the building shall be taken.
- J. Wood centering or other necessary supports for openings in masonry walls shall be accurately and strongly made, properly braced and secured into position until masonry has thoroughly set.
- K. All bracing, supports and shoring required to support construction during the formative stages shall be provided.
- L. The Contractor shall treat all grounds, blocking, plates, curbs, exterior wall furring or any woodwork that is subject to dampness or in contact with masonry or concrete with an approved non-staining preservative complying with Federal Specification TT-W-570, latest issue.
- M. The Contractor shall furnish and install rough framing for door openings; blocking around metal windows; furring as required for thin-coat plastering; blocking and rough framing for cabinets, mullion trim, ceiling trim. See drawings of special sizes of material required and for full extent of rough carpentry.

- N. The Contractor shall furnish and install all required block at fascias, windows, gravel strips, cants, nailing strips, frames and blocking for louver, and ducts to receive metal Work.

3.02 FINISHED MILLWORK

- A. Finished woodwork shall be properly framed, closely fitted and accurately set to the required lines and levels and rigidly secured in place.
- B. The Contractor shall make joints in woodwork tight, formed to conceal shrinkage. Interior corners shall be coped and external angle joints shall be mitered. All joints shall be mitered except where shown to be butt-jointed, in which case an approved device to prevent separation shall be used.
- C. The Contractor shall make the minimum number of splices in running finish, beveled and jointed where solid fastening can be made. Butt joints in running finish will not be permitted.
- D. All millwork shall be carefully put up in the best and most rigid manner, straight, plumb, level and in true alignment; shall be neatly and accurately fitted and scribed; and shall be thoroughly secured. Mitered or other fitted joints shall be planed and sanded. Nails and screws, where possible, shall be concealed. All nails shall be blind-nailed wherever possible, otherwise the nailing shall be located and driven so as not to be visible in the finish. Nail and screw heads exposed in the Work shall be countersunk except where nature or thickness of the wood does not permit. Face screws shall be countersunk and plugged with matching wood.
- E. All Work shall be left clean and free from warp, twist, open joints and other defects. The Contractor shall neatly scribe around pipes and other obstructions to fit the Work and furnish and install fillers as necessary.
- F. All cutting and repairing of this work for the accommodations of the Work of others shall be done as part of the Work of this section unless otherwise specified.
- G. All millwork, trim and finish shall be primed and back painted thoroughly with lead and oil. All built-in surfaces of millwork, which will be concealed after erection, shall be protected with two coats of aluminum paint.
- H. Grilles, register faces and like items applied to woodwork will be supplied under other Sections but shall be finally set and installed under this Section. the Contractor shall furnish and install all metal items such as angles, braces, lintels, clips, plates and stiffeners required in the construction and installation of the millwork items. All metal items exposed in the finished Work shall be smooth, without burrs or irregularities. Screws or bolts shall be countersunk.
- I. The Contractor shall not deliver millwork to any part or section of the building until all concrete, cement, thin-coat plastering, tile masonry and other similar Work has been completed and is thoroughly dried out; outside door openings are made watertight; exterior windows are glazed; and, in case of temperatures dropping below 60°F., until temporary heat and ventilation has been supplied. Millwork shall not be delivered in foggy, rainy or otherwise damp weather.

3.03 CLEAN-UP

The Contractor shall keep the Work site clean and free from rubbish, debris and all non-construction materials, and shall upon notification by either the Engineer or Owner, immediately remove any accumulation thereof. Should the Contractor fail to promptly remove such material, the Owner may have the material removed by others and the cost concurred thereby deducted from monies due or to become due the Contractors.

PART 4 – BASIS OF PAYMENT

4.01 Carpentry and Millwork – Incidental. No additional compensation will be provided for Carpentry and Millwork. The cost associated with Carpentry and Millwork shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included:

The Contractor shall furnish and install all flashing and sheet metal not specifically described in other Sections of these Specifications but required to prevent penetration of water through the exterior shell of the building. This includes, but is not limited to, roof flashing, wall flashing, counter flashing, and other masonry openings, aluminum caps, and such other Work as shown on the Drawings or required herein.

1.2 QUALITY ASSURANCE

In addition to complying with all pertinent codes, standards and regulations, the Contractor shall comply with all pertinent recommendations contained in "Architectural Sheet Metal Manual", latest revision, of the Sheet Metal and Air Conditioning Contractors National Association, Inc.

1.3 SUBMITTALS

Before any flashing and sheet metal is delivered to the job site, the Contractor shall submit complete Shop Drawings of all flashing and sheet metal proposed to be furnished and installed to the Engineer in accordance with Section 01300 of these Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS AND GAUGES

Where sheet metal is required and no material or gauge is indicated on the Drawings, the Contractor shall furnish and install the highest quality and lowest gauge commensurate with the referenced standards.

2.4 OTHER MATERIALS

A. All fastenings shall be of stainless steel.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. All sections shall be installed plumb, straight, square, level and in proper elevation,

FLASHING AND SHEET METAL

plane, location and alignment with other Work. All workmanship and finishes shall be first-class in every particular, strictly in accordance with the best practices. All work shall be complete in every detail and finished work shall be approved by the Engineer before the job will be accepted. Field connections and erection shall be made with stainless steel fasteners. All internal and external angles shall be fabricated and erected as fully closed miters all along the profile of the miters and then ground smooth to form a neat hairline jointure. The Contractor shall finish watertight and weathertight at all locations.

- B. The Contractor shall furnish the Engineer with shop drawings of installations showing all details, sections, miters, cover plates and erection around all buildings for approval before commencing the work.

3.2 EMBEDMENT

The Contractor shall embed all metal in connection with roofs in a solid bed of caulking, using materials and methods described in these Specifications.

3.4 PROTECTIVE COATING OF ALUMINUM

- A. Where aluminum cap comes in contact with wood or metal incompatible with aluminum, the Contractor shall keep aluminum surfaces from direct contact with such parts by painting the dissimilar metal or wood with a coat of heavy-bodied bituminous paint. The Contractor shall also paint aluminum surfaces in contact with concrete and other masonry materials with alkaline-resistant coatings, such as one coat of heavy-bodied bituminous paint or two coats of water-white methacrylate lacquer.

3.5 TESTS

Upon request of the Engineer, the Contractor shall demonstrate by hose or standing water that all flashing and sheet metal is completely watertight.

PART 4 – BASIS OF PAYMENT

- 4.1 Flashing and Sheet Metal – Incidental. No additional compensation will be provided for Flashing and Sheet Metal. The cost associated with Flashing and Sheet Metal shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 07610**ARCHITECTURAL METAL ROOFING**

PART 1 - GENERAL

1.01 DESCRIPTION

A. General

1. Furnish all labor, material, tools, equipment, and services for all preformed as indicated, in accordance with provisions of Contract Documents.
2. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation; included but not limited to: preformed sheet metal panels, related accessories, valleys, hips, ridges, eaves, corners, rakes, miscellaneous flashing and attaching devices.
3. Install drip edge at all outer edging and necessary flashing at all other edges.

1.02 QUALITY ASSURANCE

A. Applicable Standards:

1. SMACNA: "Architectural Sheet Metal Manual" Sheet Metal and Air Conditioning Contractors National Association, Inc.
2. AISC: "Steel Construction Manual" American Institute of Steel Construction.
3. AISI: "Cold Form Steel Design Manual" American Iron and Steel Institute.
4. ASTM A792-89: Standard Specification for Steel Sheet, Aluminum Zinc Alloy Coated by the Hot Dip Process, General Requirements.
5. ASTM A527-90: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, Lock-Forming Quality.
6. ASTM A526-90: Standard Specification for Steel Sheet, Zinc, Coated (Galvanized) by the Hot Dip Process, Commercial Quality.
7. ASTM A446-91: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, Structural (Physical) Quality.

B. Manufacturer's Qualifications:

1. Manufacturer has a minimum of three (3) years experience in manufacturing panels of this nature in a permanent, stationary, indoor production facility.

C. Installer's Qualifications:

1. Installation of panels and accessories by installers with a minimum of three (3) years experience in panel projects of this nature.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit complete shop drawings and erection details to Engineer for review. Do not proceed with manufacture prior to review of shop drawings. Do not use drawings prepared by Engineer for shop or erection drawings.
2. Shop Drawings show methods of erection, elevations, and plans of roof panels, sections and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with all materials not supplied and proposed identification of components parts and their finishes.

B. Samples:

1. Submit samples and color strips for all proposed finishes.
 - a. Submit two (2) color chip samples in color selected by the Engineer.
 - b. Submit results indicating compliance with minimum requirements of the following performance tests:
 1. Wind Uplift - U.L.90

C. Warranty(s):

1. Metal panel manufacturer, upon final acceptance for project, furnish a warranty covering bare metal against rupture, structural failure, and perforation due to normal atmospheric corrosion exposure for a period of 20 years.
2. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking, and fading for a period of twenty (20) years.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver panels to job site properly packaged to provide protection against transportation damage.

- B. Handling: Exercise extreme care in unloading, storing, and erecting panels to prevent bending, warping, twisting, end and surface damage.
- C. Storage: Store all materials and accessories above ground on well skidded platforms. Store under waterproof covering. Provide proper ventilation to panels to prevent condensation buildup between each panel.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Panel Profile:

1. 1-3/4 in high rib x 16 in. wide standing seam panel.

All accessory items such as soffit, fascia, gutters, and downspouts shall be provided by the same manufacturer as the metal roof panel system. All of this trim and accessories shall match in color and material.

B. Panel Style:

1. Narrow rib, vertical leg, concealed fastener, positive snap lock standing seam, utilizing male and female rib configurations, with factory applied hot melt mastic in female rib.
2. Narrow rib, concealed fastener, positive snap lock standing seam, utilizing male and female rib configurations.

C. Gauge:

1. 26 gauge (#UL-90 Rated – Underwriters Laboratories.)

D. Substrate:

1. Galvalume steel sheet, 0.55 ounces/square foot, minimum yield of 50,000 psi.

E. Clip:

1. 18 gauge UL-rated clip with two fasteners to structural UL-90 rated – Underwriters Laboratories.

F. Texture:

1. Smooth.

G. Safety

1. Snow guards mounted completely around building on all downslopes.

H. Finish:

1. Premium fluorocarbon coating produced with Kynar-500 or Hylar 5000 resin (20 year warranty).

I. Color:

1. Color as specified on Drawings, or as specified by the Owner and/or Engineer.

J. Acceptable Manufacturers:

1. Metal Sales Manufacturing Corp., Jefferson, Ohio; Union Corrugating Company, Fayetteville, NC; Steelo Systems, Mason, OH, or equal.

2.02 FABRICATION

- A. Roll form panels in continuous lengths, full length of detailed runs.

- B. Fabricate trim, flashing and accessories to detailed profiles.

- C. Fabricate trim and flashing from same material as panel. This includes all soffit, fascia, ridge vent, gutters, and downspouts.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.
2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.
3. Examine plywood or metal deck to ensure proper attachment to framing.
4. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves or projections, level to +/- 1/4" in 20', and properly sloped to valleys and/or eaves.
5. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
6. Verify deck is dry and free of snow or ice. Flutes in steel deck to be clean and dry or joints in wood deck to be solidly supported and nailed.

- B. Discrepancies:
 1. In event of discrepancy, notify Engineer.
 2. Do not proceed with installation until discrepancies have been resolved.

3.02 INSTALLATION

- A. Install panels so that they are weathertight, without waves, warps, buckles, fastening, stresses or distortion, allowing for expansion and contraction. Any panels having dents, chips, or other defects will be rejected by the Engineer.
- B. Install panels in accordance with manufacturer's instructions and shop drawings.
- C. Provide concealed anchors at all panel attachment locations.
- D. Install panels plumb, level, and straight with seams and ribs/battens parallel, conforming to design as indicated.
- E. Assure that all roof penetrations are sealed to manufacturer's specifications.

3.03 CLEANING, PROTECTION

- A. Dispose of excess materials and remove debris from site.
- B. Clean work in accordance with manufacturer's recommendations.
- C. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Engineer, any work that becomes damaged prior to final acceptance.
- D. Touch up minor scratches and abrasions.

The Contractor shall furnish and install all flashing and sheet metal not specifically described in other Sections of these Specifications but required to prevent penetration of water through the exterior shell of the buildings. This includes, but is not limited to, wall flashing, counter flashing, covering of exposed steel flanges, sills at glass block panels and other masonry openings, aluminum caps, flashing over glass block panels and doors, and such other Work as shown on the Drawings or required herein.

PART 4 – BASIS OF PAYMENT

- 4.1 Architectural Metal Roofing – Incidental. No additional compensation will be provided for Architectural Metal Roofing. The cost associated with Architectural Metal Roofing shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

ARCHITECTURAL METAL ROOFING

SECTION 07900

CAULKING AND WEATHERSTRIPPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included:

1. The purpose of caulking and weather-stripping in this Project is to provide a positive barrier against penetration of air and moisture at joints between items where caulking is essential to continued integrity of the barrier.
2. Such caulking and weather-stripping will normally be performed under the Work of various Sections of these Specifications but shall be performed in strict accordance with the provisions of this Section.

B. Related Work described elsewhere:

Individual requirements for caulking and weather-stripping are described in various other Sections of these Specifications and/or shown on the Drawings.

PART 2 - PRODUCTS

2.01 CAULKING AND WEATHERSTRIPPING MATERIALS:

- A. Caulking compounds - Sonolac ready-to-use acrylic latex compounds as manufactured by Sonneborn Building Products.
- B. Or Approved Equal.

2.02 CAULKING EQUIPMENT

All caulking equipment shall be only such equipment as is specifically recommended by the Manufacturer of the caulking material being installed.

PART 3 - EXECUTION

3.01 CHOICE OF CAULKING MATERIAL

The Contractor shall use only that caulking material which is best suited to the installation and is so recommended by the caulking material Manufacturer.

3.02 BACK-UP MATERIALS

- A. The Contractor shall verify the compatibility of filler material with caulking before installation and shall use filler about 1/3 to 1/2 wider than width of joint so sufficient pressure is exerted by filler to provide substantial resistance to displacement.
- B. All filler materials shall be non-oily, non-staining back-up filler such as polyethylene foam rod, expanded polyurethane, neoprene, or other filler completely compatible with the caulking material.

3.03 APPLICATION OF CAULKING

- A. Joints and spaces shall be clean and dry prior to caulking. All sides of joints shall be caulked, except where glass or metal shall be primed prior to caulking. Joints more than 3/4 inch deep shall be packed with an approved backing to within 1/2 inch of the surface prior to applying caulking.
- B. The Contractor shall install caulking in strict accordance with the Manufacturer's recommendations, taking care to produce beads of proper width and depth, to tool as recommended by the Manufacturer, and to immediately remove all surplus caulking.
- C. Joints shall be completely filled and caulking shall have a smooth and even finish, free of wrinkles. All caulked joints shall be completely watertight.
- D. Materials adjacent to caulked joints which become soiled shall immediately be cleaned.

3.04 CAULKING SCHEDULE

The Contractor shall carefully study the Drawings and furnish and install the proper caulking at each point where called for on the Drawings, plus at all other points where caulking is essential to maintaining the continued integrity of the airtight or watertight barrier. This includes, but is not limited to, all junctions between masonry and windows, doors, grilles, louvers, vents, sleeves and all openings in exterior walls. In addition, all openings through the floors of the building and roof penetrations for piping, conduit, equipment operators, ventilation ducts and other items are to be caulked air-tight around the perimeter of these openings unless other measures, such as the installation of special gaskets, are specifically called for on the Drawings.

3.05 WEATHERSTRIPPING

All exterior doors shall be provided with weather-stripping, properly installed per manufacturer's recommendations.

PART 4 – BASIS OF PAYMENT

- 4.01 Caulking and Weatherstripping – Incidental. No additional compensation will be provided for Caulking and Weatherstripping. The cost associated with Caulking and Weatherstripping shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 08100**METAL DOORS AND FRAMES****PART 1 - GENERAL****1.01 DESCRIPTION****A. Work included:**

The metal doors and frames required for this Work are indicated on the Drawings and include overhead garage doors and both insulated and hollow metal doors and frames.

1.02 QUALITY ASSURANCE

In addition to complying with all pertinent codes, standards and regulations, the Contractor shall:

- A. In guarantee and shop drawings, comply with nomenclature established in American National Standards Institute publication A123.1-1967, "Nomenclature for Steel Doors and Steel Door Frames".
- B. Provide doors and frames of construction and design having the approval of Factory Mutual Engineering Division and passing the requirements of ASTM E-152. Certificates of compliance shall be furnished in accordance with Section 01300 - Submittals.
- C. Assure that the finish on all doors and frames shall be capable of passing a 200 hour Salt Spray Test and a 200 hour Humidity Test as certified by an independent testing laboratory and in accordance with Federal Standard 141, Methods 6061 and 6201. Certificates of compliance shall be submitted in accordance with Section 01300 - Submittals.

1.03 SUBMITTALS

Before any metal doors and frames are delivered to the job site, submit shop drawings of all metal doors and frames to the Engineer for review and approval in accordance with the provisions of Section 01300 of these Specifications.

PART 2 - PRODUCTS**2.01 METAL DOORS**

- A. All metal doors and frames shall be the product of one Manufacturer. Design is referenced to products of Wayne Dalton of Lewisville, TX. Steelcraft, Inc., of Cincinnati, OH. Republic Building Products, McKenzie, TN, and Amweld Building Products, LLC, Garrettsville OH are equal. Equal products will be acceptable as substitutes provided the submittals required under this Section of these

Specifications conclusively prove the equality of the substitute to the satisfaction of the Engineer. Door accessories, including weather seals, weather-stripping, thresholds, louvers, panic hardware, etc., shall be furnished as shown on the Door Schedule and in accordance with these Specifications.

- B. All metal doors shown on the Drawings shall be of welded seamless design in 16 gauge hot-dipped galvanized (both sides) sheet steel and shall be properly reinforced for the finish hardware described in Section 08700 of these Specifications. Face sheets as well as lock and hinge edges shall have a smooth and unbroken surface.
- C. Doors shall be chemically washed, rinsed and dried prior to receiving one primer coat at least 1.5 mils in thickness. Finish coats shall be factory-applied in a standard color as selected by the Engineer.
- D. Templates shall be secured from the finish hardware supplier and all finished hardware shall be accurately installed, or provisions made for, at the factory.

2.02 METAL FRAMES

- A. All metal frames shall be accurately fabricated to match the doors to be installed in them.
- B. All metal frames shall be the types and sizes shown on the Drawings, 14 gauge hot-dipped galvanized (both sides) sheet, and shall be properly reinforced for the finish hardware described in Section 08700 of these Specifications.
- C. Frames shall be chemically washed, rinsed and dried before receiving one shop coat of baked-on metallic primer. Finish coats shall be factory-applied in a standard color as selected by the Engineer.

2.03 GARAGE DOORS

Garage doors for the proposed Building shall be Thermacore Insulated Door, Series 591, as manufactured/supplied by the Overhead Door Co. of Pittsburgh (Clopay Building Products and Wayne-Dalton Corp. Mt. Hope, OH are equals) and as specified below:

Sizes: 10 ft. (w) x 8 ft. (h); Qty. = 2
 Color: By Owner
 Panel
 Thickness: 2" (exterior steel thickness = .016")
 Insulation: Clipped-in-place, R-Value = 7.64
 Operator: Model SEL + Plus with Drawbar, 1/3 HP, 115 V, single phase
 Track: 2" Standard with support angles as required.
 Required
 Options:

- Push-Button Control Station (1 per door)
- Radio Receiver with 3 channel transmitter (1 per door)
- Pneumatic Bottom Sensing Edge
- Thermal Glazing (3 per door)
- Flexible Vinyl Jamb Seal

General Contractor shall supply 2" x 12" lumber framing around each door opening for mounting door track, etc.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The Contractor shall install all metal doors and frames in strict accordance with all pertinent codes and regulations, the approved shop drawings, and the manufacturer's recommendations, anchoring all components firmly in position for long life under hard use.

- B. The Contractor shall install all finish hardware in strict accordance with the manufacturer's recommendations, eliminating all bound conditions and making all items smoothly operating and firmly anchored into position.

PART 4 – BASIS OF PAYMENT

- 4.01 Metal Doors and Frames – Incidental. No additional compensation will be provided for Metal Doors and Frames. The cost associated with Metal Doors and Frames shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

SECTION 08700

FINISH HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included:

1. Unless otherwise approved by the Engineer, the Contractor shall furnish and install all finish hardware described in the Door Schedule and as shown on the Drawings and all other finish hardware not described but required for a complete and operable facility.

B. Related Work described elsewhere:

1. Metal Doors and Frames Section 08100

1.02 SUBMITTALS

- A. Before any finish hardware is ordered or purchased for this Work, the Contractor shall submit to the Engineer for his approval a complete list of all finish hardware proposed to be furnished for this Work, giving Manufacturer's name, catalog number, copies of Manufacturer's dimension drawings, catalog cuts, material specifications and related data for each item. This shall in no way be construed as permitting substitutions of items for the items specified. All submittals, and resubmittals if necessary shall be made in accordance with the provisions of Section 01300 of these Specifications.
- B. Prior to installation, the Contractor shall deliver to all installing personnel complete recommendations from the Manufacturers regarding installation methods.

PART 2 - PRODUCTS

2.01 FASTENINGS

- A. The Contractor shall furnish all finish hardware with all necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use.
- B. The Contractor shall furnish fastenings where necessary with expansion shields, toggle bolts, hex bolts, and other anchors approved by the Engineer, according to the material to which the hardware is to be applied and the recommendations of the hardware Manufacturer.
- C. All fastenings shall harmonize with the hardware as to material and finish.

2.02 ACCEPTANCE MANUFACTURERS

Catalog numbers used in the Door Schedule are of products of Steelcraft, Inc., Cincinnati, Ohio. All finish hardware shall be either the hardware specifically described or an equal product approved by the Engineer. Products manufactured by Steelcraft, Inc. of Cincinnati, OH. or approved equal.

2.03 OTHER MATERIALS

All other materials, not specifically described but required for a complete and proper installation of finish hardware, shall be new, first quality of their respective kinds, and subject to approval of the Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

Hardware shall be installed in strict conformance with the Manufacturer's recommendations. Door locks and cylinders shall be set up for the Owner's existing master keying system. Three (3) keys shall be provided for each door lock.

PART 4 – BASIS OF PAYMENT

4.01 Finish Hardware – Incidental. No additional compensation will be provided for Finish Hardware. The cost associated with Finish Hardware shall be included in the Lump Sum price bid for the items specified in the Bid Schedule.

END OF SECTION

ELECTRICAL WORK – GENERAL

SECTION 16010

PART 1 – GENERAL

1.1 CONTRACT DOCUMENTS

- A. The Contract Drawings and these Specifications are complementary; each to the other, and any labor or material called for by either whether or not by both, or necessary for the successful operation of any of the particular types of equipment furnished under this Contract, shall be furnished, and installed.
- B. The Contract Drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the work included. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without extra cost to the Owner.
- C. The Contractor shall familiarize himself with the other sections of these specifications in order that he may know the electrical requirements of these sections and be prepared to furnish all electrical work and materials required for equipment under those sections.
- D. The numbers of conductors shown on the Contract Drawings are not necessarily the correct numbers required. As many conductors as required in each case shall be installed.

1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish all labor and materials and perform all work necessary for proper completion, operation and use of the electrical systems as herein specified and as shown on the Contract Drawings.
- B. It is the responsibility of the Contractor that the system is balanced, phased-out, tested, adjusted, fully protected, and coordinated.
- C. The work shall include, but not necessarily be limited to, furnishing, and installing the following items:
 - 1. Identification (cables, conduit & equipment)
 - 2. Support Structures
 - 3. Raceways and Wire
 - 4. Duct Banks
 - 5. Boxes
 - 6. Grounding

7. Electrical Service
 8. Distribution Equipment
 9. Motor Controllers
 10. Junction Boxes
 11. Lighting and Lighting Controls
 12. Panelboards
 13. Emergency Generator
 14. Automatic Transfer Switch
 15. Safety Switches
 16. Circuit Breakers
 17. Custom Controls
 18. Gas Monitoring
 19. Smoke / Heat Detectors
 20. Concrete Work for Electrical
- D. Furnish and install all components of the listed systems as specified and indicated on the drawings.

1.3 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Electrical equipment shall be protected from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage, and construction.
- B. Should any apparatus be subjected to injury by water, it shall be dried out thoroughly and put through a special dielectric test as directed by the manufacturer, at the expense of the Contractor, or shall be replaced by the Contractor without additional charge.
- C. Electrical equipment shall also be protected from dust, dirt, debris, etc. by suitable care and/or covering until the work is completed and turned over to the Owner. If any damage is caused by exposure to these hazards, the equipment shall be repaired, cleaned, painted, or replaced, as necessary, without additional charge to restore it to its proper condition.
- D. The Contractor shall take necessary precautions to protect his materials and equipment from damage. After completion of his work, the Contractor shall clean all electrical equipment and enclosures inside and out.

- E. The manufacturer shall package all materials for delivery to the job site to prevent damage during shipment, handling, and storage prior to installation.
- F. All materials including conduit shall be stored in a clean dry building or trailer. Materials shall not be stored on the ground with plastic cover to shed the elements.
- G. Storage or installation of electrical equipment inside buildings or structures prior to completion of a watertight roof is not acceptable. Conduit may be installed if all open ends are sealed watertight at the end of each day's work.

1.4 COORDINATION

- A. These specifications and accompanying drawings are mutually explanatory and anything required by one but not by the other shall be considered as required by both. Where the requirements differ or are contradictory between the various parts of the specifications, different drawings, or parts of drawings or between the drawings and the specification, the more restrictive (larger size, greater rating, more options, etc.) shall apply.
- B. Drawings indicate diagrammatically the desired arrangement and the approximate location of principal conduit, wiring, apparatus, and equipment. Runs of conduit and locations of equipment are shown distorted on drawings to avoid confusion. The Contractor shall verify measurements, access openings dimensions, equipment space requirements, etc., on the job site. The entire installation shall be made in a manner to avoid obstructions, to preserve headroom, keep openings clear and to overcome local difficulties and interference with structural conditions and with other trades.
- C. If installed work interferes with the work of others, it shall be corrected by the Contractor.
- D. Pre-occupation of a space by a Contractor does not give the Contractor the right to the space. All work must be coordinated with other Contractor's and trades in advance of installation.
- E. The work under this section of the Specifications shall be performed so that the progress of the entire project, including all trades, shall not be delayed nor interfered with. Material and equipment shall be installed as fast as conditions will permit.
- F. The electrical work shall be coordinated with the other trades to avoid any conflicts of equipment. Any conflicting conditions shall be resolved with the Engineer before installation.

1.5 EQUIPMENT INTERFACE COORDINATION

- A. The plans and schematic drawings show the required control connections and interfaces between the various control panels and devices, however, during the construction process some products may be substituted by the General/Mechanical Contractor, the manufacturer may change his product, etc.
- B. The Contractor shall be responsible for coordinating with the General/Mechanical Contractor and for reviewing all submittals to verify that they conform to the electrical

requirements of other devices to which they are connected. Where discrepancies are noted, the Contractor shall:

1. Inform the General/Mechanical Contractor so that the proper equipment will be supplied, OR
2. Where the equipment specified will not work properly, inform the Engineer prior to final shop drawing review to allow changes to make the devices compatible.
3. Provide necessary materials and equipment to interface the incompatible devices. Added materials will require the approval of the Engineer. All costs shall be borne by the Contractor.
4. After equipment and materials have arrived on the job site, the Contractor shall be responsible for all materials and work required for proper interface and operation.

1.6 TEMPORARY ELECTRICAL

- A. The Electrical Contractor shall furnish and install all necessary electrical distribution equipment for the project. The Contractor shall provide temporary electrical power distribution and lighting as required to meet all applicable codes and to properly complete the work.
- B. All temporary electrical work shall meet the requirements of NFPA 241, NFPA 70 (National Electrical Code) and the applicable sections of the Federal Department of Labor, Occupational Safety and Health Regulations for Construction as contained in the latest revision of Federal Register, Volume 36.
- C. The Contractor shall remove and dispose of all temporary facilities upon completion of the project.

1.7 QUALITY ASSURANCE

- A. All material shall be new and shall conform to the standards of the Underwriter's Laboratories, Inc., in any case where such a standard has been established. In case of assemblies, the components shall be Underwriter's Laboratories, Inc. listed for use as an integral part. In addition, all materials shall conform to applicable NEMA, ANSI, and Federal Specifications requirements.
- B. The entire installation shall be made in conformance with the requirements of the latest publications of:
 1. National Fire Protection Association (NFPA)
 2. National Electrical Code (NEC)
 3. National Electrical Safety Code (NESC)
 4. National Electric Manufacturers Association (NEMA)

5. Institute of Electrical and Electronic Engineers (IEEE)
 6. Occupational Safety and Health Administration (OSHA)
 7. Applicable state and local codes and ordinances.
- C. The Contractor shall coordinate with the local inspection authority, throughout the course of the construction, to make sure that all installation methods and materials meet the inspection authority's requirements.
- D. After completion of all work, the Contractor shall have the installation inspected and certified by the local inspection authority. Any rework necessary to obtain approval shall be at the expense of the Contractor.
- E. The Contractor shall pay all charges and fees associated with inspection and certification of the electrical work.

1.8 CODES

- A. All work shall be executed in strict conformance to the requirements of the latest edition of the following codes and standards:
1. National Electrical Code
 2. National Bureau of Standards Handbook H-30
 3. State and Local Codes, and all other authorities having jurisdiction
 4. Underwriters' Laboratories, Inc.
 5. American National Standards Institute, Inc.
 6. Institute of Electrical and Electronic Engineers
 7. National Electrical Manufacturer's Association
 8. National Board of Fire Underwriters
 9. Insulated Cable Engineers Association
 10. International Electrical Testing Association
 11. American Society for Testing Materials and Specifications
 12. Federal Department of Labor Occupational Safety and Health Standards as contained in the latest revision of Federal Register Volume 36.
 13. National Fire Protection Association

- B. If the Contractor performs any work contrary to any of the above codes and regulations, he shall be held fully responsible for such violations and shall assume any and all costs arising therefrom to conform to them.

1.9 PERMITS AND FEES

- A. The Contractor shall obtain all permits, pay all fees, and furnish the Engineer with evidence of the permits before commencing the Contract work. A certificate of inspection shall be submitted, properly executed, to the Engineer prior to final acceptance of the work. Certificates shall be issued from inspection agencies acceptable to the local electrical utility, local municipality, County, State, or any other governing body having jurisdiction. Required certifications may include electrical permits/inspections or fuel storage tank registrations.

1.10 OBTAINING INFORMATION

- A. The Contractor shall obtain detailed information from the manufacturers of the equipment that he is to furnish and install, as to the proper method of installation. Shop drawings of all equipment shall be examined for service and outlet locations. Any conflict shall be brought to the attention of the Engineer for resolution. Failure to do so prior to installation will require the Contractor to make changes at his own expense as may be required by the Engineer.

1.11 SHOP DRAWINGS

- A. Submittal procedures of Shop Drawings shall be in accordance with other Sections of these Specifications.
- B. The Contractor shall prepare and submit shop drawings for the Division 16 work. Submit shop drawings for all electrical equipment and materials furnished, including basic items such as wire, conduit, boxes, etc.
- C. Detailed shop drawings, catalog cuts, and specifications shall be submitted to the Engineer for approval. Each shop drawing submitted shall be accurately identified as to the exact location and usage. Shop drawings shall include the following minimum information:
 - 1. Complete construction details including dimensions, materials, and finishes
 - 2. Diagrams or illustration showing physical characteristics
 - 3. Performance data
 - 4. Description of operation
 - 5. Name of laboratory by which item will be labeled, certified, or listed
 - 6. Where applicable, wiring diagrams showing the connections of all components of related equipment, including but not limited to the following:
 - a. Motor Control Centers, Starters, Circuit Breakers, and Overloads

- b. Panelboards, Circuit Breakers, Panelboard Cards
 - c. Disconnects and Safety Switches
 - d. Transformers
 - e. Wire, Cable, and Control Wire
 - f. Conduit
 - g. Control Panels, Instrumentation and Control Devices
- D. Make the corrections indicated on the returned shop drawings and resubmit corrected copies for final review, furnishing such other copies that may be needed. No work shown on shop drawings shall be started until they have been returned with no exceptions taken.
- 1. Samples of any particular items shall be submitted for examination, when required by the Engineer.
 - 2. No substitution of materials shall be permitted except where such approval is given by the Engineer in writing.
 - 3. All control and wiring diagrams shall be complete with the following information (as applicable):
 - 4. Sequence of operation.
 - 5. Sequence of interlocking.
 - 6. Operation of alarms.
 - 7. Terminal numbers.
 - 8. Identification of all devices in the circuit.
 - 9. Location of all devices in the circuit.
 - 10. Manufacturer's data (make and model) on all devices in the circuit.
 - 11. All other such pertinent information pertaining to system components, control functions, and wiring requirements.
- E. The Contractor shall prepare and submit detailed layout drawings for all work to be built-in and other portions of the work requiring dimensional coordination with other Contractors.
- F. The manufacturer's data shall include ratings, dimensions, model numbers, options, etc., to allow for a review to determine conformance with the contract documents.
- G. Prior to forwarding submittals for review, the Contractor shall verify that the equipment proposed interfaces properly with all associated devices such as control panels, panel boards, electric power source, etc.

1.12 JOB SITE DOCUMENTS

- A. The Contractor shall keep up to date at a central job site location a complete set of prints, specifications, shop drawings, job correspondence, etc. including all change orders and modifications. These documents shall be neatly indexed and filed and shall be available on the job site for use by the Contractor's personnel and for examination by the Engineer.
- B. The prints shall be corrected daily to show every change from the original plans and specifications. Changes shall be made in red ink. This set of prints shall be used by the Contractor as a reference in the preparation of the as-built documents. See RECORD DOCUMENTS for as-built drawing requirements.

1.13 TESTING

- A. Provide any tests of equipment, wiring or insulation deemed necessary by an inspection department or by the Engineer and provide all apparatus, meters, materials, and labor required to make such tests. Remove any material or equipment that is found to be defective during the tests and replace it at no additional cost to the Owner.
- B. Test all equipment which is furnished to this Contractor by other parties in the presence of an authorized representative of such part to determine whether or not the operation is satisfactory, and that the equipment performs the function intended.

1.14 INSTRUCTIONS

- A. The Contractor shall thoroughly instruct the Owner's representative in the proper operations of all systems. The manufacturer's representatives and other skilled personnel necessary shall be retained as long as necessary for the purpose.
- B. The Contractor shall collect three (3) sets of complete instructions for operation and maintenance of all equipment, spare parts lists, fixtures, line per wire diagrams, and systems for all pieces of equipment furnished under this Contract.
- C. Bind the data in a commercial quality 8 1/2 x 11-inch three-ring binders with cleanable hardback plastic covers. When multiple binders are used, correlate data into related consistent groupings. Identify each binder with typed or printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", list title of Project and identify subject matter of contents. Prepare Table of Contents for each binder; arrange content by system and suitably indexed. Upon conclusion of the work, deliver three (3) sets of binders to the Owner.

1.15 IDENTIFICATION

- A. The equipment nameplates shall identify the name of the equipment, and the control or the usage of the device.
- B. Submit a type written list of nameplates for approval before ordering. All nameplates shall be exclusively as described above.

- C. Refer to paragraph 2.2 for additional requirements.

1.16 LOCAL CONDITIONS

- A. All cutting and patching shall be done in a thoroughly workmanlike manner.
- B. The Contractor shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship material in sections sized to permit passing through such restricted areas in the building.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All materials shall be new, of first quality, and shall conform to the standards of the following:
 - 1. Underwriter's Laboratories, Inc.
 - 2. National Electrical Manufacturer's Association
 - 3. Insulated Cable Engineers Association
 - 4. American National Standards Institute
 - 5. Institute of Electrical and Electronics Engineers
 - 6. American Society of Testing Materials
- B. In every case where such a standard has been established for the particular type of material in question. Where no specific make of materials, apparatus and/or equipment is mentioned hereinafter, any first-class product of reputable manufacturer may be used provided such product conforms to the Contract Drawings and Specifications and has a written approval of acceptance by the Engineer.
- C. Where there is more than one item of similar equipment required under this Contract, all such similar equipment shall be the product of one manufacturer.
- D. All articles shall have the name or trademark of the manufacturer and rating in volts and amperes or other proper units marked where they can be observed readily after the device is installed.
- E. Defective equipment or equipment damaged in the course of delivery, installation or test shall be replaced or repaired in a manner meeting the approval of the Engineer.
- F. Where equipment is identified on the drawings or in these specifications as stainless steel, the grade of stainless steel shall be ASTM 316. Enclosures identified as NEMA Type 4X shall be 316 stainless steel unless otherwise noted.

2.2 IDENTIFICATION

- A. Each panelboard, disconnect switch, starter, control station, control panel, instrument, transmitter, etc. shall be labeled to indicate the name of the equipment controlled, load served, designation letter, voltage, and phase, etc. The final wording shall be submitted for review by the Engineer.
- B. Tags and labels required in paragraph "A" above shall be engraved laminated phenolic plastic type with 1/2" high white letters on a black background. The tags and labels shall be permanently attached to the various devices. (I.e., rivets, screws, etc.) The method used for attachment shall not reduce or diminish the environmental rating of the equipment or its enclosure.
- C. All equipment shall be appropriately labeled to warn of potential safety hazards.
- D. Each automatic electric motor or other automated electrical device with moving parts shall have a sign installed by the Contractor, warning of automatic remote starting.
- E. See specific Sections for additional identification requirements.

2.3 GUARANTEE

- A. The equipment manufacturer's warranties shall be passed on to the Owner. Should any defects appear within the Correction Period, the Contractor shall repair or replace said defects or any damage to building or contents caused by defective workmanship or equipment and shall make immediate adjustments at no cost to the Owner.
- B. The Contractor shall furnish maintenance and callback service for the equipment provided by him during the Correction Period. This service shall include regular examinations of the installation by competent and trained employees of the Contractor, and shall include all necessary adjustments, cleaning, supplies, and parts to keep the equipment in good operation, except parts made necessary by misuse or accidents not caused by the Contractor.

PART 3 – EXECUTION

3.1 GENERAL

- A. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance when completed.
- B. The Contractor shall verify door swings and the exact location and mounting heights of all devices, etc. with the Engineer before installation. Any work installed contrary to or without approval of the Engineer shall be subject to change as directed by the Engineer and no extra compensation will be allowed therefor.
- C. Surface-mounted panel boxes, junction boxes, conduit, etc. shall be supported by spacers to provide a clearance (approximately 1/4") between the wall/back panel and the equipment.

- D. The Contractor shall check the load balance on the phases of the various systems and reconnect where necessary as approved by the Engineer to provide equal division of the loads between the phases of the various systems.

3.2 INSTALLATION STANDARDS

- A. The installation of all materials and equipment for the electrical work shall comply with the "National Electrical Contractors Association Standard of Construction". All work shall be completed in a neat, thorough, clean, and workmanlike manner.
- B. Installation of materials shall comply with the manufacturer's recommendations.
- C. The Contractor shall supply all auxiliary equipment, frames, supports, connectors, terminals, access panels, and other devices required for proper installation and operation of equipment furnished and installed by him.
- D. Concrete anchors shall be expansion type or sleeve type anchors installed according to the manufacturer's instructions.
- E. Plastic anchors, self-tapping concrete screws, and powder-actuated fasteners are not acceptable and shall not be used for the support of any permanently installed equipment.

3.3 SEQUENCE OF WORK

- A. The Contractor shall review the overall construction requirements and schedule his work to coordinate with the work of the General/Mechanical Contractor and the requirements of all Divisions of the specifications.

3.4 PHASE IDENTIFICATION

- A. Wires 8 AWG and smaller shall have continuous colored outer covering per the table below.
- B. Wires 6 AWG and larger shall be identified at all periods of termination by colored, gummed, or plastic tape applied to the wires per the table below.

<u>Applicable System Voltage</u>	<u>Phase A (L1)</u>	<u>Phase B (L2)</u>	<u>Phase C</u>	<u>Grounded</u>
208 V, 3 phase, 4 wire	Black	Red	Blue	White
480 V, 3 phase, 4 wire	Brown	Orange	Yellow	Gray
240 V, 1 phase, 3 wire	Black	Red	N/A	White

- C. Equipment ground conductors shall be green.
- D. The same colors shall be used for the same phases throughout the entire project.
- E. Color coding for multi-conductor or control cables shall comply with the ICEA, E-2 color sequence.
- F. Bus bars in switchboards, motor control centers, and panelboards shall be properly identified by the color codes specified for the various voltages.

- G. Every coil or reel of wire shall bear the manufacturer's name, the Underwriters' label, type, voltage, size, length, and manufacturing date, and shall be delivered to the job in original containers for inspection. Wire shall be manufactured in the USA.

3.5 EQUIPMENT LOCATIONS

- A. In control room areas all receptacle outlets, wall switches and associated conduit shall be concealed in the wall construction, however, other equipment and conduit/wiring must be surface mounted. All equipment specifically designed for surface mounting shall have surface conduit regardless of the location.
- B. Equipment locations shown on the drawings may change due to interference problems, equipment design, etc. The Contractor shall verify the locations of devices and equipment installed by other Contractor's prior to final rough in. Adjust conduit layouts as required to compensate for changes.

3.6 ACCESS TO EQUIPMENT

- A. All devices and equipment shall be located to provide NEC required access for operation, maintenance, and repair. Access shall be from the floor without the use of ladders except for devices that must be concealed above a ceiling. The equipment locations shall be reviewed with the work of other trades and contracts to verify that adequate working space will remain after all equipment is installed.
- B. Where devices and equipment are installed in non-accessible ceilings or wall construction, flush mounted access panels shall be furnished and installed by the Contractor. Where equipment is installed by the Contractor in attics, crawl spaces and the like, the Contractor shall provide lighting, 120 VAC power receptacles where none exist.
- C. Where equipment locations shown on the drawings deny adequate access, the Contractor shall notify the Engineer to allow for review and adjustment of the location.

3.7 CONCRETE WORK FOR ELECTRICAL

- A. The Electrical Contractor shall complete all concrete work required by the electrical drawings including but not limited to:
- B. Housekeeping pads under the motor control centers, generators and other electrical equipment supplied under the electrical work.
- C. Foundations for transformers or buildings supplied by the electrical contract.
- D. Bases for support structures where a building or other suitable mounting structure is not available, including light pole bases.
- E. Repair and patchwork associated with any electrical equipment installation or demolition.
- F. Electrical duct banks.

- G. All concrete work shall comply with the requirements of the CONCRETE division of the General/Mechanical specifications.

3.8 SUPPORT STRUCTURES

- A. The Contractor shall provide support structures for mounting electrical control panels and other equipment where there are no buildings or other structures suitable for mounting and support of equipment and where shown on the drawings.
- B. Where there are no support structures shown on the drawings, the support structures shall be fabricated by welding aluminum angle as required for proper support of the various panels, equipment and conduit runs. The aluminum angle dimensions shall be L3" x 3" x 3/16" for structures with horizontal dimensions of 36" or less and L4" x 4" x 1/4" for structures with horizontal dimensions greater than 36". A 1/4" thick aluminum equipment mounting plate shall be welded to the angle structure. Base plates shall be 12" x 12" x 3/4" with welded connections and four 1/2" stainless steel anchor bolts on each leg.
- C. Where a support structure is located in an area where a concrete base (i.e., floor) does not exist, a concrete foundation shall be provided at each leg of the support structure. The foundations shall consist of a 20" diameter by 48" deep reinforced concrete shape (minimum) extending 2" above grade or as shown on the drawings.
- D. Where a support structure is located in area where a concrete base is available, each leg shall be securely anchored into the concrete with suitable anchor bolts extending at least four inches into the concrete on top of a concrete grout pad to keep the base at least two inches above the concrete.
- E. The dimensions of the support structure shall be as required to mount the equipment on one side and shall provide 20% spare mounting space to accommodate future changes. Minimum sizes are shown on the drawings.
- F. Where support structures are fabricated from structural channel (i.e., Unistrut®), all ends of the channel shall be fitted with metal end caps manufactured from the same materials as the channel. End caps are not required in locations above 8' above the finished floor. The intention of the end caps is to minimize the potential for injury to personnel.
- G. After all equipment, conduit and wiring are installed, the Contractor shall ensure that all support devices are adequately braced. Additional bracing and stiffeners shall be installed, as necessary.

3.9 SLEEVE OPENINGS, CUTTING AND PATCHING

- A. The Contractor shall provide all sleeve holes and other openings through any part of the various buildings and structures.
- B. The Contractor shall be responsible for all cutting and patching required to accommodate his work.
- C. Structural members and tank walls shall not be cut without consent from the Engineer. Patching shall match the original conditions.

3.10 EQUIPMENT TERMINATIONS

- A. The Contractor shall coordinate and ensure that the electrical terminations (i.e., Lugs) on all equipment are furnished to accept the cables and conductors shown on the drawings and in the specifications. The Contractor shall also coordinate the entry and exit location of all conduits/cables into equipment enclosures.

END OF SECTION

BASIC ELECTRICAL MATERIALS AND METHODS

SECTION 16050

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and materials necessary to provide basic electrical materials in accordance with the plans and as specified herein.
- B. This section includes limited scope general construction materials and methods for application with electrical installations as follows:
 - 1. Excavation for underground utilities and services, including underground raceways, vaults, junction boxes, and equipment.
 - 2. Miscellaneous metals for support of electrical materials and equipment.
 - 3. Nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment.
 - 4. Joint sealers for sealing around electrical materials and equipment, and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
 - 5. Concrete used for the following:
 - a. Housekeeping pads
 - b. Foundations for transformers, generators or buildings supplied with electrical work
 - c. Bases for supports
 - d. Filling in box outs in floor slabs, after conduit installation.
 - e. Pole foundations
- C. Where necessary, detailed specifications are provided elsewhere in this section and/or on the drawings.

1.2 QUALITY ASSURANCE

- A. Perform all work associated with basic electrical materials in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein. Where provisions of the pertinent codes and standards conflict with this specification, the more stringent provision shall govern.
 - 1. American Institute of Steel Construction (AISC) "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings."
 - 2. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel."
 - 3. National Electrical Code (NEC).

BASIC ELECTRICAL MATERIAL AND METHODS

B. Qualifications

1. Installer Qualifications. Engage an experienced Installer for the installation and application of joint sealers.
2. Qualify welding processes and welding operators in accordance with American Welding Society (AWS) D1.1 "Structural Welding Code -Steel."
 - a. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.3 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Submit the following:
 1. Product data for joint sealers.
 2. Shop drawings detailing fabrication and installation for metal fabrications and wood supports and anchorage for electrical materials and equipment.
 3. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.
 4. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this section.

1.4 JOB CONDITIONS

- A. Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instruction for multicomponent materials.
- B. Store and handle joint sealer materials in compliance with the manufacturer's recommendations to prevent their deterioration and damage.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Miscellaneous Metals and Reinforcing Materials
 1. Provide steel plates, shapes, bars, and bar grating conforming to ASTM A 36.

BASIC ELECTRICAL MATERIAL AND METHODS

2. Provide cold-formed steel tubing conforming to ASTM A 500.
3. Provide hot-rolled steel tubing conforming to ASTM A 501.
4. Provide steel pipe conforming to ASTM A 53, Schedule 40, welded.
5. Provide non-shrink, non-metallic grout, which is pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout, recommended for interior and exterior applications.
6. Provide fasteners which are zinc-coated or stainless steel, type, grade, and class as required for the application.
7. Provide deformed reinforcing bars conforming to ASTM A615, Grade 40 or 60, unless otherwise indicated.
8. Provide reinforcing materials with size and placement as shown on the plans.
9. Provide welded wire fabric conforming to ASTM A185.

B. Miscellaneous Lumber

1. Provide framing materials that are Standard Grade, light framing size lumber of any species. Number 3 Common or Standard Grade boards complying with West Coast Lumber Inspection Bureau (WCLIB) or American Wood Preservers Association (AWPA) rules or Number 3 boards complying with Southern Pine Inspection Bureau (SPIB) rules. Lumber shall be preservative treated in accordance with AWPA LP-2, and kiln dried to a moisture content of not more than 19 percent.
2. Provide construction panels which are plywood panels; American Plywood Association (APA) C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 15/32 inch.

C. Joint Sealers

1. Provide joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
2. Provide colors as selected by the Engineer from manufacturer's standard colors.
3. Provide the following types of elastomeric joint sealers:
 - a. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates, formulated with fungicide, intended for sealing interior joints with non-porous substrates, and subject to in-service exposure to conditions of high humidity and temperature extremes.
4. Provide fire-resistant watertight joint sealers which are two-part,

foamed-in-place, silicone sealant formulated for use in through-penetration firestopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by UL, or other testing and inspection agency acceptable to authorities having jurisdiction. Material shall be a closed cell, non-adhering material.

- D. Concrete: Provide concrete as specified in Division 03 – Concrete.

2.2 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

1. One Part, Mildew-Resistant, Silicone Sealant
 - a. "Dow Corning 786," Dow Corning Corp.
 - b. "SCS 1702 Sanitary," General Electric Co.
 - c. "863 #345 White," Pecora Corp.
 - d. "Proglaze White," Tremco Corp.
 - e. "OmniPlus," Sonneborn Building Products Div.
2. Fire Resistant Joint Sealers
 - a. "Dow Corning 3-6548 Silicone RTV Foam," Dow Corning Corp.
 - b. "Metacaulk 1000," Rectorseal

PART 3 – EXECUTION

3.1 COORDINATION

- A. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Field-verify all locations and dimensions to ensure that the equipment will be properly located, readily accessible, and installed in accordance with all pertinent codes and regulations, the contract documents, and the referenced standards.
- C. The work shall be carefully laid out in advance, and where cutting, drilling, etc., of floors, walls, ceilings, or other surfaces is necessary for proper installation, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.
- D. In the event any discrepancies are discovered, immediately notify the Engineer in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION

BASIC ELECTRICAL MATERIAL AND METHODS

- A. Preparation for Joint Sealers
 - 1. Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
 - 2. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.3 EXCAVATION

- A. Comply with the applicable requirements of 02221 – Excavation, Backfilling & Compaction for Structures.
- B. For the excavation of underground vaults and electrical structures conform to elevations and dimensions shown within a tolerance of +0.10 foot and extending a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 - 1. Excavate, by hand, area within drip line or large trees. Protect the root system from drainage and drying out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 - 2. Take care not to disturb the bottom of excavation. Excavate by hand to final grade just before concrete reinforcement or precast concrete is placed.
- C. Excavate trenches for electrical installation as follows:
 - 1. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches' clearance on both sides of raceways and equipment.
 - 2. Excavate trenches to depth indicated or required.
 - 3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
 - 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
- D. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 - 2. Removal of concrete formwork.

BASIC ELECTRICAL MATERIAL AND METHODS

3. Removal of shoring and bracing, and backfilling of voids.
4. Removal of trash and debris.

Where subsidence occurs at electrical installation excavation during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.4 INSTALLATION

A. Erection of Metal Supports and Anchorage

1. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
2. Provide field welding which complies with AWS "Structural Welding Code."

B. Erection of Wood Supports and Anchorage

1. Cut, fit, place nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
2. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

C. Application of Joint Sealers

1. Comply with joint sealer manufacturers printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

3. Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
4. Install firestopping sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency. Use dams to obtain proper sealing.

D. Installation of Housekeeping Pads

1. Provide a housekeeping pad for all floor-mounted equipment, unless noted otherwise. Fabricate pad as follows:
 - a. Coordinate size of housekeeping pad with actual equipment provided. Fabricate base 4 inches (12 inches for generators) larger in both directions than the overall dimensions of the supported equipment.
 - b. Form concrete pads with framing lumber treated with form release compounds. Provide 1-inch chamfer on top edge and corners of pad.
 - c. Install welded wire fabric and place anchor bolts and sleeves to facilitate securing equipment. See details provided on the drawings.

END OF SECTION

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ELECTRICAL DEMOLITION

SECTION 16060

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall:

1. Perform the electrical demolition work noted on the Drawings.
2. The Contractor is required to disconnect wiring and conduit connections prior to equipment removal.
3. Examine all the drawings, to determine what equipment and materials are being removed, replaced, demolished, etc.
4. Furnish all labor, materials, equipment, and appurtenances necessary to complete the demolition work.
5. Demolition work shall include but not be limited to:
 - a. All demolition work required to complete the work as shown on the drawings.
 - b. Assisting as required, with disconnecting and wiring/conduit removal.

1.2 RELATED WORK

A. Specified elsewhere:

1. 16010 – Electrical Work – General

1.3 DAMAGED EQUIPMENT AND MATERIALS

- ###### A. Equipment and materials which are intended to remain, and which are inadvertently removed or damaged during demolition and renovation work, shall be repaired or replaced as directed by the Owner or Engineer at no additional cost to the Owner.

1.4 DISPOSITION OF MATERIALS

- ###### A. The Owner shall have the right to retain any and/or all removed equipment and materials.
- ###### B. The Contractor shall verify which equipment and materials the Owner desires to retain prior to the demolition and renovation work.
- ###### C. All equipment and materials which the Owner desires to retain and which require special care to avoid damage during removal shall be removed by the Owner prior to the start of the Contractor's work.

- D. Equipment and materials designated as "Owner retained" shall be removed and stored on the floor or ground near the point of removal. The Owner will move retained equipment and materials from the construction area.
- E. The Contractor is responsible for transportation and proper disposition of all equipment and materials, which the Owner does not desire to retain.

1.5 DRAWING AND SITE REVIEW

- A. The Contractor shall review all contract documents to determine the extent and scope of the changes to the existing facilities and the related work. Contractor is responsible for all demolition associated with this project.
- B. All work shall be verified by the Contractor during pre-bid, on-site inspections to determine the extent, location, and quantities.

1.6 REUSE OF EXISTING MATERIALS

- A. Materials noted "to be removed" shall not be used for the new construction.
- B. Equipment noted to be "relocated" may be reused if it meets the intent of the intended function.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

3.1 EXISTING EQUIPMENT TO BE REMOVED

- A. Disconnect existing electrical equipment noted or shown "To be removed" to allow for safe demolition and removal.
- B. Connect replacement or relocated electrical equipment, remove all existing wire and conduit, and install new wire and conduit as required and as shown on the drawings.
- C. Where a system is noted "to be removed", all associated motors, safety disconnect switches, indicators; control stations, control panels, capacitors, wire, conduit, etc. shall also be removed.
 - 1. All conduit and wire between the various components "to be removed" shall be removed. All exposed conduit and wiring associated with the equipment "to be removed" shall also be removed all the way back to the motor control center, panelboard, control stations, or control panel where the circuit originates or to the nearest junction box where active equipment is connected.

2. Exposed conduit and wire that are located on a different level or in a different space than the removed equipment shall also be removed.
- D. Those portions of a conduit run that are embedded in concrete do not have to be removed; however, the wire shall be removed.
 - E. Existing underground conduit which is unused and not marked for removal shall be left in place with a pull cord installed.
 1. Where the existing underground conduit stubs up above grade, the conduit shall be cut off 2" above grade, capped and marked.
 2. Where existing underground conduit stubs into a building or structure the conduit shall be cutoff 2" from the surface and capped.
 3. The Contractor shall provide a durable tag on both ends of the conduit run with a unique identification number. The Contractor shall also provide a typed list that identifies all of the unused conduits complete with end locations.
 - F. Conduit and wire which are attached to equipment, which is "to be removed," may be removed with the equipment. All remaining conduit and wire which is not removed with the equipment shall be removed separately.
 - G. All unused equipment or conduit supports and anchors shall be removed.

3.2 PATCHING

- A. All holes, conduit penetrations and openings in floors and walls resulting from the demolition and any renovation work shall be filled/patched to match existing.
- B. Where removed conduit enters concrete walls, ceilings, or floors; the conduit shall be cut off near the concrete and then ground or machined down to a point 1/4" below the surface. Seal the conduit and patch the surface with expanding concrete.
- C. Where surface finishes (i.e.: paint) are damaged or where finishes behind removed equipment do not match surrounding finishes, apply a new finish to match existing as closely as possible.

3.2 EQUIPMENT AND CONDUIT ANCHORS

- A. All anchor bolts and other connectors associated with removed equipment and materials shall be removed. Holes shall be filled/patched, and finishes repaired.

END OF SECTION

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CONTROL PANELS/DEVICES - FURNISHED WITH EQUIPMENT

SECTION 16070

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Electrical Contractor shall:

1. Unless otherwise noted on the drawings, receive, store, mount and make control and power wiring connections for control panels and other electrical devices furnished with equipment (FWE) under other Sections or other Contracts. Control panels/devices/equipment on this project include but are not limited to the following:
 - a. Fans
 - b. Infrared Heating System
 - c. HVAC Split Systems
2. Review the drawings and specifications for the equipment furnished by the General/Mechanical Contractor and provide for all electrical and control requirements noted. The Electrical Contractor shall be responsible for all electrical installation and connection requirements whether shown in the General/Mechanical contract documents or in the Electrical contract documents.
3. Assist with the testing, adjusting, checkout, etc. all control panels supplied or furnished by others.

B. General/Mechanical Contractor:

1. All equipment, control panels and other devices furnished to the Electrical Contractor for installation shall be complete with installation instructions and manufacturer's recommendations.
2. Where factory assistance is required for proper installation, testing, checkout and demonstration, the General/Mechanical Contractor shall provide the required services.
3. Provide factory assistance during checkout to make minor interface adjustments (programming or wiring changes) such as changing dry contacts to powered contacts, changing NO contacts to NC contacts, program modifications, etc. to facilitate interface between the various control panels and devices.
4. Provide assistance during any training and demonstrations.

1.02 RELATED WORK

A. Specified elsewhere:

CONTROL PANEL /DEVICES – FURNISHED WITH EQUIPMENT

1. 14450 - Mechanical Work

1.03 TESTING

- A. The Electrical Contractor shall assist with the testing and checkout of all control panels. Testing shall include checking of wiring and wiring connections to verify the equipment is in good operating order and has been properly installed.
- B. The testing and checkout requirements are limited to the external connections and functions. Where problems with the internal operations of the panel are identified, the contractor supplying the equipment shall be responsible for correcting the internal problems.
- C. Assist other trades during systems start-up, checkout and testing of all control panels and control systems.

1.04 TRAINING

- A. Assist during any training for equipment furnished under this Section. This shall be limited to utilizing the interface information and not operation of the associated sub systems.
- B. Any training time shall be allocated to the various components as indicated under the associated paragraphs.

1.05 DEMONSTRATION

- A. Assist with demonstrating the proper function of equipment furnished under this Section. Demonstration shall be limited to showing the interface and displays are functioning properly and not actual operation of the associated sub systems.
- B. Demonstration time shall be as required to complete the demonstration.

1.06 CONTROL PANELS/DEVICES "FURNISHED WITH EQUIPMENT"

- A. Control panels and equipment marked on the electrical drawings or in this Section as (FWE), "furnished with equipment" are items which are furnished with equipment or systems detailed under other Divisions of this specification or other associated Contracts for this project.
- B. The Electrical Contractor shall receive, store, install, make wire and conduit connections, test and checkout electrical items indicated as FWE.
- C. All items marked as FWE shall be complete with appropriate mounting brackets and other hardware except where noted otherwise.
- D. All items marked as FWE which require the assistance of factory trained personnel or authorized representatives during installation, test and checkout shall be furnished complete with these required services. These services shall be paid by the contractor furnishing the control panels or equipment.

CONTROL PANEL /DEVICES – FURNISHED WITH EQUIPMENT

- E. The Electrical Contractor shall furnish all electrical items which are not specifically noted on the drawings or in the specifications as FWE. This shall include wire, cable, cord grips, support hooks, etc.

PART 2: PRODUCTS

Not used.

PART 3: EXECUTION

3.01 GENERAL

- A. Receive, mount, and install all control panels and electrical equipment. Where adequate and appropriately located structures are not available for mounting panels, provide equipment support structures as indicated in Sections 26 05 00 and 26 05 29.
- B. Make all control and power wiring connections to panels and associated remote devices as recommended by the manufacturer, as directed by the General/Mechanical Contractor, and as shown on the drawings.
- C. Test and checkout all control panels, wiring connections, etc. Verify all interfaces between various components. Assist in calibration and system startup. Test as required to isolate problems and correct all defects or problems. Problems or defects in equipment (FWE) shall be corrected by the contractor furnishing the equipment.
- D. Provide assistance during the calibration of all control elements.
- E. All wiring entering or leaving the control panels shall be terminated on terminal blocks. All wiring shall be terminated with a compression type spade terminal suitable for use with the terminal strip. Wires shall not be wrapped directly around terminals. Where the control panel is furnished with box type screw clamp terminal blocks, the spade type terminal is not required.
- F. Add wire numbers from the schematic drawings of the various items of equipment to the contract documents and use these numbers to identify all wiring associated with the equipment. See the schematic drawings for wire numbers or for indication regarding which wire-numbering system will be used. Where number conflicts occur, a letter or letters will be added to the equipment wire numbers. Verify designations with the Engineer when conflicts occur.
- G. Since the numbering system in some of the control panels will be different than the number on the external wiring, the Contractor shall complete a cross-reference table for each panel where the numbers differ. The table shall cross-reference the internal wire or terminal numbers with the external wire numbers. Three (3) final versions of this table shall be typed and encapsulated inside plastic sheets and located in the plan pocket of each panel.

END OF SECTION

CONTROL PANEL /DEVICES – FURNISHED WITH EQUIPMENT

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ELECTRICAL IDENTIFICATION

SECTION 16075

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and materials necessary to perform the work in accordance with the plans and as specified herein.
- B. This section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:
 - 1. Operational instruction signs
 - 2. Warning and caution signs
 - 3. Equipment labels and signs

1.2 QUALITY ASSURANCE

- A. Perform all work associated with electrical identification in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.
- B. Components and installation shall comply with National Fire Protection Association (NFPA) 70 "National Electrical Code (NEC)."
- C. American National Standards Institute (ANSI) Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems", with regard to type and size of lettering for raceway and cable labels.

1.3 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Submit product data for each type of product specified.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/8-inch minimum thick. Engraved legend in white letters on black face and punched for mechanical fasteners.

- B. Baked Enamel Warning and Caution Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.
- C. Exterior Metal Backed Butyrate Warning and Caution Signs: Weather resistant, nonfading, preprinted cellulose acetate butyrate signs with 20-gauge, galvanized steel backing, with colors, legend, and size appropriate to the location. Provide 1/4-inch grommets in corners for mounting.
- D. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.
- E. Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from minus 50°F to 350°F. Provide ties in specified colors when used for color coding. All ties shall be of the UV resistant type.

2.2 MANUFACTURERS

- A. Subject to compliance with the requirements, manufacturers offering products that may be incorporated in the Work include the following:
 1. American Labelmark Co.
 2. Calpico, Inc.
 3. Cole-Flex Corporation
 4. Emed Co., Inc.
 5. George-Ingraham Corporation
 6. Ideal Industries, Inc.
 7. Kraftbilt
 8. LEM Products, Inc.
 9. Markal Corporation
 10. National Band and Tag Co.
 11. Panduit Corporation
 12. Radar Engineers Div., EPIC Corporation
 13. Seton Name Plate Co.
 14. Standard Signs, Inc.
 15. W. H. Brady, Co.

16. Or Equal

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.
- C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- D. Identify Junction, Pull, and Connection Boxes: Code required caution sign for boxes shall be pressure sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.
- E. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

(240) 208Y/120 Volts	Phase	(480) 480Y/277 Volts
Black	(L1) A	Brown
Red	(L2) B	Orange*
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green
*Where not permitted by inspecting authority, use purple.		

- 1. Use conductors with color factory applied the entire length of the conductors. The following field applied color-coding methods may be used in lieu of factory coded wire for sizes larger than No. 10 AWG:
 - a. Apply colored, pressure sensitive plastic tape in half lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1 inch wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

F. Raceway Identification

1. Cable trays shall have engraved 4-inch x 5-inch nameplates indicating voltage, phase, and circuits. Nameplates shall be spaced every 80 feet or portion thereof. Color coding shall be as specified above.

G. Tag or label conductors as follows:

1. Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
2. Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure (except for three circuit, four wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by means of coded color of conductor insulation. For control and communications/signal wiring, use color coding for wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
3. Match identification markings with designations used in panelboards, shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

H. Apply warning, caution, instruction signs, and stencils as follows:

1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

I. Install equipment/system circuit/device identification as follows:

1. Apply equipment identification labels of engraved plastic laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide 1/2-inch high white lettering on a black background. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment:
 - a. Panelboards, electrical cabinets, and enclosures
 - b. Electrical switchgear and switchboard compartments
 - c. Motor control center compartments
 - d. Motor starters
 - e. Power transfer equipment
 - f. Contactors

- g. Transformers
 - h. Power generating units
 - i. Telephone switching and termination equipment
 - j. Fire alarm master station or control panel
 - k. Individual compartments in switchgear, switchboards, and motor control centers
 - l. Enclosed circuit breakers
 - m. Disconnect switches
 - n. Control panels
 - o. Each control panel component
 - p. Provide single line of text with 1/4-inch high lettering on a 5/8-inch label (1-inch high where two lines are required) on the following:
 - 1) Push button stations
 - 2) Remote controlled switches
 - 3) Dimmers
 - 4) Control devices
 - 5) Light switches
2. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
 3. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
 4. Each switchboard, MCC, substation, major control panel, and major telecommunication panel shall, in addition to individual compartment nameplates, have a 4-inch x 5-inch master engraved nameplate indicating equipment designation, voltage, phase, ampacity, and year installed. Color coding shall be same as above.

END OF SECTION

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RACEWAYS

SECTION 16110

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and materials necessary to provide raceways in accordance with the plans and as specified herein.
- B. Types of raceways specified in this section include the following:
 - 1. Electrical metallic tubing
 - 2. Flexible metal conduit
 - 3. Rigid metal conduit
 - 4. PVC coated Rigid metal conduit
 - 5. Liquid-tight flexible metallic conduit
 - 6. Rigid, non-metallic conduit
 - 7. Liquid-tight flexible non-metallic conduit
 - 8. Wireways
- C. A schedule may be provided on the drawings that identifies all required raceways for this project. Where a schedule is not provided, the raceways shall be individually identified on the drawings. In addition to the raceways shown on the drawings/schedule, the Contractor shall be responsible for providing raceways for the following systems:
 - 1. Building interior and exterior lighting circuits. This shall include branch wiring and low voltage lighting network cabling. All lighting raceways shall be sized, furnished, and installed by the Contractor.
 - 2. Interior telephone and data circuits. All telephone and data raceways shall be sized, furnished, and installed by the Contractor.
 - 3. The Contractor shall review all of the contract drawings to determine the number of and location of all devices associated with the above systems.
- D. Additional raceways shall be furnished and supplied by the Contractor, even if not specifically noted on the raceway schedule, but implied or noted on the plan drawings or schematic drawings.

RACEWAYS

1.2 QUALITY ASSURANCE

- A. Perform all work in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.
 - 1. National Electrical Manufacturers Association (NEMA) Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.
 - 2. Underwriters' Laboratories (UL) Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL-listed and labeled. Provide listed fire resistance ratings for joint sealers as applicable in accordance with American Society for Testing and Materials (ASTM) E814.
 - 3. National Electrical Code (NEC) Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.
 - 4. National Fire Protection Association (NFPA) Compliance: Comply with applicable requirements of NFPA standards relating to fire ratings of wall, floors, and ceilings penetrated by conduits.

1.3 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Submit the following:
 - 1. Provide product data for each type of the following products:
 - a. Raceway and fittings
 - b. Wireway and fittings
 - 2. Provide manufacturer's written installation instructions for wireway, metallic raceway, and non-metallic raceway products.

PART 2 – PRODUCTS

2.1 METAL CONDUIT

- A. Provide metal conduit of types, grades, sizes, and weights (wall thicknesses) for each service area as indicated on the Contract Drawings. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways. Set screw fittings shall not be used on this project.
- B. Electrical Metallic Tubing: Provide electrical metallic tubing (EMT), hot-dip galvanized steel, and fittings conforming to American National Standards Institute (ANSI) C80.3

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and UL-797. Fittings for electrical metallic tubing shall be all steel compression type. Expansion fittings shall be O-Z Gedney type TX.

- C. Rigid Steel Conduit: Provide heavy walled rigid steel galvanized zinc coated inside and outside, 316 stainless steel or rigid aluminum conduit manufactured of 6063 alloy, T-1 temper, threaded-type. Conduit shall conform to Federal Specification WW-C-581E, ANSI C80.1 and UL 6. Rigid aluminum conduit and 316 stainless steel shall conform to Federal Specification (WW-C-540C; AL only), ANSI C80.1/C80.5 and UL 6A.
- D. Rigid Steel Conduit – PVC Coated: Conduit shall meet the requirements for rigid steel conduit prior to installation of other coatings. The exterior of PVC coated conduit shall have a primer over the galvanize and .040" (minimum) PVC coating overall. The interior of the conduit shall be coated with a .002" urethane finish. The PVC coating shall meet the requirements of NEMA-RN1. The conduit shall be furnished with PVC repair materials for correcting imperfections and coating fittings, threads, etc.
- E. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spirally wound interlocked galvanized strip steel.
- F. Liquid-tight flexible metallic conduit: Conduit shall meet the requirements of NEC 350 and shall have a flexible galvanized (or 316 stainless to match conduit system) steel conduit core with extruded PVC jacket. Flexible conduit (flexible couplings) installed in explosion hazard areas shall be Cooper Crouse-Hinds all stainless steel ECLK series or equal. If the conduit system is PVC coated, the explosion proof flexible conduit shall also be PVC coated in addition to being stainless steel.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:
 - 1. AFC
 - 2. Alflex Corporation
 - 3. Allied Tube and Conduit
 - 4. Electri-Flex Co.
 - 5. TV Steel Tubular Products Co.
 - 6. Perma-Cote Industries
 - 7. Robroy Industries
 - 8. Triangle PWC, Inc.
 - 9. VAW of America Inc.
 - 10. Wheatland Tube Co.
 - 11. Or Equal

2.2 NON-METALLIC CONDUIT

- A. Provide non-metallic conduit of types, sizes, and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements which comply with provisions of NEC for raceways.
- B. Rigid Nonmetallic Conduit: Schedule 40 or 80, 90°C, UL-rated, construct of PVC and conforming to NEMA TC-2, for direct burial, or normal above-ground use, UL-651 listed and in conformity with NEC Article 347.
- C. Liquid-Tight Flexible Non-Metallic Conduit: Continuous spiral of hard PVC encapsulated with flexible PVC.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:
 - 1. Cantex Industries
 - 2. Carlon
 - 3. Cole Flex-Corporation
 - 4. Electric-Flex
 - 5. Or Equal

2.3 CONDUIT FITTINGS AND ACCESSORIES

- A. Provide conduit accessories of types, sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.
- B. All fittings for rigid metal (steel) conduit shall be Form 8, cast of iron with threaded connections. Compression, set screw or crimp type fittings are not acceptable. Covers shall be gasketed cast iron. Conduit bodies are to have an electrogalvanized finish, followed by a baked-on powder epoxy finish to a minimum of 2.5 mil thickness, and at least one additional baked layer of epoxy applied with an additional 2.0 mil thickness or better.
- C. All fittings for 316 stainless steel conduit shall be form 8 cast 316 stainless steel with threaded connections. Covers shall be gasketed cast 316 stainless steel.
- D. All fittings for rigid aluminum conduit shall be Form 85, manufactured of copper free, sand cast aluminum with a baked aluminum lacquer finish and cast, tapered, threaded hub connections. Compression, set screw or crimp type fittings are not acceptable. Die-cast fittings are not acceptable. Covers shall be gasketed cast aluminum.
- E. All fittings for rigid PVC coated metal conduit shall be PVC coated with appropriate PVC sleeves, gaskets, etc. PVC coated fittings shall be form 8 conduit fittings, with a gasket to effectively seal out the corrosive elements. Where liquid tight flexible metal

conduit is installed on a rigid PVC coated metal conduit system, all fittings shall be factory PVC coated.

- F. All fittings for rigid non-metallic conduit shall have solvent welded type connections. A primer shall be used prior to applying the solvent. Primer and Solvent shall be by or approved by the manufacturer of the conduit.
- G. All fittings for liquidtight flexible metal conduit shall be designed, approved for the application, and match the material of the connected raceway system. 316 stainless steel for stainless conduit, aluminum for aluminum conduit, etc.
- H. All box connections for rigid metal conduit shall be made with a watertight type hub with female bushing nipple, o-ring seal and grounding locknut that will accept a bonding wire. Hubs for use with rigid steel conduit shall be Meyers MHUB series or equal. Hubs for use with 316 stainless steel conduit shall be Meyers SSTGK series or equal. Hubs for use with rigid aluminum conduit shall be equal to a Meyers STAG series. It may be necessary to supply separate hubs and grounding locknuts to meet the above requirements.
- I. Hazardous location seal fittings shall be selected to maintain the minimum required fill volume of the raceway system.
- J. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp-type.
 - 1. Straight Terminal Connectors: One-piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 - 2. 45-Degree or 90-Degree Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
- K. Liquidtight Flexible Non-Metallic Conduit Fittings: PVC, one-piece body with PVC ferrule and neoprene gasket.
- L. Conduit to cable tray connections shall be made with clamps designed for the application. Clamps shall be Cooper Crouse-Hinds LCC series or equal. Conduit ends shall be fitted with insulated bushings.
- M. Sealing Fittings and Products
 - 1. Provide mechanical pipe seals as specified in Division 16 Section “Supporting Devices”.
 - 2. Provide joint sealants as specified in Division 16 Section “Basic Electrical Materials and Methods”.
 - 3. Provide gland-type sealing bushings for interior conduit seals as specified in Division 16 Section “Supporting Devices”.

N. Available Manufacturers: Subject to compliance with requirements, manufacturers offering conduit and conduit accessories which may be incorporated in the work include the following:

1. Adalet/PLM
2. Appleton Electric
3. Carlon Div. of Indian Head
4. Condux International, Inc.
5. Eaton Crouse-Hinds
6. Electri-Flex Co.
7. Killark Electric Mfg. Co.
8. O.Z. Gedney
9. Perma-Cote Industries
10. Robroy Industries
11. Unistrut Corporation
12. Or Equal

2.4 WIREWAYS

- A. Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.
- B. General Purpose Wireways: NEMA type 1 steel, front-accessible, totally enclosed with bolted covers. Finish with rust-inhibiting coating and gray baked enamel finish. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.
- C. Oil-Tight Wireways: NEMA type 12, oil-tight and dust-tight, steel with hinged gasketed cover, external latches and flanged gasketed joints. Finished with gray enamel paint inside and outside.
- D. Watertight Wireways: NEMA type 4X, watertight, corrosion-resistant stainless steel with hinged gasketed cover, screw clamps and flanged gasketed joints.
- E. Subject to compliance with the requirements, manufacturers offering wireways which may be incorporated in the work include the following:
 1. Saginaw Control and Engineering

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2. B-Line Systems, Inc.
3. Hoffman Engineering Co.
4. Schneider Electric
5. Or Equal

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Notify the Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 COORDINATION

- A. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.

3.3 INSTALLATION – GENERAL

- A. Complete the installation of raceways before starting installation of cables and wires in raceways. All spare raceways shall be capped or plugged and include a pull wire. All metallic raceways shall be grounded.
- B. Install raceways as indicated in accordance with manufacturer's written installation instructions, and in compliance with NEC, and National Electrical Contractors Association (NECA) "Standards of Installation." Use roughing-in dimensions furnished by the supplier for all electrically operated units. Set raceways and boxes for connection to units only after the dimensions and locations clear with other trades. Install units plumb and level and maintain manufacturer's recommended clearances.
- C. Conduit support devices and clamps shall be specifically manufactured and designed for applications with specific type of electrical conduit.
- D. Beam clamps, threaded rod, 'U' hangers, clips, trapeze supports, etc. shall be used in conjunction with support devices.
- E. All support devices for galvanized rigid steel conduit, including bolts, anchors, etc. shall have a hot-dipped galvanized coating. Supports for PVC coated conduit shall be PVC coated in addition to other protective coatings. Bolts, anchors, etc. for PVC coated conduit shall be stainless steel. Channel used to support PVC coated conduit shall be stainless steel. All support devices for aluminum or 316 stainless steel conduit, including bolts, anchors, etc. shall be stainless steel. Channel used to support the conduit shall be 316 stainless steel.
- F. Plastic anchors and self-tapping concrete screws are not acceptable.

RACEWAYS

- G. Mechanically assemble metal raceways for conductors to form continuous electrical conductor, and make connections to electrical boxes, fittings, and cabinets to provide effective electrical continuity and a rigid mechanical assembly. Avoid the use of dissimilar metals throughout the system to eliminate the possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.

3.4 INSTALLATION – CONDUITS

- A. All interior raceways in the garage area(s) shall be surface mounted rigid galvanized conduit (RGS)/fittings. All other interior raceways shall be Electrical Metallic Tubing (EMT)/fittings and/or metal-clad cable assemblies (MC) concealed in walls and ceilings.
- B. It is the intention of these specifications that the raceways shown on the raceway schedule shall be new through their entire length. Where existing devices are being re-used or are being replaced with new equipment, the existing conduit may be re-used. Where existing conduit cannot complete the raceway, new conduit sections shall be added. This shall include conduit (straight pipe, liquidtight flexible metal, etc.) and fittings (Hubs, nipples, 3-piece fittings, etc.).
- C. All rigid PVC coated metal conduit shall be installed with PVC coated fittings and PVC coated sleeves to fill the openings and voids between the straight conduit runs and the various fittings (hubs, condulets, junction boxes, etc).
- D. All conduit installed in underground applications shall be rigid non-metallic conduit except where specifically noted as another conduit type on the drawings or raceway schedule.
- E. Where conduit installed in concrete encased underground duct banks is noted as (RGS), rigid steel conduit shall be used.
- F. Where the raceway in a duct bank extends above the floor or above grade, and terminates in a wall or structure mounted device, the final elbow below grade and remainder of the conduit run shall be rigid steel. Where the steel or aluminum conduit comes in contact with the earth or concrete, apply 3M Temflex 1100P corrosion protective tape to the conduit up to a point 12” above the earth or above the concrete.
- G. Where rigid non-metallic conduit installed in underground applications terminates directly inside enclosed electrical equipment, the final elbow or fitting may be PVC.
- H. No conduit shall be smaller than 3/4" trade size, except where shown on the drawings or where required by a particular piece of equipment.
- I. All exposed conduit runs shall be installed parallel or perpendicular to the building walls.
- J. All power conduits shall include a separate equipment ground conductor.
- K. Seal each end of all conduits where they enter a junction box, control panel, or enclosure with "duct seal".

- L. Liquidtight flexible metal conduit shall be used for final connections to motors, transformers, and other equipment subject to movement or vibration. Both conduit and connectors shall be of the approved grounding type.
- M. All conduits shall be blown and swabbed before wires are pulled.
- N. Install all exposed conduit with standard radius bends with not more than three (3) bends between terminals. Install all underground conduits with large radius sweeps with not more than three (3) bends between terminals. Should a greater number of bends be necessary, install pull boxes or manholes.
- O. Where underground conduit runs exceed 100 feet, all sweeps and elbows shall be steel.
- P. Install pull boxes in all above grade conduit runs exceeding 100 feet in length.
- Q. Maintain a minimum separation from fluid (water, sewer, etc.) piping of 6" and do not install electrical conduit below fluid piping. Maintain a minimum separation from heat sources of at least 12".
- R. Installation of PVC-coated conduit raceway shall be in accordance with the manufacturer's recommendations. To insure compliance, the Contractor shall be certified by the conduit manufacturer before installation can proceed.
- S. Where conduits are routed across building expansion joints, conduit expansion fittings shall be inserted in the conduit run at the location of the expansion joint.
- T. If conditions are such that the installation of a conduit expansion fitting is impractical; a section of flexible conduit provided with an adequate amount of slack will be acceptable.
- U. All conduits shall be identified at all pull boxes, terminal boxes, manholes, control cabinets, control panels, enclosures etc. with permanent brass or plastic labels attached directly to or adjacent to the conduit utilizing the numbers shown on the raceway schedule.
- V. All metal conduit systems shall be mechanically and electrically continuous from source of current to all outlets and devices and grounded in accordance with the National Electrical Code. All threaded connections shall be made wrench tight with no more than two threads exposed. Overthreaded conduits exposing more than two threads are not acceptable.
- W. Conduits shall not be installed directly to surfaces. Conduits shall be supported by channel or clampbacks to provide a clearance between the wall/backpanel and the conduit. Clampback material shall be the same as the mounted conduit.
- X. Preparation
 - 1. Field-bend conduit with benders designed for the purpose so as not to distort or vary the internal diameter. Cut conduits straight and properly ream.

2. Metal Conduits: Cut conduit threads deep and clean. Use of running threads at conduit joints and terminations is prohibited. Conduits installed underground, in slabs, or exterior shall have threads painted with a corrosion-inhibiting compound before couplings are assembled.
3. Non-Metallic Conduits: All PVC conduit joints shall be solvent welded to provide a watertight seal capable of sustaining a hydrostatic pressure of 25 pounds per square inch (psi) for 12 hours. PVC conduit shall be installed in a sand bed except PVC conduit encased in concrete.
4. Install joint sealers as specified in Division 16 Section "Basic Electrical Materials and Methods".
5. Install mechanical pipe seals as specified in Division 16 Section "Supporting Devices".

Y. Routing

1. Install exposed conduits and conduits above suspended ceilings, parallel or perpendicular to walls, ceilings, or structural members. Do not run through structural members. Avoid horizontal runs within partitions or side walls. Avoid ceiling inserts, lights, or ventilation ducts or outlets. Do not run conduits across pipe shafts or ventilation duct openings and keep conduits a minimum of 12 inches from parallel runs of flues, hot water pipes, or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
2. Finished Areas: Conduits installed in finished areas of new construction shall be concealed in walls, below or in slabs, or above suspended ceilings.
3. Concrete Slabs: Generally, all raceways shall be surface mounted. Embedding raceways in walls, concrete slabs or underground shall only be permitted when specifically shown on the drawings or on the raceway schedule.
4. Conduits in concrete slabs (where shown on plans only) shall be placed between the bottom and top reinforcing steel. Separate conduits by not less than the diameter of the largest conduit to ensure proper concrete bond. Conduits crossing in the slab must be reviewed by the Engineer for proper cover.
5. Exterior: Do not run conduits exposed on the exterior surface of architecturally detailed buildings.
6. Underground: All underground conduits in roadway and parking areas shall be concrete-encased, unless specifically shown otherwise. Concrete-encased conduits shall have a minimum of 3 inches of concrete cover. Make changes of direction with long sweep bends. Conduits shall slope toward manholes or pullboxes and away from buildings with a pitch of not less than 3 inches in 100 feet. All trenches shall be backfilled with compacted granular material to subbase.

RACEWAYS

Z. Penetrations

1. Exterior Walls: Conduits penetrating exterior walls of any structure (other than handholes, manholes, or pullboxes) below grade, at grade floors, or below grade floors shall be sealed to prevent moisture migration. The exterior of the conduit shall be sealed with a mechanical pipe seal as described in Division 16 Section "Supporting Devices". As close as practical to the penetration, install a junction box to allow for the installation of the interior conduit seal. The interior conduit seal shall be a gland-type sealing, bushing, or RTV sealant. Ensure that conduits do not retain water against these seals.
 2. Fire-Rated Walls: Conduits penetrating fire-rated walls, floors, and partitions shall be sealed with a fire-rated sealant as described in Division 16 Section "Basic Electrical Materials and Methods".
 3. Roofs: Conduits shall penetrate roofs only where specifically shown on the plans and shall be coordinated with other Divisions of the Specifications. Provide all required flashing.
 4. Supports: All conduits must be supported with materials specifically made for this purpose. Do not use wire hangers. Do not attach any parts of the conduit system to ventilation ducts. Conduit supports shall be attached to the building. Support conduits on each side of bends and on a spacing not to exceed the following: 6 feet for conduits smaller than 1-1/4 inches and 8 feet for conduits 1-1/4 inches and larger. Support riser conduits at each floor level with clamp hangers. Set conduit anchors in water bearing or waterproofed walls with waterproof cement. All underground conduits shall be securely anchored to prevent movement during placement of concrete or backfill. Use precasted separators and heavy gauge wire ties or other approved fasteners.
- AA. Fittings: Install miscellaneous fittings, such as reducers, chase nipples, three-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install grounding-type expansion fittings in raceways every 200 feet of linear run or wherever structural joints are crossed to allow for expansion and contraction.
- BB. Cleaning: During construction, protect partially completed raceway runs from entrance of dirt, moisture, and debris by means of suitable factory-made duct plugs. After completion of installation, pull a mandrel or plastic mouse through every conduit to check for alignment and clear passage. Use an iron shot mandrel with a diameter of 1/4 inch less than the nominal size of the conduit and with a length equal to the conduit diameter. The mandrel shall have a leather or rubber gasket slightly larger than the conduit opening. After testing the conduits with the mandrel, pull a stiff brush through each duct until it is clear of any particles of earth, sand, or gravel, then install plugs until wire is to be pulled. Clean existing ducts to be used for new cable in the same manner as noted above.

3.5 INSTALLATION – WIREWAYS

- A. Uses Permitted
 - 1. Use watertight wireways in damp or wet interior areas and for all exterior areas.
 - 2. Use oiltight wireways in dry process areas.
 - 3. Use general purpose wireways in non-process areas.
- B. Routing: Install wireways parallel or perpendicular to wall, floors, ceilings, or structural members.
- C. Supports: All wireways must be supported with materials specifically made for this purpose. Do not use wire hangers. Do not attach any parts of the wireway system to ventilation ducts. Properly support and anchor wireways for their entire length by structural materials. Wireways shall not span any space unsupported. Set wireway anchors on water bearing or waterproofed walls with waterproof cement.
- D. Fittings: Install fittings that have been specifically designed and manufactured for their particular application.

END OF SECTION

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

SECTION 16111

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all underground electrical duct banks as shown on the drawings and as required for proper installation of the various electrical wiring systems, including service feeders, power feeders, branch circuits, lighting, control, instrumentation, signal, communications etc.
- B. Complete all trench and backfill as required for the duct banks.
- C. Where shown, encase duct banks in concrete complete with reinforcing bar and connections to manholes, hand holes, structures, etc.
- D. Notify the Engineer 24 hours in advance of all mandrel testing and concrete pours.

1.2 COORDINATION

- A. The Contractor shall review the layout shown on the drawings and resolve all conflicts with various underground utilities, grades, and piping systems. The resolution may be slight variations in the underground duct bank routing or elevation.
- B. The underground duct bank must maintain a minimum of 24" of earth cover over the top of the highest conduit, however increasing the depth is acceptable as a means of resolving conflicts with piping systems.
- C. Stake the locations of the underground duct banks for review and approval of the ENGINEER.
- D. Maintain a minimum separation from fluid, including water & sewer piping of 24" and do not install underground duct bank below fluid piping, except where crossing at a sharp angle.
- E. The location of ducts in the duct bank may be changed when it will help avoid interference of one conduit with another where changes in direction occur or where conduits end at a building. These changes must be reviewed and approved by the Engineer prior to construction.

1.3 TESTING

- A. After the underground duct bank is completed and prior to wire pulling, the conduit runs shall be proven with a mouse or iron mandrel.
- B. Where used, the mouse shall be a plastic shape with diameter slightly larger than the conduit to be tested.

- C. The mouse shall have a pull cord attached to the end and shall be pulled or blown through each conduit to verify no breaks, offsets, etc. prior to pulling wires.
- D. Any damage to the mouse or failure of the mouse to pass through the conduit shall be considered as evidence of a faulty installation. All faulty installations shall be repaired or replaced.
- E. The Engineer shall witness the mouse testing, and the Contractor shall notify the Engineer prior to conducting these tests.

PART 2 – PRODUCTS

2.1 CONDUIT

- A. All underground conduits shall be rigid non-metallic conduit except where noted on the drawings. See Section 16110 Raceways.
- B. Where the raceway in a duct bank extends above the floor or above grade, and terminates in a wall or structure mounted device, the final elbow below grade and remainder of the conduit run shall be rigid steel. Where the steel or aluminum conduit comes in contact with the earth or concrete, apply 3M Temflex 1100P corrosion protective tape to the conduit up to a point 12” above the earth or above the concrete.

2.2 CONDUIT SUPPORTS

- A. The conduit supports for holding the conduit in position during concrete encasement shall be plastic interlocking type specifically designed for the purpose. The spacers shall be installed with a maximum spacing of 5'-0". The spacing shall be decreased where required to maintain the conduit in the proper position during the placement of the concrete encasement.
- B. Conduit supports shall maintain a minimum of 3" space between the exterior of one conduit and the exterior surface of the next conduit.

2.3 CONCRETE ENCASEMENT

- A. Concrete, forms, reinforcement bars, etc. shall be in accordance with the CONCRETE division of the general/mechanical section of the specifications. Concrete for electrical work shall be installed in the exact same manor and with the exact same procedures as all other structural concrete on the project. Unless otherwise noted, concrete for electrical work shall be Class A, 4,000 psi strength.
- B. The concrete may be installed utilizing the sides of the trench as forms where the trench has straight even walls and where the soil conditions will not damage the concrete. In all other locations forms shall be utilized.

2.4 WARNING TAPE AND TRACER WIRE

- A. Warning tape shall be a continuous strip of red polyethylene and shall have the words "CAUTION ELECTRIC LINE BELOW" printed on 2'-6" centers.
- B. Tracer wire shall be a red, #12 AWG stranded copper wire with polyethylene or (HDPE), 45 mil thick insulation, approved for direct buried applications.

PART 3 – EXECUTION

3.1 CONDUIT

- A. Conduit for underground duct banks shall be rigid non-metallic conduit except where specifically noted otherwise on the drawings or raceway schedule and where the conduit transitions to above grade condition.
- B. Where underground conduit enters into a building or structure, the final conduit section (5' minimum) shall be rigid steel, regardless if the balance of the run is rigid non-metallic conduit. The steel conduit shall be used to provide additional shear strength for the duct bank to building transition.
- C. All underground conduit runs shall be sealed and made watertight. Special care shall be taken to make each solvent welded connection watertight and to seal connections to manholes, handholes and building/ structure penetrations.
- D. Where underground conduit enters into a building or structure, each conduit shall be sealed to prevent water from entering into the building. Each conduit, with or without cables shall be fitted with an inflatable, flexible metallic laminate bladder system. The system shall be a Rayflate Duct Sealing System. The CONTRACTOR shall provide the specific sealing system components based on the number and configuration of wires. The CONTRACTOR shall purchase one complete CO2 gas installation tool for the project and then turn it over to the OWNER at the completion of the project. Additionally, one box of 10 full, CO2 gas cylinders shall be provided to the OWNER at the completion of the project.
- E. All spare conduit runs shall have nylon pull cords installed and tied off at each end.

3.2 CONDUIT SUPPORT

- A. Anchor wire or rods shall be installed to hold the conduit and to prevent flotation during installation of concrete encasement.
- B. All underground conduit runs consisting of two (2) or more conduits shall have plastic spacers installed at 5-foot centers. Plastic spacers shall be specifically designed for use with electrical conduit.

3.3 CONCRETE ENCASEMENT

- A. No concrete shall be placed until the Engineer has reviewed the installation. The Contractor shall notify the Engineer 24 hours in advance to allow for examination of the duct bank prior to the concrete pour.

UNDERGROUND DUCTS AND RACEWAYS
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- B. All conduit runs 2" trade size and larger and all conduit runs of more than two (2) conduits in the same trench shall be encased in concrete, unless otherwise shown.
- C. The concrete encasement shall provide a minimum of 3" of concrete cover on all sides of each conduit.
- D. All concrete encased duct banks with any dimension exceeding 16" shall have 4 #4 steel reinforcing rods located at the corners of the concrete envelope and parallel to the conduit. Duct banks with no dimension exceeding 16" shall have 2 #4 steel reinforcing rods located top and bottom of the duct bank. #3 steel reinforcing bar saddles shall be installed every 36" along the duct bank length. The reinforcing bars shall have a minimum of 2" of concrete cover and shall overlap a minimum of 24" and be tied at ends of the rods.
- E. A #2 AWG bare copper conductor shall be installed in each duct bank, including duct bank spurs. Bond the conductor to the nearest building steel on each end. Where a duct bank ends at a pole or free-standing panel, bond the conductor to the panel and/or a driven ground rod.
- F. The reinforcing rods of the duct bank concrete encasement shall be doweled into all manholes, building foundations, structures, etc. which they enter or pass through. The reinforcing bar of the duct bank shall be embedded into the structure a depth as required by the epoxy or grout manufacturer to fully develop the bar unless otherwise specified.

3.4 WARNING TAPE AND TRACER WIRE

- A. Install the continuous marking tape 18" below grade along the centerline of all underground duct banks and conduit runs.
- B. Install the tracer wire directly on the center of each duct bank or centered between conduits. Where a duct spurs, splice the tracer wire with a manufacturer approved direct burial splice kit. Terminate the tracer wire at each end inside a short section of rigid PVC conduit. If the duct terminates inside a building or structure cap the conduit inside the building. If the duct terminates at an enclosure, extend the section of conduit into the enclosure. Permanently identify the tracer wire as a "Duct Bank Tracer" on each end.

END OF SECTION

SECTION 16120

WIRES, CABLES, AND CONNECTORS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and materials necessary to install wires, cables, and connectors in accordance with the plans and as specified herein.
- B. This section includes wires, cables, and connectors for power, lighting, signal, control, and related systems rated 600 volts and less.

1.2 QUALITY ASSURANCE

- A. Perform all work associated with wires, cables, and connectors in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.
 - 1. National Protection Association (NFPA) 70, National Electrical Code (NEC).
 - 2. Underwriters' Laboratories, Inc. (UL) Compliance. Provide components which are listed and labeled by UL under the following standards.
 - a. UL Standard 83 Thermoplastic Insulated Wires and Cables
 - b. UL Standard 44 Thermoset Insulated Wires and Cables
 - c. UL Standard 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
 - d. UL Standard 854 Service Entrance Cable
 - 3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA) Compliance. Provide components which comply with the following standards:
 - a. WC-5 Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 - b. WC-7 Cross-Linked Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 - c. WC-8 Ethylene Propylene Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 - 4. Institute of Electrical and Electronic Engineers (IEEE) Compliance. Provide components which comply with the following standards:
 - a. Standard 82 Test Procedure for Impulse Voltage Tests on Insulated Conductors.

- B. Comply with provisions of these specifications and conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.

1.3 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Submit the following:
 - 1. Product data for electrical wires, cables, and connectors.
 - 2. Product data for Megger insulation testing instrument.
 - 3. Report sheets for Megger testing.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable properly packaged in factory-fabricated-type containers or wound on NEMA specified type wire and cable reels.
- B. Store wire and cable in clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Wires and Cables
 - 1. Provide electrical wires and cables of manufacturer's standard materials as indicated by published product information designed and constructed as recommended by manufacturer for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
 - 2. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by the Installer to comply with project's installation requirements, NEC, and NEMA standards. Select from the following UL types those wires with construction features which fulfill project requirements:
 - a. Insulation, moisture, and heat-resistant, flame-retardant thermoset; conductor, annealed copper (XHHW).
 - b. Insulation, moisture, and heat-resistant, flame-retardant thermoplastic; conductor, annealed copper (THWN).

WIRE, CABLES, AND CONNECTORS

3. Provide color coding for phase identification in accordance with requirements in Division 16 Section 16075 - Electrical Identification.
4. Conductor stranding, unless otherwise noted, shall be as follows:

Conductor Size (AWG or kcmil)	Strands
No. 14	7
No. 12 to No. 10	7
No. 8 to No. 2	7
No. 1 to No. 4/0	19
250 and above	37

B. Low Voltage Cable/Conductors

1. 600 Volt Copper Cable:

- a. UL Listed conductors of 98 percent conductivity copper. Conductors must be Class B stranded as per ASTM B-8.
- b. Insulation must be cross-linked ethylene. Insulation must meet or exceed all requirements of UL Standard 44.
- c. Cable must be rated 90°C dry, 75°C wet.
- d. Provide conductors of proper size and ampacity ratings according to NEC Article 310 except for the following modifications:
 - 1) Minimum Conductor Size:
 - a) No. 12 AWG in power and branch feeder circuits.
 - b) No. 14 AWG in control, alarm, and status circuits.
 - 2) Maximum number of conductors in raceways or conduits not to exceed four (three phase conductors and one neutral) plus ground except for control wires or when so indicated on the drawings.
- e. Insulated conductors must bear the date of manufacture imprinted on the wire insulation with other identification. Wire and cable manufactured more than 12 months before delivery to the job site must not be used.
- f. Type UF non-metallic insulated cable, ROMEX or BX not permitted for use in this project.

C. Variable Frequency Drive Motor Supply Cable:

1. Provide cable which meets the following:
 - a. Variable frequency drive cables #1 AWG or larger, where identified on the cable schedule, shall be class B stranded copper wire with XLPE

WIRE, CABLES, AND CONNECTORS

insulation, 3 bare stranded ground conductors, a longitudinal corrugated copper tape shield and a black PVC Jacket. The cable shall carry a 600V UL-TC rating with a temperature range of -20°C to 90°C. The cable shall be a Lapp Olflex VFD Symmetrical or equal.

- b. Variable frequency drive cables #2 AWG or smaller, where identified on the cable schedule, shall be class K stranded copper with a specially formulated semi conductive insulation designed for nonlinear/VFD drives, 100% shielding with foil tape and a tinned copper braid and an industrial grade PVC jacket. There shall be three current carrying conductors and one ground conductor. The cable shall carry a 600V UL-TC rating with a temperature range of -25°C to 90°C. The cable shall be a Lapp Olflex VFD Slim or equal.
- c. The minimum bending radius shall be 15 times the overall diameter of the cable.
- d. Termination of copper shield shall be in accordance with the manufacturer's recommendations.

D. Multi-Conductor Power Cable:

- 1. Provide cable which meets the following:
 - a. Multi-conductor power cable shall be NEC type TC, 600V with class B stranded copper conductors (Three insulated conductors and one bare copper ground conductor). The overall jacket shall be sunlight resistant PVC. Separate or individual conductors shall not be substituted for multi-conductor cables.
 - b. Cable UL Listed 90°C Dry; 75°C wet.
- 2. Cable shall be suitable for installation in raceways and free air.

E. Multi-Conductor Control Cable:

- 1. Provide cable which meets the following:
 - a. Control cable shall be general purpose, NEC type TC with a 600V with class B stranded copper conductors. Each wire shall be color-coded with a cross-linked polyethylene insulation (XHHW) and the entire cable shall be covered with a PVC jacket. Where multi-conductor cable is shown on the drawings, the cable shall run from device terminals to the appropriate control panel terminals without splices. The color coding shall comply with ICEA, E-2 color sequence. Separate or individual conductors shall not be substituted for multi-conductor cables.
 - b. Cable UL Listed 90°C Dry; 75°C wet.
 - c. Cable passing the IEEE 383 and UL 1277 Vertical Cable Tray Flame Tests at 70,000 BTU/hr and the 210,000 BTU/hr flame test per ICEA T-29-520.
- 2. Cable shall be suitable for installation in raceways and free air.

F. Shielded Instrumentation Cable:

1. Provide cable which meets the following:
 2. Cable fabricated using stranded tin-coated copper conductors, PVC insulated with a nylon overcoat and a PVC Jacket.
 3. Cable 100 percent shielded, utilizing aluminum-polyester foil, incorporating a #18 AWG stranded tinned copper drain wire.
 4. Cable passing UL 1581 Vertical Tray Flame Test for VW-1 Rating.
 5. Cable UL (recognized) Subject 1277 having a 600-volt insulation and 90°C temperature rating, twisted pairs, or triads, #16 AWG.
 6. Cable NEC Type TC listed.
- G. Direct Burial Conductors and Cables:
1. Type USE/RHH/RHW insulation, UL 854 listed, Type RHW-2/USE-2.
 2. Conform to physical and minimum thickness requirements of NEMA WC 3.
- H. Flexible Cords and Cables:
1. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
 2. Conform to physical and minimum thickness requirements of NEMA WC 8.
- I. Fiber Optic Cables:
1. Fiber optic cables shall be of heavy-duty construction and designed for direct burial, duct, plenum, outside and tray applications. The cables shall utilize an aluminum interlocking outer armor covered by a fluoropolymer jacket, tight-buffered optical fibers surrounded by an aramid strength member with an inner fluoropolymer jacket covering. The cables shall conform to the following specifications:
 - a. Fiber Counts - see schedule and/or drawings, 4 count minimum
 - b. Type - Multimode
 - c. Core/Clad/Coating size - 50/125/245mm
 - d. Storage Temperature Range - -40°C to +80°C
 - e. Operating Temperature Range - -40°C to +80°C
 - f. Max Attenuation (@850/1310nm) - 3.0/1.0 dB/km
 - g. Min Bandwidth (@850/1310nm) - 950/500 MHz-km
- J. Special Cables:
1. Special wiring and cables for signal, instrumentation and communication shall be as indicated under the appropriate Section, on the drawings, on the cable schedule or as recommended by the equipment manufacturer.

K. Splices:

1. Provide UL-type factory-fabricated metal connectors and terminals of sizes, ampacity ratings, materials, types, and classes indicated.
2. Twist-on Connectors: Conforming to UL 486 C, consisting of a tapered spring with insulated outer covering.
3. Compression Connectors: Tin-plated copper. Configuration shall be tee, in-line, etc., as required.
4. Terminals: Tin-plated copper, compression locking fork tongue with insulated barrel.
5. Compression Lugs: Tin-plated copper, standard barrel, one-hole, or two-hole as required.
6. Heat-Shrink Insulation: Heat-shrinkable polyolefin with an internally applied adhesive watertight sealant.
7. Motor Connection Kit: Consisting of compression lugs bolted together, cloth tape cover, and heat-shrink insulation.

L. Terminations:

1. Terminations shall be made with bolted or mechanical compression connectors. Large diameter power cable shall terminate with NEMA 2-hole, long barrel crimp type lugs suitable for copper or aluminum cable rated for 75°C where direct connections to bus is required. The Contractor shall verify the required sizes as shown on the drawings, the cable schedule or as dictated by the cable size.
2. All wiring shall be terminated and spliced with compression type insulated connectors.
3. Connectors shall have insulation covering with a thickness of 1.5 times the conductor insulation thickness. The insulation covering may be part of the assembly or an applied heat shrinkable material.
4. All control and instrumentation wiring shall be terminated in control panels, terminal boxes and at control devices with compression type, PVC, or nylon insulated fork tongue lugs where the device terminals cannot accept bare wire.
5. Terminations made in below grade boxes or boxes that are located in wet/damp areas shall be made with waterproof butt splice connectors. These areas shall include the wet well side of pump stations, meter/valve vaults, etc. The connectors shall be Molex Perma-Seal™, all weather heat sealable crimp connectors.

6. Each fiber optic shall be terminated with a fusion-spliced pigtail on each end. The connector types shall be as required by the terminal devices.

M. Wire and Cable Markers:

1. Wire markers for power feeders and branch circuit conductors shall be Brady B-500 adhesive backed vinyl cloth type or approved equal.
2. Wire markers for control, instrument and telephone wiring shall be Brady B-321 heat shrinkable polyolefin type or approved equal.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

1. Wire and Cable
 - a. American Insulated Wire Corp
 - b. Southwire Company
 - c. Brintec Corporation
 - d. Carol Cable Co., Inc.
 - e. Lapp Group
 - f. Optical Cable Corporation
 - g. Senator Wire and Cable Co.
 - h. Or Equal
2. Connectors and Terminals for Wires and Cable Conductors
 - a. AMP
 - b. Burndy Corporation
 - c. Ideal Industries, Inc.
 - d. 3M Company
 - e. Molex
 - f. Optical Cable Corporation
 - g. O-Z/Gedney Co.
 - h. Raychem
 - i. Thomas and Betts Corporation
 - j. Or Equal

PART 3 – EXECUTION

3.1 WIRE AND CABLE INSTALLATION

- A. Uses Permitted:
1. Install UL Type XHHW cable for power feeders, motor branch circuits, panelboard feeder circuits, and below grade or exterior power and control circuits.
 2. Install UL Type THWN or XHHW wiring in conduit, for branch circuits for lighting, receptacles, and interior control and metering circuits.
 3. Install UL Type MTW wiring interior to instrument and control panels. Conductors shall be stranded with at least 19 strands in the conductor.
- B. Install electrical cables, wires, and connectors in compliance with NEC.
- C. Coordinate cable installation with other work.
- D. All power/lighting wiring shall be completely installed in conduit unless otherwise noted.
- E. Low level wiring (telephone, data, security, HVAC control, etc.) shall be installed in a combination of conduit and cable tray. Concealed wiring shall be installed in conduit up to a point approximately two inches from a cable tray. At no point shall cables be routed in free air without support by either conduit or cable tray. Cables shall not be supported on the outside of conduits.
- F. Pull conductors simultaneously where more than one is being installed in the same raceway. Use UL listed pulling compound or lubricant, where necessary.
- G. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
- H. Conceal all cable in finished spaces.
- I. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible.
- J. Power conductors shall be No. 12 AWG minimum. Control conductors shall be No. 14 AWG.
- K. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

3.2 CONNECTOR, TERMINAL, AND SPLICE INSTALLATION

A. Uses Permitted:

1. Install twist-on connectors for lighting, communication, and receptacle branch circuits and utilization equipment only in size No. 10 AWG and smaller and only in finished areas.
2. All control and instrumentation wire shall terminate with compression type fork lugs on screw clamp terminal strips in control cabinets, terminal boxes, starters, control panels, or device terminals. Control wire may be installed without compression type termination lugs on a temporary basis for checkout prior to final wire marking.
3. The intention of these specifications is that all feeder, control, and instrument wire shall not be spliced. All control wires shall terminate on terminal blocks or at device terminals.
4. Where control and power wiring are in the same enclosure, the control wiring shall be bundled and separated to the maximum extent possible from the power wiring. Where instrument circuits (shielded cable) cannot be separated from power wiring, the cable shall be installed in conduit inside the enclosure, or a metal barrier shall be installed between them.
5. Install motor connection kits on all motors.
6. Install compression connectors and lugs for all other connections.

B. Use splice and tap connectors which are compatible with conductor material.

C. Install all compression connectors, splices, and lugs with a ratcheting tool which will not release until proper compression is achieved.

D. Install splices which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced.

E. All feeder and branch circuit wires shall be color coded to match the OWNER's existing coding or where no consistent coding exists, as follows:

Wire	(480) 480Y/277V, 3PH	(240) 208Y/120V, (1PH) 3PH
Phase A	Brown	(L1) Black
Phase B	Orange	(L2) Red
Phase C	Yellow	Blue
Grounded Conductor	Gray	White
Equipment Ground Conductor	Green	Green

F. Wire sizes #8 AWG and larger may be identified by tags or labels on each end instead of insulation color. Tags or labels shall have the same color-coding.

- G. Pulling lubricant shall be a type recommended by the wire or cable manufacturer.
- H. No conductors shall be pulled until conduits are free from moisture and contaminants.
- I. Immediately after pulling a feeder or branch power cable (Does not apply to branch lighting fixture and receptacle circuits), the following information shall be submitted, in writing, to the Engineer and/or to the Consultant performing the power system study, if applicable:
 - 1. Date
 - 2. Temperature
 - 3. Weather
 - 4. Pulled By
 - 5. Cable No.
 - 6. Cable from Equipment
 - 7. Cable to Equipment
 - 8. No. of Conductors
 - 9. Cable Type (1/C, 3/C, VFD, etc.)
 - 10. Insulation Type
 - 11. Voltage Rating
 - 12. Shielding (N/A or Type)
 - 13. Manufacturer
 - 14. Final Length
- J. All splices shall be made only by specific permission of the Engineer, and then only in manholes or pull boxes, and shall be sealed watertight with approved heat-shrink insulation.
- K. Tighten electrical connectors and terminals in accordance with manufacturer's published torque tightening values. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and 486B.

3.3 WIRE AND CABLE MARKERS

- A. All power feeders and branch circuit wires shall be tagged in cabinets, junction boxes, panel boards, etc. with permanent labels attached to the wire within 6 inches of the termination point. Labels shall be legible and shall not be removed, cut-off, etc. Each

individual conductor shall be labeled with an alphanumeric code that corresponds to the cable schedule (PXXX-A, B, C, N, L1, L2, G or SPARE-1,2...).

- B. All control, telephone, signal, and instrumentation wires shall be identified on each end. The overall cable (If available) shall be labeled with an alphanumeric code that corresponds to the cable schedule (CXXX). Individual conductors shall be labeled to correspond with the identifications provided by the individual equipment manufacturers to which the conductors are attached. Where no such identifications exist, the individual conductors shall also be labeled to correspond to the cable schedule (CXXX-1, 2, 3... or SPARE-1, 2...).
- C. Numbers shall be typed on the heat shrinkable labels with permanent ink. Hand lettered labels are not acceptable.
- D. Labels shall be installed approximately 1/2" from the termination point and shrunk to a tight fit on the wire with a heat gun.
- E. Labels shall be oriented such that they are right side up and readable after the wire is connected to the terminal block.
- F. All cables shall be identified in all pull boxes, terminal boxes, manholes, control cabinets, control panels, enclosures etc. with permanent labels attached to the cable.

3.4 FIELD QUALITY CONTROL

- A. The Contractor shall test each electrical circuit after permanent cables are in place with terminators installed, but before cable or wire is connected to equipment or devices to demonstrate that each circuit is free from improper grounds and short circuits.
- B. The Contractor shall test the insulation resistance between phases and from each phase to ground for each of the following feeder and motor branch circuits:
 - 1. All feeders size 4/0 and larger.
 - 2. Motors feeders for any motor over 5 HP.
- C. Measure the insulation resistance at 500 volts dc with a hand-cranked or motor-driven insulation testing instrument. Battery-operated test instruments are not permitted.
- D. If any insulation resistance measures less than 50 megohms, the cable shall be considered faulty with the cable failing the insulation test. In moist environments, bag the ends of the cable to prevent a faulty test.
- E. Any cable which fails the insulation tests, or which fails when tested under full load conditions shall be replaced with new cable for the full length and retested. Corrective action and repeated tests shall be accomplished at the Contractor's own expense.

- F. Maintain testing report sheets identifying each cable tested, what each feeder or motor branch circuit will be connected to, and the level of insulation resistance measured. Test reports shall be signed by the tester and submitted to the Engineer for review.
- G. All fiber optic cables shall be tested to ANSI/TIA-568-C.3.

END OF SECTION

CABINETS, BOXES, AND FITTINGS

SECTION 16130

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install electrical boxes and fittings in accordance with the plans and as specified herein.

- B. Types of electrical boxes and fittings specified in this section include the following:
 - 1. Outlet boxes
 - 2. Junction boxes
 - 3. Pull boxes
 - 4. Floor boxes
 - 5. Bushings
 - 6. Locknuts
 - 7. Knockout closures

1.2 QUALITY ASSURANCE

- A. Perform all work in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.
 - 1. National Electrical Code (NEC) Compliance. Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
 - 2. Underwriters' Laboratories (UL) Compliance. Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes, fittings and enclosures which are UL listed and labeled.
 - 3. National Electrical Manufacturer's Association (NEMA) Compliance. Comply with applicable requirements of NEMA Standard Publication Nos. OS1, OS2, and 250 pertaining to outlet and device boxes, covers, and box supports.
 - 4. Federal Specification (FS) Compliance. Comply with applicable requirements of FS W-C-586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies and Entrance Caps."

1.3 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Shop Drawings for Electrical Boxes and Fittings: For shop-fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.

1.4 DELIVERY, HANDLING, AND STORAGE

- A. Store cabinets, boxes, and fittings in clean, dry space; protect products from weather, damaging fumes, construction debris, and traffic.

2.1 ELECTRICAL BOXES AND FITTINGS

- A. Electrical cabinets, boxes, and fittings of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations. Provide corrosion-resistant box knockout closures to suit respective installation requirements and applications.

2.2 METALLIC OUTLET, DEVICE AND WIRING BOXES

- A. Conform to UL 514A, "Metallic Outlet Boxes, Electrical" and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.
- B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes, and accessories suitable for each location, including mounting brackets and straps, cable clamps, exterior rings, and fixture studs.
- C. Cast Aluminum Boxes: Copper-free aluminum threaded raceway entries, features, and accessories suitable for each location including mounting ears, threaded screw holes for devices, and closure plugs. All exposed outlet boxes for use with rigid galvanized or aluminum conduit shall be type "FD" (No type FS) cast aluminum boxes with cast aluminum device plates/cast aluminum blank covers or Cooper Crouse-Hinds type GUA outlet boxes with thread covers.

2.3 NON-METALLIC OUTLET, DEVICE, AND WIRING BOXES

- A. Conform to NEMA OS 2, "Non-Metallic Outlet Boxes, Device Boxes, Covers, and Box Supports," and UL 514C, "Non-Metallic Outlet Boxes, Flush Device Boxes, and Covers." Boxes shall be molded PVC units of type, shape, size, and depth to suit location and application.
- B. Non-Metallic Boxes: Ultraviolet stabilized, non-conductive, high-impact-resistant boxes

with integrally molded raceway entrance hubs and removable mounting flanges. Boxes shall be equipped with threaded screw holes for device and cover plate mounting. Each box shall have molded cover of matching polyvinyl chloride (PVC) material suitable for the application.

2.4 PULL AND JUNCTION BOXES

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes," for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted-on covers of same material as box and shall be of size and shape to suit application. All boxes 6-inch x 6-inch or larger shall have hinged doors.
- B. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanize after fabrication. Cover shall be gasketed.
- C. Stainless Steel Boxes: Fabricate of stainless-steel conforming to Type 316 of American Society for Testing and Materials (ASTM) A 167, "Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip." Where necessary to provide a rigid assembly, construct with internal structural stainless-steel bracing. Cover shall be gasketed.
- D. Cast Aluminum Boxes: Molded of copper-free aluminum, with gasketed cover and integral threaded conduit entrances similar to Cooper Crouse-Hinds type GUA outlet boxes.
- E. Cast Nonmetallic Boxes: Ultraviolet stabilized, non-conductive, high-impact-resistant PVC boxes with gasketed cover and integral mounting flanges.

2.5 STEEL ENCLOSURES WITH HINGED DOORS

- A. General: Comply with UL 50, "Cabinets and Enclosures," and NEMA ICS6 "Enclosures for Industrial Control and Systems."
- B. Construction: Sheet steel, 16-gauge, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface-mounting.
- C. Doors: Hinged directly to cabinet and removable with approximately 3/4-inch flange around all edges, shaped to cover edge of box. Provide handle-operated, key-locking latch. Individual door width shall be no greater than 24 inches. Provide multiple doors where required.
- D. Mounting Panel: Provide painted removable internal mounting panel for component installation.
- E. Enclosure: NEMA type as indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips.

2.6 CAST METALLIC ENCLOSURES WITH HINGED DOORS

- A. Copper-free aluminum with bolted, hinged doors. Where used at hazardous (classified) locations, enclosures shall conform to UL and shall be listed and labeled for the classification of hazard involved.

2.7 MOLDED NONMETALLIC ENCLOSURES WITH HINGED DOOR

- A. Molded, glass-fiber-reinforced high-impact-strength polyester with bolt or screw-secured doors and solid neoprene gaskets.

2.8 CORROSION INHIBITORS

- A. All enclosures containing equipment, terminals, or splices shall have a vapor phase corrosion inhibitor. Provide two spares for each one installed.

2.9 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 1. Adalet-PLM Div.; Scott Fetzer Co.
 2. American Electric
 3. Eaton; Crouse-Hinds, Co.
 4. Appleton Electric Co.; Emerson Electric Co.
 5. Harvey Hubbell, Inc.
 6. OZ/Gedney Co.; General Signal Co.
 7. Pass and Seymour, Inc.
 8. Thomas & Betts Co., Inc.
 9. Walker; Wire Mold Company
 10. Or Equal

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. In general, all outlet boxes and small junction and pull boxes shall be cast aluminum with cast aluminum device plates or cast aluminum blank covers. Boxes which must be larger than outlet boxes shall be made of ASTM 316 stainless steel and shall be rated NEMA type 4X unless specifically shown otherwise. Metal boxes with conduit concentric or eccentric knockouts shall not be used.
- B. Install electrical boxes and fittings as indicated, in accordance with manufacturer's

CABINETS, BOXES, AND FITTINGS

written instructions, applicable requirements of NEC and National Electrical Contractor's Association (NECA) "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.

- C. Install items where indicated and where required to suit code requirements and installation conditions. Cap unused knockout hole where blanks have been removed and plug unused conduit hubs so as to maintain the NEMA rating of the box. Install boxes in locations which ensure ready accessibility to enclosed electrical wiring and avoid installing boxes back-to-back in walls where there would be less than 6 inches (150 mm) separation. Fasten boxes firmly and rigidly to substrates or structural surfaces to which attached or solidly embed electrical boxes in concrete or masonry. Do not install aluminum products in concrete.
- D. Outlet and device boxes for flush-mounted installation shall be a minimum of 4-inch square or octagonal and positioned accurately to allow for surface finish thickness.
- E. Junction boxes, pull boxes, and enclosures which are surface-mounted shall utilize spacers to maintain 1/4-inch clearance from the wall.
- F. Floor boxes shall be installed level and flush with finish flooring material.
- G. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and secure connections when fastened with locknut or bushing on rounded surfaces.
- H. Provide electrical connections for installed boxes.

3.2 COORDINATION

- A. Coordinate installation of electrical cabinets, boxes, and fittings with wire/cable, wiring devices, and raceway installation work.

3.3 APPLICATIONS

- A. Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the Contract Drawings and the following requirements:
 - 1. Use galvanized flat rolled sheet steel boxes where shown concealed in finished areas with framed construction.
 - 2. Each box with associated covers and fittings shall have a NEMA rating suitable for each location or as indicated on the contract drawings.

- B. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location as indicated on the contract drawings.
- C. Enclosures with Hinged Doors: Install enclosures and associated materials and NEMA types suitable for each location as indicated on the contract drawings.
- D. Floor Boxes: Install cast iron floor boxes at each location as indicated on the contract drawings.

3.4 GROUNDING

- A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

3.5 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components, remove burrs, dirt, and construction debris, and repair damaged finish including chips, scratches, abrasions, and weld marks.

END OF SECTION

SUPPORTING DEVICES

SECTION 16190

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install supporting devices in accordance with the plans and as specified herein.
- B. Types of supports, anchors, sleeves, and seals specified in this section include the following:
 - 1. Clevis hangers
 - 2. Riser clamps
 - 3. C-clamps
 - 4. I-beam clamps
 - 5. One-hole conduit straps
 - 6. Two-hole conduit straps
 - 7. Round steel rods
 - 8. Lead expansion anchors
 - 9. Toggle bolts
 - 10. Wall and floor seals
 - 11. U-channel strut system
- C. Supports, anchors, sleeves and seals furnished as part of factory fabricated equipment, are specified as part of that equipment assembly in other divisions and Division 16 sections.

1.2 QUALITY ASSURANCE

- A. Perform all work in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.
 - 1. Comply with NEC requirements as applicable to construction and installation of electrical supporting devices.
 - 2. Comply with applicable Manufacturer's Standardization Society (MSS) standard requirements pertaining to fabrication and installation practices for pipe hangers and supports.

SUPPORTING DEVICES

3. Comply with National Electrical Contractors Association's (NECA) "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
4. Provide electrical components which are Underwriters' Laboratories, Inc (UL) listed and labeled.
5. Comply with Federal Specification (FS) FF-S-760 pertaining to retaining straps for conduit, pipe, and cable.

1.3 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Submit the following:
 1. Product data for all proposed supporting devices.

1.4 DELIVERY, HANDLING, AND STORAGE

- A. Deliver supporting devices properly packaged in factory fabricated type container.
- B. Store supporting devices in clean dry space in original containers. Protect products from weather damaging fumes, construction debris, and traffic.
- C. Handle supporting devices carefully to avoid damage.

PART 2 – PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

- A. Provide supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is the installer's option.
- B. Provide supporting devices of types, sizes and materials indicated for the types of areas as defined on the Contract Drawings; and having the following construction features:
 1. Clevis Hangers: For supporting conduit; with 1/2-inch diameter hole for round steel rod.
 2. Riser Clamps: For supporting conduit; with two bolts and nuts.
 3. Reducing Couplings: Steel rod reducing coupling, 1/2-inch x 5/8-inch; galvanized steel.
 4. C-Clamps: Malleable iron; 1/2-inch rod size.

5. I-Beam Clamps: Galvanized steel, stainless steel or PVC coated Galvanized steel, 1-1/4-inch x 3/16-inch stock, 3/8-inch cross bolt; flange width 2 inches.
 6. One Hole Conduit Straps: For supporting conduit.
 7. Two Hole Conduit Straps: For supporting conduit; 3/4-inch strap width; and 2-1/8 inches between center of screw holes.
 8. Hexagon Nuts: For 1/2-inch rod size.
 9. Round Steel Rod: Galvanized steel or stainless steel; 1/2-inch diameter.
 10. Offset Conduit Clamps: For supporting conduit.
- C. All sleeve holes or other openings in outside walls shall be sealed to prevent any water seepage through these openings. All locations where wall sleeves pass through exterior structure walls or tank walls shall have cast iron, HDPE or steel sleeves installed. The sleeves shall be complete with water stop.
- D. Where sleeve openings enter spaces through walls at a location below grade or where identified on the drawings, the space between the conduit and the wall opening shall be sealed with a mechanical type seal. The mechanical seal shall be a modular type consisting of synthetic rubber link shaped to continuously fill the annular space between the pipe and the wall opening. The closure shall be watertight when the bolts are tightened. The bolts shall be 316 stainless steel.
1. Acceptable Manufacturers:
 - a. Link Seal
 - b. Or Equal

2.2 ANCHORS

- A. Provide anchors of types, sizes and materials indicated; and having the following construction features:
1. Lead Expansion Anchors: 1/2-inch.
 2. Toggle Bolts: Springhead; 3/16-inch x 4 inch.
 3. Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for rigid metal conduit; conduit size, wire type, and count as indicated; construct body of malleable iron casting with hot dip galvanized finish.
 4. Subject to compliance with the requirements, manufacturers offering supports and anchors which may be incorporated in the work include the following:
 - a. Ackerman Johnson Fastening Systems Inc.
 - b. Ideal Industries, Inc.
 - c. Joslyn Manufacturing and Supply Co.

- d. McGraw Edison Co.
- e. Rawlplug Co. Inc.
- f. Star Expansion Co.
- g. U.S. Expansion Bolt Co.
- h. Or Equal

2.3 U-CHANNEL STRUT SYSTEMS

- A. Provide U-channel strut system for supporting electrical equipment, 12-gauge hot dip galvanized steel, or stainless steel, of types and sizes indicated; construct with 9/16-inch diameter holes, 8-inch o.c. on top surface, with standard finish, and with the following fittings which mate and match with U-channel:
 - 1. Fixture hangers
 - 2. Channel hangers
 - 3. End caps
 - 4. Beam clamps
 - 5. Wiring stud
 - 6. Rigid conduit clamps
 - 7. Conduit hangers
 - 8. U-bolts
- B. Subject to compliance with the requirements, provide channel systems of one of the following manufacturers:
 - 1. B-Line Systems, Inc.
 - 2. OZ/Gedney Div.; General Signal Corporation
 - 3. Unistrut Div.; GTE Products Corporation
 - 4. GS Metals Corp.; Globes Strut
 - 5. Or Equal

PART 3 – EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

- A. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturers' written instructions and with recognized industry practices to ensure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacing indicated and in compliance with NEC requirements.
- D. Install conduit seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal. Provide seals for the interior of conduits which penetrate exterior or water bearing walls, consisting of gland type sealing.

END OF SECTION

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ENGINE GENERATORS

SECTION 16235

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Electrical Contractor shall furnish all labor, materials, equipment, and appurtenances necessary for one (1) fixed engine-generator standby emergency power system installed outdoors in a weather protective, sound attenuated enclosure.
- B. This section includes a packaged engine-generator set for a standby power supply with the following features:
 - 1. Engine-generator, controls, and accessories
 - 2. Exhaust silencer and piping
 - 3. Fuel system with integral sub-base tank
 - 4. Batteries and battery charger
 - 5. Weather protective, sound attenuated housing with accessories
- C. Related Sections include the following:
 - 1. Section 16450 “Grounding” for specifications covering grounding of components.
 - 2. Section 16075 “Electrical Identification” for specifications covering electrical systems.
 - 3. Section 16236 “Transfer Switches” for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.2 SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal Damage curve for generator.
 - 2. Time-current characteristic of curves for generator protective device.
- B. Shop Drawings: Detailed equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawing of engine-generator set and other components specified.
2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
3. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Qualification Data: For manufacturer.
 1. The generator shall be manufactured by a firm that has been regularly engaged in the production of engine-generator sets and associated controls for a minimum of twenty years, thereby identifying one source of supply and responsibility.
 2. The manufacturer shall provide factory-trained service and parts support through a factory authorized dealer/supplier that is regularly doing business in the area of installation.
 3. The manufacturer shall have printed literature and brochures describing the standard system specified, not a one-of-a-kind fabrication.
- D. Source quality-control test reports.
 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.
 7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
 8. Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures" include the following:

- a. List of tools and replacement items recommended to be stored at the Project for ready access. Including part and drawing numbers, current prices, and source of supply.
- E. Field quality-control test reports.
- F. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals.
 - 1. List of tools and replacement items recommended to be stored at the Project for ready access. Including part and drawing numbers, current prices, and source of supply.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Three of each different size and/or type.
 - 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. Belts: One set of each generator fan belt.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Source Limitations: Obtain packaged engine-generator sets and auxiliary components through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASME B15.1
- E. Comply with NFPA 37
- F. Comply with NFPA 30

- G. Comply with NFPA 70
- H. Comply with NFPA 99
- I. Comply with NFPA 110 requirements for Level 1 emergency power supply system
- J. Comply with UL 2200
- K. The complete generator system shall be in full compliance with all federal, state, county, and local codes. The Supplier shall be responsible for meeting these requirements, even when not specifically detailed in these specifications. The Supplier shall consult the timeline specified by the contract documents to determine the required installation date for the purpose of providing a unit that will meet the applicable emissions and above ground fuel storage tank standards and/or requirements.
- L. Noise Emission: Comply with generator specification for maximum noise level at due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.7 PROJECT COORDINATION

- 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 Owner no fewer than seven days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Minimum Temperature: 0° F / -17.78°C
 - 2. Maximum Temperature: 104° F /40°C
 - 3. Relative Humidity: 0 - 95 percent
 - 4. Altitude: 1,000 feet / 300 meters

1.8 WARRANTY

- A. The Electrical Contractor shall provide the services of a factory representative to conduct the initial start-up, checkout, and demonstration of the engine-generator units.
- B. Provide a five (5) year or 1500 hours written warranty on all engine-generator parts including the engine, alternator, controls and accessories and the automatic transfer switch. The warranty shall consist of a comprehensive extended warranty for a total of five (5) years.
- C. The Supplier shall include a full two years of maintenance and testing services. The maintenance shall include a minimum of two visits per year by a qualified service technician to perform all maintenance included in the manufacturers published recommended maintenance schedule. If critical maintenance must be performed based on actual generator runtimes, the Supplier must request in writing, to be notified by the Owner, when the generator approaches the runtime limit. The testing shall include one visit per year to perform a 100% rated load test into a portable load bank. Overall load bank testing requirements shall be one initial, one after the first year and one after the second year. Year one shall commence after all initial testing and demonstration has been completed. All load banks, cables, test equipment, etc. required shall be furnished by the Supplier. Any consumable materials required during the two-year maintenance period shall be furnished (and disposed of) by the Supplier.
- D. The warranty shall cover all parts of the engine, alternator and control panel and automatic transfer switch for a full five (5) years including shipping of repair or replacement parts and equipment to the site.
- E. All labor costs including travel costs and travel time shall be covered for a full five (5) years.
- F. The warranty shall include consumables only when damage or loss is caused by a warrantable defect.
- G. The warranty shall have no deductibles applied.

1.9 PADEP REQUEST FOR DETERMINATION

- A. The Electrical Contractor shall prepare and submit a Request for Determination of Changes of Minor Significance and Exemption from Plan Approval/Operating Permit (RFD) to the Pennsylvania Department of Environmental Protection (PADEP). It shall be requested that the generator is being provided for "Emergency Use" only and will comply with the requirements set forth with the operation of the unit under this classification. The Electrical Contractor shall not move forward with the purchase of the generator set until a letter has been received from the PADEP indicating that the RFD has been reviewed and it has been determined that the generator set does not require plan approval. The PADEP can reject the RFD for a particular application; therefore, it is critical that the RFD is completed before the generator is installed. The Electrical Contractor is responsible for complying with all PADEP requirements as identified during Request for Determination

process to obtain Air Permitting after installation. All fees associated with air permitting are the Electrical Contractor's responsibility.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements set forth in these specifications, provide a product by one of the following manufacturers:
 - 1. Caterpillar
 - 2. Cummins
 - 3. Or Equal

2.2 ENGINE-GENERATOR SET

- A. The engine-generator and controls shall be manufactured, assembled, tested, and shipped as a unit. The engine-generator shall meet the detailed requirements of all paragraphs of the specification. The equipment of some manufacturers may require larger capacities and ratings in order to meet all requirements, however, in no case shall the capacities, sizes, ratings, etc. be less than those specified.
- B. The engine-generator unit shall be a standard production series and a prototype shall have been tested as follows:
 - 1. Maximum power level.
 - 2. Minimum motor starting capacity.
 - 3. Structural soundness.
 - 4. Torsigraph analysis per MIL-STD/705B, method 504.2. Torsional peaks not to exceed 5000 psi at the critical operating speed.
 - 5. Fuel consumption.
 - 6. Engine-generator cooling air flow.
 - 7. Transient response and steady state governing.
 - 8. Generator temperature rise per NEMA MGI-22.40.
 - 9. Single step load pick-up per NFPA 76A-822.
 - 10. Harmonic analysis and voltage wave form, deviation per MIL-STD705B, method 601.4.

11. Short circuit test for mechanical and electrical strength.

- C. The prototype unit tested shall have the same engine, fuel type, generator and major subsystems as the unit proposed.
- D. All requirements and ratings shall be based on operation at 1,000 feet at a maximum ambient temperature of 104°F. with all accessories (radiator fan, water pump, fuel pump, filters, oil pump, etc.) installed and connected.
- E. Extended stack alternators are acceptable if they are prototype tested and standard catalogued equipment.

1. The alternator shall be rated for 105°C. rise and have a minimum three phase continuous standby rating as follows:

ID	KW	KVA	PF	VOLTAGE	PHASE	SKVA (90% sustained voltage)
Hazmat	40	50	1.0	120/240V	1P3W	150

- F. The engine shall be a #2 diesel fueled, turbocharged, 4-cycle, 1800 RPM, water cooled with mounted radiator, fan, and water pump.
- G. The horsepower rating of the prime mover shall be such that any overloads which occur during motor starting, even though they may exceed the steady-state capability of the prime mover, shall not cause stalling.
- H. The engine shall have the following minimum ratings:

ID	BMEP	BHP	DISPLACEMENT	CYLINDERS	CYCLE
Hazmat	146 psi	69	3.3 liter	4	4

- I. The radiator and cooling system shall be sized to allow for continuous operation at full load in ambient temperatures of 104°F.
- J. The engine shall be equipped with an engine mounted thermostatically controlled 120 VAC, 1 phase, 1,500-Watt coolant heater and a 120 VAC, 100-Watt alternator heater. Both heaters shall be supplied with cord and plug connections. The Electrical Contractor shall furnish and install receptacles for these heaters inside the generator enclosure, along with the battery charger.
- K. Full pressure lubrication shall be supplied by a positive displacement lubricating oil pump. The engine shall have oil filters with replaceable elements.
- L. Engine-generator speed shall be governed by an electronic governor to maintain isochronous speed regulation for outputs from no-load to full-load. The governor shall have an adjustment to allow for 0 to 5% droop.

ENGINE GENERATORS

- M. The engine shall have a DC alternator with a transistorized voltage regulator. Remote 2-wire starting shall utilize a solenoid shift, electric starter.
- N. The generating set shall contain a complete engine start-stop control which starts the engine on closing contacts and stops the engine on opening contacts.
- O. The generator shall be a three phase, broad range reconnectable (12 leads) with full single-phase output capabilities, brushless, revolving field type with permanent magnet or EBS type exciter and solid-state voltage regulator. The stator shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semi-flexible driving flange to ensure permanent alignment. The insulation system shall be Class H as defined by NEMA MG-1. The generator shall withstand a high potential test of 1500 volts, 60 Hz to ground for one minute per NEMA MG-1.
- P. A heavy-duty lead acid battery shall be provided and shall be mounted inside the generator frame by the engine-generator manufacturer complete with appropriate cables. The battery shall have a cold crank rating as recommended by the engine-generator manufacturer.
- Q. An automatic float battery charger shall be installed inside the generator enclosure (If the charger is mounted outside of the enclosure, 120 VAC power must be provided by the Electrical Contractor and the charger must be installed inside a NEMA Type 3R enclosure). The battery charger shall be an automatic float type with amp rating as recommended by the engine-generator manufacturer and shall operate on 120 volts ac. The charger shall have overcurrent protection on both the ac input and the dc output. The charge rate shall be adjustable, and the circuitry shall maintain a constant battery voltage without overcharging. The charger shall be supplied with a cord and plug connection.
- R. A critical exhaust silencer shall be installed complete with piping, supports and appropriate shielding of the hot exhaust components. The silencer shall be installed with necessary stainless steel flexible tubing, exhaust rain cap, brackets, supports, etc. Silencer shall be installed inside the generator enclosure.
- S. A generator main circuit breaker set, mounted, and wired on the engine-generator skid. The circuit breaker shall be a UL listed, molded case, thermal magnetic type rated 200 Amps, 250 VAC, 2-pole.
- T. A ground lug shall be installed on the engine-generator skid and all equipment appropriately bonded.

2.3 FUEL STORAGE

- A. Base-Mounted Fuel Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Capacity: Fuel for 24-hour continuous operation at 100 percent rated power output.

3. Features:
 - a. Emergency tank and basin vents
 - b. Mechanical level gauge
 - c. Fuel supply and return lines, connected to generator set with flexible fuel lines, as recommended by the engine manufacturer, and in compliance with UL2200 and NFPA requirements.
 - d. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
 - e. High and low-level float switches to indicate fuel level. Wire switches to generator control for local and remote indication of fuel level.
 - f. Basin drain
 - g. Integral lifting provisions
 - h. Vandal-resistant fill cap
 - i. Lockable fill spill containment arrangement with manual drain valve. During fueling operations, the manual valve shall be closed to catch any overflow at the fill cap. This arrangement shall be installed inside the generator enclosure.
4. Containment Provisions: Comply with requirements of UL142 for double wall tank.

2.4 CONTROLS 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 generator set. When mode-selector switch is switched to the on position, the generator set shall start. The off position of same switch shall initiate generator-set shutdown. When generator set is running, specified system or equipment failures or derangements shall automatically shut down generator set and initiate alarms.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts the generator set. The off position of same switch shall initiate generator-set shutdown. When generator set is running, specified system or equipment failures or derangements shall automatically shut down generator set and initiate alarms.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Rigidly mounted to the generator set.

D. Digital Generator Controller:

1. Generator Control Panel Protection Features: KWH/KVARH meter, Engine (Over speed, Battery Over/Under Voltage, Auxiliary Excitation and Speed/Frequency Mismatch), Generator (Over/Under Voltage, Over/Under Frequency, Unbalanced Voltage, Dead Bus Detection, Overload, Reverse/Reduced Power, Definite Over Current and Time Over Current, Inverse Time Over Current, Measured Ground Fault, Phase Rotation).
2. Agency Approvals:
 - a. Conforms to UL 508, Industrial Control Equipment – UL Recognized Component.
 - b. Conforms to CSA Std. C22.2 No. 14, Industrial Control Equipment – CSA Certified
 - c. Complies with NFPA 110, Standard for Emergency and Standby Power Systems.
3. CE Compliance:
 - a. Low Voltage Directive (LVD) - 73/23/EEC as amended by 93/68/EEC
 - b. Electromagnetic Compatibility (EMC) - 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
 - c. EN 50178:1997 - Electronic Equipment for use in Power Installations
 - d. EN 61000-6-4:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Emission Standard for Industrial Environments
 - e. EN 61000-6-2:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments.
4. Environmental:
 - a. Temperature: Operating: -40 to 70°C (-40 to 158°F), Storage: -40 to 85°C (-40 to 185°F)
 - b. Humidity: IEC 68-2-38
 - c. Salt Fog: ASTM B 17-73, IEC 68-2-11 (tested while operational)
 - d. Ingress Protection: IEC IP54 for front panel
 - e. Shock: 15 G in 3 perpendicular planes
 - f. Vibration:

- 1) 5 to 29 to 5 Hz: 1.5 G peak for 5 min.
- 2) 29 to 52 to 29 Hz: 0.036" DECS-A for 2.5 min.
- 3) 52 to 500 to 52 Hz: 5 G peak for 7.5 min.

5. Engine Control:

- a. Cranking Control: Cycle or Continuous
- b. Engine Cool down
- c. Successful Start Counter: Counts and records successful engine starts
- d. Timers including, but not limited to:
 - 4) Engine Cool down Timer
 - 5) Engine Maintenance Timer
 - 6) Pre-Alarm Time Delays for Weak/Low Battery Voltage
 - 7) Alarm Time Delay for Over speed
 - 8) Alarm Time Delay for Sender Failure.

6. Alarms:

- a. Low Oil Pressure
- b. High Coolant Temperature
- c. Low Coolant Level
- d. Low Fuel Level
- e. Over speed
- f. Over crank
- g. Engine Sender Unit Failure
- h. Fuel Leak/Fuel Sender Failure
- i. Emergency Stop
- j. Battery Charger Failure
- k. Critical Low Fuel Shutdown

7. Pre-Alarms:

- a. Low Oil Pressure
- b. High Coolant Temperature
- c. Low Coolant Temperature
- d. Battery Overvoltage
- e. Weak Battery
- f. Battery Charger Failure
- g. Engine Sender Unit Failure
- h. Engine kW Overload (3 levels)
- i. Maintenance Interval Timer
- j. Low Coolant Level
- k. Low Fuel Level
- l. Fuel Leak Detect
- m. High Fuel Level

8. Generator Protection ANSI Functions:
 - a. Under voltage (27)
 - b. Overvoltage (59)
 - c. ANSI Codes Reverse Power (32)
 - d. Over frequency (81O)
 - e. Loss of Excitation (40Q)
 - f. Under frequency (81U)

- E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following accessories:
 1. Relays: Relay board shall include (2) 10-amp form C relays customizable for user defined functionality requirements. Standard outputs as follows:
 - a. Engine-generator Run
 - b. Engine-generator Fail

- F. 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.

2.5 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: The generator shall be a three phase, broad range reconnectable, 12 leads, with full single-phase output capabilities. Generator shaft shall be directly connected to the engine shaft. Exciter shall be a revolving field type with a permanent magnet type exciter and solid-state voltage regulator.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. 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.
- F. Enclosure: Drip proof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator:
 1. True RMS Sensing – One or three phase sensing mode. Voltage regulation shall be within plus or minus 2% of rated voltage from no-load to full load. The voltage regulation scheme shall be suitable for use with SCR type variable frequency drives and rectifier input sections and shall be immune from SCR

tracking and other harmonic induced problems. The instantaneous voltage dip shall meet the requirements of NFPA 110. Circuitry shall sense true RMS voltage rather than average for superior load regulation.

2. Soft-Start Ramp on Initial Start-Up Controlled increase to rated voltage. Limits overshoot of voltage during voltage build-up.
3. Engine Unloading Monitors the rate of frequency change during transient conditions. Provides additional voltage dip during speed drop to allow engine to recover faster.
4. Overvoltage Shutdown Provides generator protection during sustained overvoltage. The overvoltage point is preset at 20% over normal generator operating voltage, with a preset timeout of 0.75 seconds.

2.6 WEATHER PROTECTIVE SOUND ATTENUATED HOUSING

- A. Description: Enclosure shall be designed to be wind resistant up to 100 mph. ASCE 7-05 Exposure C, 3-second wind gusts.
- B. Description: Steel enclosure with the following features:
 1. Construction: Formed and/or welded steel.
 2. A fabricated steel base with double walled fuel tank. The base assembly shall include an integral double walled fuel tank with features and capacity as specified above (2.3(A)(2)).
 3. Hinged doors for access with lockable latches.
 4. Louvered and/or baffled air inlet. Grated air outlet. The enclosure shall be provided with an exhaust silencer which shall be mounted inside of the enclosure and shall allow the generator set package to meet specified sound level requirements. The silencer and exhaust shall include a raincap and rainshield.
 5. Interior lined with acoustical foam for sound attenuation.
 6. Choice of standard colors. Custom colors shall be available upon request.
 7. Sound Attenuation:
 - a. Oil and water-resistant acoustical materials to reduce noise emissions.
 - b. Average sound pressure level shall not exceed 69 dB(A) at 7 meters at full load in accordance with ISO 8528-10 and ANSI S1.13-2005.

2.7 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.8 SOURCE QUALITY CONTROL

- A. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set, 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. Full Load Run
 - 3. Maximum Power
 - 4. Voltage Regulation
 - 5. Transient and Steady-State Governing
 - 6. Single-Step Load Pickup
 - 7. Safety Shutdown
 - 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
 - 9. 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 set performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Furnish and install a reinforced concrete mounting pad for the standby emergency generator as shown on the drawings. Install anchor bolts in the concrete pad and anchor the complete assembly as recommended by the manufacturer. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work. Install ground connections and bond to the building ground grid.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

- C. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
- D. The Electrical Contractor shall provide all lubricating oil, anti-freeze, filters, etc. required for proper operation, test and checkout of the engine-generator unit.
- E. Furnish recommended diesel fuel as required to complete all tests, checkout and demonstration. At final completion of the project, the Electrical Contractor shall furnish a sufficient amount of diesel fuel to fill the tank. The fuel shall be suitable for storage in an unheated tank located outside in cold weather conditions.

3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding"
- B. Connect wiring according to Division 16 Section "Wires Cables & Connectors."

3.4 IDENTIFICATION

- A. Identify system components according to Division 16 Section "Electrical Identification."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative and EGSA (Electrical Generating Systems Association Certified Technician to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative and EGSA Certified Technician to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. After the engine-generator unit, complete with all accessories, has been installed and all servicing and checkout completed, the following tests shall be performed in the presence of the Owner or the Owner's representative:
 - a. Cold engine-generator start with connection to 100% of rated load into a load bank within 10 seconds. Verify that all parameters are within specified limits and continue to operate the generator at full load for 2 hours while recording parameters (volts, amps, temperature, oil pressure, frequency, etc.) every 15 minutes. All load banks, cables, test equipment, etc. required for this test shall be furnished by the Electrical Contractor.
 - b. With all of the facility equipment operating normally, simulate a power failure by disconnecting the main power source. Observe the proper operation of the automatic transfer switch, generator start, transfer of the

load, and start and proper operation of all equipment. Continue to operate the facility for a period of 1 hour while starting and stopping various items of equipment and observing the engine-generator for proper operation.

- c. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - d. 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.
 - e. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - f. 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.
 - g. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120kPa). 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.
2. Should it be necessary to perform the above tests on different days, the Electrical Contractor shall ensure that the factory representative will be present during all testing activities.
- D. Coordinate tests for transfer switches and run them concurrently.
 - E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
 - F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. 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.

3.6 DEMONSTRATION

- A. After all tests have been completed and record documents delivered to the Owner, the Contractor shall provide the services of a factory representative to demonstrate the engine-generator with all accessories and auxiliary equipment to the Owner or the Owner's representative.
- B. The demonstration shall include proper operation, periodic maintenance, and checkout of each major component. Specific attention shall be paid to safe operating procedures and safety hazards.
- C. The demonstration shall be separate from all other testing and checkout and shall be performed at the installed generator. The exact time shall be at the Owner's convenience and shall be a minimum of 4 hours.

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TRANSFER SWITCHES

SECTION 16236

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Electrical Contractor shall furnish and install transfer switches, where shown, rated 250 V and less, including the following:
 - 1. Automatic transfer switches
 - 2. Manual transfer switches

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
 - 1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.
 - 2. Single-Line Diagram: Show connections between transfer switch, power sources, and load.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
 - 1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
 - 2. Internal electrical wiring and control drawings.
 - 3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
 - 4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.
- C. Manufacturer and Supplier Qualification Data
 - 1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality

TRANSFER SWITCHES

assurance in design/development, production, installation, and service, in accordance with ISO 9001.

2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Features and operating sequences.
 2. List of all factory settings of relays, timers, and protective devices; provide setting and calibration instructions where applicable.
- E. Warranty documents demonstrating compliance with the project's contract requirements.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than eight hours from time of notification.
1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in-service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
 2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
 3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.
- B. Source Limitations: Where multiple units are specified, all transfer switches shall be obtained through one source from a single manufacturer. When the transfer switch(es) is included with an associated generator, the generator set manufacturer shall warrant the transfer switch(es) to provide a single source of responsibility for products provided.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

- D. The transfer switch installation and application shall conform to the requirements of the following codes and standards:
1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
 2. CSA 282, Emergency Electrical Power Supply for Buildings, and CSA C22.2, No. 14-M91 Industrial Control Equipment
 3. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
 4. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches.
 5. IBC – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance.
 6. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 7. EN55011, Class B Radiated Emissions and Class B Conducted Emissions.
 8. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity.
 9. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity.
 10. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity.
 11. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity.
 12. IEC 1000-4-6 Conducted Field Immunity.
 13. IEC 1000-4-11 Voltage Dip Immunity.
 14. IEEE 62.41, AC Voltage Surge Immunity.
 15. IEEE 62.45, AC Voltage Surge Testing.
- E. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 2 systems, regardless of the actual circuit level.
- F. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of one (1) year from registered commissioning and start-up.
- G. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc. during the minimum noted warranty period described above.

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H. Warranty documents demonstrating compliance with the project's contract requirements.

1.5 WARRANTY

1. The Electrical Contractor shall provide the services of a factory representative to conduct the initial start-up, checkout, and demonstration of the transfer switch(es).
2. Provide a five (5) year warranty on all automatic transfer switch parts, including any accessories. The warranty shall consist of a comprehensive extended warranty for a total of five (5) years.
3. The Supplier shall include a full two years of maintenance and testing services. The maintenance shall include a minimum of two visits per year by a qualified service technician to perform all maintenance included in the manufacturers published recommended maintenance schedule. The maintenance shall coincide with generator maintenance, which has been specified under this same contract. Any consumable materials required during the two-year maintenance period shall be furnished (and disposed of) by the Supplier.
4. The warranty shall cover all parts of the automatic transfer switch for a full five (5) years including shipping of repair or replacement parts and equipment to the site.
5. All labor costs including travel costs and travel time shall be covered for a full five (5) years.
6. The warranty shall include consumables only when damage or loss is caused by a warrantable defect.
7. The warranty shall have no deductibles applied.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Caterpillar
 2. Cummins
 3. ASCO
 4. Eaton
 5. ABB Zenith
 6. Or equal

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Provide transfer switches in the number and ratings that are shown on the drawings. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.
- B. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test. The withstand rating shall be 10,000A @ 240 V or as shown on the drawings.
- C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
 - 2. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
 - 3. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
 - 4. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from a generator set.
 - 5. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical but must be coordinated with control function.
 - 6. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.

7. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
 8. Transfer switches designated on the drawings as “4-pole” shall be provided with a switched neutral pole which is switched simultaneously with phase poles.
 9. Transfer switches designated on the drawings as “3-pole” shall have a full current-rated neutral bar with lugs.
 10. Transfer switches designated on the drawings as “service entrance” switches shall meet the requirements of section 2.4 of this specification.
- G. Control: Transfer switch control shall be capable of communicating with an engine-generator control, other switches and remote programming devices over a high-speed network interface.
- H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism
- I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer’s discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.
- J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:
1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
 2. Exterior cabinet doors shall provide complete protection for the system’s internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
 3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements as indicated on the contract drawings.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with requirements for Level 2 equipment according to NFPA 110.
- B. Indicated current ratings:

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1. Refer to the Project drawings for specifications on the sizes and types of automatic transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
 2. Main contacts shall be rated for 250 VAC minimum.
 3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).
- C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical but must be coordinated with control functions.
- D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project.
- E. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the engine-generator control, other transfer switches, remote annunciation equipment, and other devices over a high-speed control network.
- F. Neutral Switching: Transfer switches designated on the drawings as 4-pole shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is not acceptable.
- G. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
- H. Automatic Transfer Switch Control Features
1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 250 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
 2. All transfer switch sensing shall be configurable from an operator panel or from a Windows PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
 3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.

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4. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
 5. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
 6. The control system shall be designed, and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
 7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
 8. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.
- I. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.
1. The indicator panel LEDs shall display:
 - a. Which source the load is connected to (Source 1 or Source 2).
 - b. Which source or sources are available.
 - c. When switch is not set for automatic operation, because the control is disabled, or the bypass switch is in use.
 - d. When the switch is in test/exercise mode.
 2. The indicator shall have pushbuttons that allow the operator to activate the following functions:
 - a. Activate pre-programmed test sequence.
 - b. Override programmed delays, and immediately go to the next operation.
 - c. Reset the control by clearing any faults.
 - d. Test all of the LEDs by lighting them simultaneously.
 3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:
 - a. AC voltage for all phases, normal and emergency.

TRANSFER SWITCHES

- b. Source status: connected or not connected.
 - c. Load data, including voltage, AC current, frequency, KW, KVA, and power factor.
4. The display panel shall be password-protected, and allow the operator to view and make adjustments:
- a. Set nominal voltage and frequency for the transfer switch.
 - b. Adjust voltage and frequency sensor operation set points.
 - c. Set up time clock functions.
 - d. Set up load sequence functions.
 - e. Enable or disable control functions including program transition.
 - f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history.

J. Control Functions: Functions managed by the control shall include:

- 1. Software adjustable time delays:
 - a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (set at 5 seconds).
 - b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 seconds).
 - c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (set at 1 minute).
 - d. Engine cooldown: 0 to 30 minutes (set at 5 minutes).
 - e. Programmed transition: 0 to 60 seconds (set at 5 seconds).
- 2. Undervoltage sensing: Normal, emergency source.
 - a. Pickup: 85 to 98% of nominal voltage (default 90%).
 - b. Dropout: 75 to 98% of nominal voltage (default 90%).
 - c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec).
 - d. Accurate to within +/- 1% of nominal voltage.
- 3. Over-voltage sensing: Normal, emergency source.
 - a. Pickup: 95 to 99% of dropout setting (default 95%).
 - b. Dropout: 105 to 135% of nominal voltage (default 110%).
 - c. Dropout time delay: 0.5 to 120 seconds (default 3 sec).
 - d. Accurate to within +/- 1% of nominal voltage.
- 4. Over/under frequency sensing:
 - a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%).
 - b. Dropout: +/-1% beyond pickup (default 1%).
 - c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec).
 - d. Accurate to within +/- 0.2%.

5. Voltage imbalance sensing:
 - a. Dropout: 2 to 10% (default 4%).
 - b. Pickup: 90% of dropout.
 - c. Time delay: 2.0 to 20 seconds (default 5 sec).

6. Phase rotation sensing:
 - a. Time delay: 100 msec
7. Loss of single-phase detection:
 - a. Time delay: 100 msec

K. Control features shall include:

1. Programmable engine-generator exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.
 - a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.
2. In event of a loss of power to the control, all control settings, real-time clock setting, and the engine start-time delay setting will be retained.
3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

L. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
2. Provide one set Form C contact to indicate a general/common transfer switch alarm condition.
3. The transfer switch shall be provided with a network communication card and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
4. Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

M. Engine Starting Contacts

1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

2.4 SERVICE ENTRANCE TRANSFER SWITCHES

- A. Transfer switches must be specifically intended for service entrance applications and labeled "Suitable for service entrance use only".
- B. Transfer switch shall meet NEC requirements for emergency, legally required and standby applications as specified in UL 1008.
- C. Entire transfer switch including enclosure must be listed and labeled to UL 1008; switches with only the mechanism listed are not acceptable.
- D. Molded case circuit breaker must be UL 489 listed.

2.5 MANUAL TRANSFER SWITCHES

A. Ratings:

1. Refer to the Project drawings for specifications on the sizes and types of manual transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Manual transfer switches shall be double throw with main contacts rated for 250 VAC minimum.
3. Manual transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).

B. Construction

1. Switch blades and jaws and bus bars shall be visible and plated copper. Switches shall have a red handle that is easily pad-lockable with three 3/8-inch shank locks in any position.
2. Switches shall be of double throw design such that both switches may not be closed simultaneously. Handle operation shall have an "OFF" position between the two "ON" positions.
3. Switches shall have deionizing arc chutes
4. Switches shall have factory-installed ground lug kit

5. Switch assembly and operating handle shall be an integral part of the enclosure base
6. Switch blades shall be readily visible in the “ON” and “OFF” position
7. Switch operating mechanism shall be non-teasable, positive quick-make/quick-break type. Bail type mechanisms are not acceptable
8. Fusible switches shall be suitable for service entrance equipment, where shown
9. Switches shall have a solid or switched neutral as shown on the drawings
10. Switches shall be suitable for systems capable of 100 kA at 250 V
11. Embossed or engraved ON-OFF indication shall be provided
12. Double-make, double-break switch blade feature shall be provided

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Control Panel Mounting: Surface or floor mounted, unless otherwise indicated.
- B. Identify components according to Division 16 Section "Electrical Identification."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
- C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.
- D. Ground equipment according to Division 16 Section "Grounding"
- E. Connect wiring according to Division 16 Section "Wires, Cables and Connectors"

3.3 SOURCE QUALITY CONTROL

- A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.
- B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.
- C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.
- B. Manufacturer's representative shall perform tests and inspections and prepare test reports.
- C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.
 - 1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.
 - 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Verify time-delay settings.
 - c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).
 - d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown, where applicable.

3.5 DEMONSTRATION

- A. After installation, the transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering transfer switch equipment, for up to 10 people employed by the Owner.
 - 1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service, where applicable and maintenance tools provided under this contract, and emergency operation procedures.

2. The class duration shall be at least 8 hours in length and include practical operation with the installed equipment.

3.6 SERVICE AND SUPPORT

- A. The manufacturer shall supply the Owner with a complete set of the service and maintenance software required to support the product, where applicable. The software shall be provided at a training class attended by the user, to qualify the user in proper use of the software. The software shall have the following features and capabilities:
 1. The software shall be Microsoft Windows compatible.
 2. The software shall use the Windows Explorer format, for ease of use and commonality with other software in use at the facility.
 3. The software shall allow adjustment of all functions described herein, adjustment of operating levels of all protective functions, and programming of all optional functions in the controller. Adjustments shall be possible over modem from a facility that is remote from the generator set.
 4. The software shall be capable of storing and displaying data for any function monitored by the generator set control. This data shall be available in common file formats, and on graphical “strip chart” displays.
 5. The software shall automatically record all control operations and adjustments performed by any operator or software user, for tracking of changes to the control.
 6. The software shall display all warning, shutdown, and status changes programmed into transfer switch controller. For each event, the control shall provide information on the nature of the event, when it last occurred, and how many times it has occurred.

END OF SECTION

UTILITY SERVICE

SECTION 16400

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Upgrade the existing 120/240 VAC electrical services at the Beaver County Emergency Services building located at 501 Constitution Boulevard, Beaver Falls, PA 15010. The utility service transformer may need to be upsized with new service conductors installed to supply a new meter and main distribution panel. The existing service conductors and meter shall be removed after the new service is placed into operation.
- B. Any direct utility costs will be paid by the Owner.

1.2 UTILITY CONTACT

The electric utility company contact for the above work is as follows:

Attention:	Duquesne Light	Phone (cell): 412.393.2415
	Mr. Brian Sell	bsell@duqlight.com
	214 Meadowlark Lane	Inspection Work Order – 4539570299
	Aliquippa, PA 15001	Engineer Tech Order – 1138963

PART 2 - PRODUCTS

2.1 ELECTRICAL SERVICE

The electrical service for this project shall be a 400A, 120/240 VAC, single-phase, three-wire, solidly grounded service.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Arrange/coordinate any required electric utility work for this project. The Contractor shall be responsible for all electrical service site work, including grounding, conduits, and as required by the utility company.
- B. The electrical service shall be installed per the contract drawings and Duquesne Light Company standards as outlined in the latest edition of “Electric Service Installation Rules.” The Electrical Contractor shall meet with the utility field technician/designer at the site to review the actual site conditions and the proposed installation. Written confirmation shall be obtained from the utility for the proposed installation.

All grounding shall be in strict accordance with the National Electrical Code and the utility company's requirements.

END OF SECTION

OVERCURRENT PROTECTIVE DEVICES

SECTION 16410

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Electrical Contractor shall provide the labor, tools, equipment, and materials necessary to install overcurrent protective devices in accordance with the plans and as specified herein.
- B. Work of this Section includes, but is not limited to:
 - 1. Fuses rated 600A and less
 - 2. Circuit breakers

1.2 QUALITY ASSURANCE

- A. Codes and Standards: Perform all work associated with overcurrent protective devices in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.
 - 1. Electrical Component Standard: Components and installation shall comply with National Fire Protection Association (NFPA) 70 "National Electrical Code (NEC)."
 - 2. Listing and Labeling: Provide products specified in this section that are listed and labeled.
 - a. The terms "listed" and "labeled" shall be defined as they are in the NEC, Article 100.
 - 3. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in Occupational Safety and Health Administration (OSHA) Regulation 1910.7.
- B. Single Source Responsibility: Obtain similar OCPDs from a single manufacturer.

1.3 SUBMITTALS

- A. General: Furnish manufacturer's product data, test reports, and materials certifications as required.

- B. Submittals: Submit the following:
 - 1. Product data for fuses, circuit breakers, and OCPD accessories specified in this section, including descriptive data and time-current curves for all protective devices and let-through current curves for those with current limiting characteristics. Include coordination charts and tables and related data.
- C. Reference Submittals
 - 1. Installer's certification
 - 2. Manufacturer's certification
 - 3. Test reports
 - 4. Manufacturer's descriptive literature
 - 5. Operating and maintenance instructions
 - 6. Spare parts list

1.4 DELIVERY, HANDLING, AND STORAGE

- A. Deliver OCPDs and components in factory fabricated type containers or wrappings, which properly protect devices from damage.
- B. Handle OCPDs carefully to prevent physical damage to OCPDs and components. Do not install damaged OCPDs; remove from site and replace damaged devices with new.
- C. Store OCPDs in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.

1.5 DEFINITIONS

- A. OCPD: A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.
- B. Ampere Squared Seconds: An expression of available thermal energy resulting from current flow. With regard to current limiting fuses and circuit breakers, the ampere squared seconds during fault current interruption represents the energy allowed to flow before the fuse or breaker interrupts the fault current within its current limiting range.

2.1 MATERIALS

A. General

1. Provide OCPDs in indicated types, as integral components of panelboards, switchboards, and motor control centers; and also, as individually enclosed and mounted single units.
2. Enclosures: National Electrical Manufacturers Association (NEMA) 250 "Enclosures for Electrical Equipment (1,000 volts Maximum)."

B. Cartridge Fuses

1. NEMA Standard FU1, "Low Voltage Cartridge Fuses": Unless indicated otherwise, provide nonrenewable cartridge fuses of indicated types, classes, and current ratings that have voltage ratings consistent with the circuits on which they are used.
2. Class J Fuses: Underwriters' Laboratories, Inc. (UL) 198C, "High Interrupting Capacity Fuses, Current Limiting Type".
3. Class L Fuses: UL 198C, "High Interrupting Capacity Fuses, Current Limiting Type".
4. Class RK1 and RK5 Dual Element Time Delay Fuses: UL 198E, "Class R Fuses".
5. Provide a complete set of fuses for all fusible equipment on the job.
6. All fuses shall be of the same manufacturer and shall have an interrupting rating of 200,000 A, RMS symmetrical, except where otherwise noted.
7. All fuses shall bear UL label and class designation.
8. Fuse identification labels showing size and type of fuse installed shall be placed inside the cover of each switch or piece of equipment.
9. All fuse enclosures shall have NEMA type enclosures suitable for the location or as indicated on the drawings.
10. Fuse voltage shall be as required for the service.
11. Fuses Rated 600A and Less
 - a. Fuses which protect motor circuits and transformers shall be time

delay type, UL Listed, Class RK-1, except where otherwise noted.

- b. Fuses which are protecting circuit breakers, circuit breaker panels, and resistive heating circuits shall be fast-acting, current limiting type, UL listed, Class J, except where otherwise noted.

C. Circuit Breakers

1. Circuit breakers shall be molded case type, with ampere rating, frame size and number of poles as shown.
2. All circuit breakers shall meet UL 489 "Molded Case Circuit Breakers and Circuit Breaker Enclosures," NEMA AB 1 "Molded Case Circuit Breakers", and Federal Specification W-C-375.
3. Circuit breakers shall be bolt in type.
4. Circuit breakers shall have a minimum RMS symmetrical short circuit interrupting capacity rating of 10,000 amperes at 208Y/120VAC and 120/240VAC, or 65,000 amperes at 480Y/277VAC, unless a greater rating is indicated on the drawings or as required by the available fault current.
5. Tripping Device: Quick make, quick break toggle mechanism with inverse time delay and instantaneous overcurrent trip protection for each pole.
6. Adjustable Instantaneous Trip Devices: Factory adjusted to low trip setting current values.
7. Provide circuit breakers with ampere sizes greater than 100A with solid state trip devices having the following adjustable settings:
 - a. Long time ampere rating
 - b. Long time delay
 - c. Short time ampere rating
 - d. Short time delay
 - e. I^2T
 - f. Instantaneous ampere rating
 - g. Ground fault pickup
 - h. Ground fault delay
 - i. Ground I^2T
8. Provide circuit breakers with ampere sizes 1200A or greater with an energy-reducing maintenance switch with local status indication.
9. Provide circuit breakers appropriate for applications, including Type SWD for switching fluorescent lighting loads, and Type HACR for heating, air-conditioning, and refrigeration equipment.

OVERCURRENT PROTECTIVE DEVICES

10. All circuit breaker enclosures shall have NEMA type enclosures suitable for the location or as indicated on the drawings.

D. OCPD Accessories

1. Install label inside enclosure identifying the type of OCPD installed, its overcurrent rating, its interrupt rating and UL class. Where applicable, trip settings and time delays should be provided on permanent labels.

- E. For types and ratings required, furnish spare fuses, amounting to one fuse for every five installed fuses, but not less than one set of three of each type of fuse.

2.2 MANUFACTURERS

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

1. Cartridge Fuses

- a. Bussmann
- b. Littelfuse
- c. Mersen
- d. Or Equal

2. Molded Case Circuit Breakers

- a. Eaton
- b. ABB
- c. Siemens
- d. Schneider Electric
- e. Or Equal

3.1 INSTALLATION

A. General

1. Install fuses and circuit breakers as indicated, in accordance manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with the NEC, and NEMA Standards.
2. Inspect each circuit breaker and fuse visually.
3. Perform several mechanical ON-OFF operations on each circuit breaker and switch.

4. Verify circuit continuity on each pole in closed position.
- B. Independently Mounted OCPDs: Locate as indicated and install in accordance with manufacturer's written installation instructions.
 - C. OCPDs in distribution equipment shall be factory installed.

3.2 IDENTIFICATION

- A. Identify components in accordance with Division 26 Section "Electrical Identification".

3.3 CONNECTIONS

- A. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and UL 486B.

3.4 GROUNDING

- A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.5 FIELD QUALITY CONTROL

- A. Visual and Mechanical Inspection: Include the following inspections and related work.
 1. Overcurrent Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make the final system adjustments.

2. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.
3. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
4. Check tightness of electrical connections of OCPDs with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
5. Clean OCPDs using manufacturer's approved methods and materials.
6. Verify installation of proper fuse types and ratings in fusible OCPDs.

3.6 CLEANING

- A. Upon completion of installation, inspect OCPDs. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

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CIRCUIT AND MOTOR DISCONNECTS

SECTION 16411

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and material necessary to install circuit and motor disconnects in accordance with the Plans and as specified herein.
- B. Extent of circuit and motor disconnect switch work is indicated by the drawings and, if provided, schedules.
- C. Types of circuit and motor disconnect switches in this section include the following:
 - 1. Equipment disconnects
 - 2. Motor circuit disconnects

1.2 QUALITY ASSURANCE

- A. Perform all work associated with circuit and motor disconnects in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.
 - 1. National Electrical Code (NEC) Compliance. Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.
 - 2. Underwriters' Laboratories, Inc. (UL) Compliance. Comply with requirements of UL 98 "Enclosed and Dead Front Switches." Provide circuit and motor disconnect switches which have been UL listed and labeled.
 - 3. National Electrical Manufacturers Association (NEMA) Compliance. Comply with applicable requirements of NEMA Standards Pub No. KS 1 "Enclosed Switches" and 250 "Enclosures for Electrical Equipment (1,000 Volts Maximum)."

1.3 SUBMITTALS

- A. Furnish samples, manufacturer's product data, test reports, and materials certifications as required.
- B. Submit the following:
 - 1. Product data for each type of product specified.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver circuit and motor disconnect switches properly packaged in factory fabricated type containers or wrappings, which properly protect devices from damage.
- B. Store circuit and motor disconnect switches in original packaging and protect from weather and construction traffic. Wherever possible, store indoors, where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle circuit and motor disconnect switches carefully to prevent physical damage. Do not install damaged disconnect switches, remove them from site, and replace damaged devices with new.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Provide surface mounted, heavy-duty type, enclosed safety switches, of types, sizes, and electrical characteristics as required for the indicated installation; fused if noted on plan. Provide switches incorporating quick make, quick break type switches, so that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable and is padlockable in OFF position. Construct current carrying parts of high conductivity copper with silver tungsten type switch contacts; and positive pressure type reinforced fuse clips where fusible switches are specified or required by code.
- B. Safety disconnect switches shall be three (3) pole units with the amp or horsepower rating based on the load served or as shown on the drawings.
- C. Switch enclosures shall be rated NEMA type 4X 316 stainless-steel unless noted otherwise on the drawings.
- D. Switches to be installed exposed outside shall be padlockable in both the ON and OFF positions. All other switches shall be padlockable in the OFF position.
- E. Provide fuses for safety switches, as noted on plans, and as described in Division 16 Section “Overcurrent Protection Devices”.

2.2 SWITCH RATED PLUGS AND RECEPTACLES

- A. Plugs and receptacles must be listed to UL Subject 2682, Switch Rated Plugs and Receptacles.
- B. Plugs and receptacles must have constant pressure butt-contacts with solid silver-nickel tips. Pin and sleeve contacts are not permitted.
- C. Receptacles must have dead front construction. Live parts must be inaccessible to thin tools or wire.

- D. Plugs and receptacles must be able to close at least once on a conditional short-circuit current of 65,000A. (Short circuit testing should be performed with RK1 current limiting fuses sized at 400% of the highest full load motor ampacity associated with the device).
- E. Plugs and receptacles must incorporate an integral switching mechanism to ensure the load is broken before the plug is removed from the receptacle.
- F. Plug and receptacle wire terminals must be spring assisted to prevent loosening due to conductor yielding, shocks, vibrations, or thermal cycling.
- G. The minimum environmental rating of plugs and receptacles must be NEMA type 4.
- H. Ingress protection must be achieved automatically when the plug is fully inserted into the receptacles, without additional manual operation.
- I. Plugs and receptacles must have a system of different keying positions in order to discriminate between circuits or incompatible operating voltages or frequencies.
- J. Plugs and receptacles installed outdoor must be able to withstand UV radiation.

2.3 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide circuit and motor disconnects of one of the following (for each type of switch):
 - 1. Eaton
 - 2. Schneider Electric
 - 3. Siemens
 - 4. ABB
 - 5. Meltric Corporation
 - 6. Or Equal

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and National Electrical Contractor's Association (NECA) "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

- C. Install disconnect switches for use with motor driven equipment, motors, and controllers within sight of the motor position unless otherwise indicated.
- D. Provide suitable means for mounting disconnect switches.

3.2 GROUNDING

- A. Provide equipment grounding connections, tightened to assure a permanent and effective ground, for electrical disconnect switches where indicated.

3.3 FIELD QUALITY CONTROL

- A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry, and demonstrate capability and compliance with requirements.

END OF SECTION

GROUNDING

SECTION 16450

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install grounding materials in accordance with the Contract Drawings and as specified herein.
- B. This section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this section may be supplemented in other sections of these Specifications.
- C. Applications of electrical grounding and bonding work in this section include the following:
 - 1. Underground metal piping
 - 2. Underground metal and steel reinforced concrete structures
 - 3. Electrical power systems
 - 4. Grounding electrodes
 - 5. Counterpoise loops
 - 6. Separately derived systems
 - 7. Raceways
 - 8. Service equipment
 - 9. Enclosures
 - 10. Equipment, including fencing
 - 11. Lighting standards
 - 12. Isolated signal ground

1.2 QUALITY ASSURANCE

- A. Perform all work to furnish and install grounding in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with the Contract Drawings and as specified herein.

GROUNDING

1. Comply with applicable local electrical code requirements of the authority having jurisdiction, and National Electrical Code (NEC) as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment. Use of conduit system for ground conductor shall not be allowed.
2. Comply with applicable requirements of UL Standards Nos. 467, "Grounding and Bonding Equipment", and 869 "Reference Standard for Service Equipment", pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors", Provide grounding and bonding products which are UL listed and labeled for their intended usage.
3. Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits, and equipment.

1.3 SUBMITTALS

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Submit the following:
 1. Product data for ground rods, connectors and connection materials, and grounding fittings, Field testing organization certificate, signed by the Contractor, certifying that the organization performing field tests complies with the requirements specified in Quality Assurance below.
 2. Report of field tests and observations certified by the testing organization.

1.4 DELIVERY, HANDLING, AND STORAGE

- A. Deliver ground wire properly packaged in factory fabricated type containers or wound on NEMA specified type wire reels.
- B. Handle grounding wire carefully to avoid abrasing, puncturing, and tearing wire insulation. Ensure that dielectric resistance of the cable is maintained.
- C. Store grounding materials and ground wire in clean dry space in original containers, protect products from weather damaging fumes, construction debris, and traffic.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Grounding and Bonding Products
 1. Types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

GROUNDING

2. Conductor Materials: Copper Clad Steel
- B. Wire and Cable Conductors
1. Comply with Division 16 Section “Wires, Cables and Connectors”, Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
 2. Isolated Ground and Direct Current Low Level Signal Grounding Conductors: Green insulated.
 3. Equipment Grounding Conductor
 - a. The minimum ground wire size for power circuits shall be No. 12 AWG, except where otherwise noted, for all wire sizes, the conductor shall be stranded.
 - b. The minimum ground wire size for control circuits shall be No. 14 AWG, except where otherwise noted.
 - c. All wire sizes shown on the plan drawings, details, and sketches are based on insulated copper wire based on 60°C for circuits 100 amperes and less, and the use of 75°C for higher ampere rated circuits.
 - d. Conductors for grounding system shall be soft or medium hard drawn, stranded, bare copper, except where otherwise noted.
 4. All conductors buried in ground shall be bare.
 5. Conductors for grounding grid and connection of equipment or other items to grounding grid shall be #6 AWG minimum or as noted on the drawings.
 6. Grounding Electrode Conductor: Stranded cable
 7. Bare Copper Conductors: Conform to the following:
 - a. Solid Conductors: ASTM B-3
 - b. Assembly of Stranded Conductors: ASTM B-8
 - c. Tinned Conductors: ASTM B-33
- C. Identification of Ground Conductors
1. Ground conductors shall have conductor identification.
 2. Ground conductor identification shall be as called for in the National Electric Code, where covered.
 3. Ground conductors larger than No. 6 AWG may be identified by taped color coding at all splices and terminations.
 4. Ground conductors No. 6 AWG and smaller shall be color coded.
 5. Ground conductor color coding shall be green throughout.

6. Wire markers made of paper tape shall not be used.

D. Miscellaneous Conductors

1. Ground Bus: Bare annealed copper bars of rectangular cross section with 98 percent conductivity, rigidly attach to structure. Use standoff insulated attachment for isolated and low-level DC Systems.
2. Braided Bonding Jumpers: Copper tape, braided No. 30 gauge bare copper wire, terminated with copper ferrules.
3. Bonding Strap Conductor/Connectors: Soft copper, 0.05-inch-thick and 2 inches wide, except as indicated.

E. Connector Products

1. Listed and labeled as grounding connectors for the materials shall be used.
2. Pressure Connectors: High conductivity plated units.
3. Bolted Clamps: Heavy duty units listed for the application.
4. Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

F. Grounding Electrodes

1. Ground Rods: Copper clad steel with high strength steel core and electrolytic grade copper outer sheath, molten welded to core.
 - a. Size: 3/4 inch by 10 feet

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include the following:

1. Anixter, Inc.
2. Bashlin Industries, Inc.
3. Buckingham Mfg. Co.
4. A.B. Chance Co.
5. Dossert Corporation
6. Engineered Products Co.
7. Erico Products, Inc.

8. Galvan Industries, Inc.
9. GB Electrical, Inc.
10. General Machine Products Co., Inc.
11. Hastings Fiber Glass Products, Inc.
12. Ideal Industries, Inc.
13. Kearney-National
14. McGill Mfg.
15. O-Z/Gedney Co.
16. Raco, Inc.
17. Thomas & Betts Corp.
18. W.H. Salisbury & Co.
19. Utilco Co.

B. Exothermic Weld Connections

1. Cadweld
2. Therm-O-Weld

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.
2. Ground Rods: Locate a minimum of one rod length from each other and at least the same distance from any other grounding electrode, interconnect all ground rods with bare conductors buried at least 24 inches below grade. Connect bare cable ground conductors to ground rods by means of exothermic welds. Make these connections without damaging the copper coating or exposing the steel, Drive rods until tops are 2'-6" below finished floor or final grade except as otherwise indicated.
3. Metallic Water Service Pipe: Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground

conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings. Bond the ground conductor conduit to the conductor at each end.

4. Braided Type Bonding Jumpers: Install ground clamps on meter piping to bypass meters electrically. Use elsewhere for flexible bonding and grounding connections.
5. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.
6. Test Wells: Furnish and locate as indicated in accordance with details provided.
7. Conductors for grounding grid and connection of equipment or other items to grounding grid shall be #6 AWG bare copper minimum.
8. Provide ground rods and ground grid at service entrance equipment as shown on the drawings or as required.
9. All ground rods shall be driven into undisturbed earth so that the top of the rod is a minimum of 2'-6" below finished grade.
10. All underground grounding conductors shall be a minimum of 2'-6" below grade.
11. Provide an equipment ground wire in all feeder circuits.
12. Provide an equipment ground wire in all branch circuit conduits.
13. Where grounding conductors are subject to mechanical injury, they shall be protected by encasement in concrete or installed in a rigid schedule 80 PVC raceway.
14. All connection of ground conductors to ground rods, bus bars, structural members, pipes, or fences and splices of ground conductors shall be made by exothermic welds, except where otherwise noted.
 - a. All connections to bar lugs shall be exothermic weld or compression type.
 - b. Bolted type connection of ground conductors may only be made where terminal lugs or blocks have been furnished and installed in equipment by the Manufacturer.
 - c. Prior to the installation of any exothermic weld on connector, all connecting surfaces shall be thoroughly cleaned in accordance with the Manufacturer's recommendations.
 - d. Failure to thoroughly clean connecting surfaces shall constitute justifiable ground to require the Contractor to remove and re-install all similar connections at no expense to the Owner or Engineer.

GROUNDING

15. The Contractor shall not allow or cause any connection or splice for the grounding system to be covered up or enclosed until it has been inspected and approved by the Inspecting Authority.
 - a. Any connection or splice that is covered up or enclosed before such inspection and approval shall be uncovered at the Contractor's expense.
 - b. After it has been inspected and approved, the Contractor shall cover up or enclose the connection or splice it at his own expense.
16. The resistance to ground for the entire grounding system shall not exceed 25 ohms under normal dry conditions. Tests of grounding resistance shall not be made within 24 hr after a rainfall. If, after testing the system, it is found that the resistance exceeds the specified value, the Contractor shall install the necessary number of ground rods to reduce the resistance to less than the specified value.

B. Connections

1. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - a. Use electroplated or hot tin coated materials to assure high conductivity and make contact points closer in order of galvanic series.
 - b. Make connections with clean bare metal at points of contact.
 - c. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
2. Exothermic Welded Connections: Use for connections to structural steel and for underground connections except those at test wells, install at connections to ground rods. Comply with manufacturer's written recommendations, Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable,
3. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure type grounding lugs, where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.
4. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torque requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.
5. Connections at Test Wells: Use compression type connectors on conductors and make bolted and clamped type connections between conductors and ground rods.

6. Compression Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
 7. Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.
- C. Underground Distribution System Grounding
1. Manholes, Handholes, and Underground Pull boxes: Install a driven ground rod close to the wall and set the rod depth such that 4 inches will extend above the finished floor. Where necessary, install ground rod before the manhole is placed and provide a No. 6 AWG bare tinned copper conductor from the ground rod into the manhole through a waterproof sleeve in the manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure sensitive tape or heat shrunk insulating sleeve from 2 inches above to 6 inches below the concrete. Seal floor opening with waterproof nonshrink grout.
 2. Connections at Manholes, Handholds, and Underground pull boxes: Connect exposed metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or hand hole to the ground rod or ground conductor. Connect circuit ground wire to ground rod. Make connections with minimum No. 6 AWG stranded hard drawn copper wire. Train conductors plumb or level around corners and fasten to manhole or hand hole walls. Connect to cable armor and cable shields by means of tinned terminals soldered to the armor or shield, or as recommended by manufacturer of splicing and termination kits.
 3. Grounding System: Ground noncurrent carrying metallic items associated with manholes, substations, and pad mounted equipment by connecting them to bare underground cable and grounding electrodes arranged as indicated.
- D. Isolated Signal Ground: Where shown on plan, provide a minimum No. 2 AWG stranded, tinned, insulated ground conductor from each control panel or remote I/O panel to a designated system ground point. Grounding conductor shall be routed in 3/4-inch Schedule 80 PVC conduit from panel location to system ground connection point. Terminate ground conductor at an insulated, isolated ground bus and at system ground point. Connection at ground rods shall be via exothermic welds.

3.2 APPLICATION

- A. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated. Use of conduit system for ground conductor shall not be allowed.

1. Install separate insulated equipment grounding conductors with circuit conductors for the following in addition to those locations where required by code:
 - a. Feeders and branch circuits
 2. Computer Panel Circuits: Install separate insulated equipment ground wire in branch circuits from computer area power panels.
 3. Instrumentation, Digital Control: Install separate insulated equipment ground conductor in all instrumentation, digital control circuits.
 4. Nonmetallic Raceways: Install an insulated equipment ground conductor in nonmetallic raceways unless they are designated for telephone or data cables.
 5. Air Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct mounted electrical devices operating at 120 volts and above including air cleaners and heaters, Bond the conductor to each such unit and to the air duct.
- B. Underground Conductors: Bare, tinned, stranded copper except as otherwise indicated.
- C. Signal and Communications: For telephone, alarm, and communication systems, provide a No. 4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location.
- D. Separately derived systems required by NEC to be grounded shall be grounded in accordance with NEC paragraph 250-30.
- E. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to a grounding electrode as indicated in addition to separate equipment grounding conductor run with supply branch circuit.

END OF SECTION

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PANELBOARDS

SECTION 16471

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The Electrical Contractor shall furnish and install the panelboards as specified and as shown on the contract drawings.

1.2 REFERENCES

- A. The panelboards and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA and UL as follows:
 - 1. UL 67 – Panelboards
 - 2. UL 50 – Cabinets and boxes
 - 3. UL 98 – Enclosed and dead-front switches
 - 4. UL 489 – Molded case circuit breakers and circuit breaker enclosures
 - 5. NEMA PB1 - Panelboards
 - 6. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
 - 7. NEMA AB 1 - Molded Case Circuit Breakers
 - 8. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
 - 9. NFPA 70 – National Electrical Code
 - 10. Fed. Spec. W-P-115C
 - 11. Circuit breaker – Type I class 1 and Type II class 1

1.3 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 - 1. Breaker layout drawing with dimensions indicated and nameplate designation
 - 2. Component list
 - 3. Conduit entry/exit locations

PANELBOARDS

4. Assembly ratings including:
 - a. Short-circuit rating.
 - b. Voltage.
 - c. Continuous current.
 5. Cable terminal sizes.
 6. Product data sheets.
- B. Where applicable, the following additional information shall be submitted to the Engineer:
1. Key interlock scheme drawing and sequence of operations

1.4 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.03, and shall incorporate all changes made during the manufacturing process
 2. Installation information
 3. Seismic certification and equipment anchorage details as specified

1.5 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.6 REGULATORY REQUIREMENTS

- A. The panelboards shall be UL labeled.

1.7 DELIVERY, STORAGE AND HANDLING

Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment. Operation and Maintenance Manuals

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins, and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Eaton
- B. Schneider Electric
- C. ABB
- D. Siemens
- E. Or Equal

2.2 RATINGS

- A. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings but not less than 10,000 amperes RMS symmetrical.
- B. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings but not less than 35,000 amperes RMS symmetrical.
- C. Panelboards shall be labeled with a UL short-circuit rating. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:
 - 1. Size and type of upstream device
 - 2. Branch devices that can be used
 - 3. UL series short-circuit rating
- D. All panelboards shall be fully rated. Series rated panelboards shall only be allowed under special, approved applications.

2.3 CONSTRUCTION

- A. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

- B. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three-point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.
- C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
- D. Surface trims shall be the same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.
- E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
- F. All locks shall be keyed alike.

2.4 BUS

- A. Main bus bars shall be tin-plated copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
- B. A system ground bus shall be included in all panels.
- C. Full-size 100%-rated insulated neutral bars shall be included for panelboards. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

2.5 MAIN CIRCUIT BREAKER

- A. Shall be of the same manufacturer as the panelboard.
- B. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
- C. Two and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker which allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

PANELBOARDS

- D. Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
- E. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
- F. Circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

2.6 BRANCH CIRCUIT BREAKERS

- A. Shall be of the same manufacturer as the panelboard. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the panelboard schedules.
- B. Molded case branch circuit breakers shall have bolt-on type bus connectors.
- C. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
- D. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be an indicator appearing on the circuit breaker housing.
- E. The exposed faceplates of all branch circuit breakers shall be flush with one another.
- F. Circuit breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.
- G. Circuit breakers shall be UL listed with the following ratings (15-30A), High Intensity Discharge (HID) and (15-20A), Switch Duty (SWD).

2.7 BRANCH CIRCUIT PANELBOARDS

- A. The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated.
- B. Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
- C. Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be a minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits.

1. Circuit breaker handle locks shall be provided for all circuits that supply exit signs and emergency lighting fixtures.
- D. Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts, and 65,000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.

2.8 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

- A. Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be fully rated. Panelboards shall have molded case circuit breakers as indicated below.
- B. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.

2.9 SURGE PROTECTIVE DEVICES

- A. Provide integral surge protective devices as indicated in the panel schedules and as specified in Section 16479.

2.10 ENCLOSURE

- A. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided. All interior enclosures shall be rated NEMA type 1 unless otherwise noted. All exterior enclosures shall be rated NEMA type 4X unless otherwise noted. NEMA type 4X enclosures shall be constructed of 316 stainless steel, dead-front door design. Latches shall be quick-release fast-operating clamp assemblies. Clamps shall not require a tool for entry. A factory supplied and sized 120 VAC thermostatically controlled, anti-condensation heater shall be furnished with each NEMA type 4X enclosure. The heater circuit shall be wired to field terminal blocks.
- B. Enclosures shall be provided with blank ends.
- C. Where indicated on the drawings, branch circuit panelboards shall be column width type.

2.11 NAMEPLATES

- A. Provide an engraved nameplate for each panel section.

2.12 FINISH

- A. Painted surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray ANSI 61 paint applied, except NEMA type 4X enclosures.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and NEC standards.
- B. Anchor panelboards to structure and make branch circuit connections.
- C. Coordinate the panelboard bus ratings and circuit breaker coordination rating with the available fault current.
- D. Wiring inside panelboards shall be bundled and tied in a neat orderly manner.
- E. All panelboards shall have a typed schedule to show the branch circuit loads.
- F. Each circuit breaker shall be labeled to match the numbering system shown on the panel schedule with an engraved plastic label (For example, three-pole shall be labeled as #-#-# and not as a single #). Self-adhesive printed paper labels are not acceptable. All labels shall be installed in a neat, square, and orderly manner.
- G. Surge protection devices shall be mounted integral in each new panelboard.
- H. Each panelboard shall have an identification label on the front cover indicating the voltage, phase, and identifications designation.
- I. All labels shall be engraved phenolic plastic type with ¼" high letters. The tags and labels shall be permanently attached panelboard (i.e., rivets, screws, etc.).

3.2 FIELD QUALITY CONTROL

- A. Inspect the complete installation for physical damage, proper alignment, anchorage, and grounding.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.
- C. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

END OF SECTION

PANELBOARDS

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LIGHTING CONTACTORS

SECTION 16485

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The CONTRACTOR shall:

1. Furnish and install the low voltage lighting contactors as specified herein and as shown on the contract drawings.

1.2 REFERENCES

A. The contactors shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA, ANSI and UL.

1.3 SUBMITTALS

A. The following information shall be submitted to the Engineer:

1. Master drawing index
 - a. Dimensioned outline drawings
 - b. Conduit entry/exit locations
 - c. Cable terminal sizes
 - d. Wiring diagrams
 - e. Nameplate schedule
2. Ratings, including:
 - a. Voltage
 - b. Continuous current
3. Product data sheets
4. Final as-built drawings and information for items listed above and shall incorporate all changes made during the manufacturing process.
5. Wiring diagrams

1.4 QUALIFICATIONS

A. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

1. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the

Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Eaton
- B. Siemens
- C. ABB
- D. Or Equal

2.2 LIGHTING CONTACTORS

- A. Magnetically Latched Lighting Contactors
 1. The contactors shall be designed to withstand the large initial inrush currents of tungsten and ballast lamp loads as well as non-motor (resistive) loads without contact welding.
 2. The contactors shall be capable of being "magnetically latched" with the use of a permanent magnet.
 3. The contactors shall be operated by an (ON) signal and an (OFF) signal preventing the contactor from switching to (OFF) during control circuit power failures.
 4. Pilot devices, where indicated, shall be 30mm, oil-tight and flange mounted. Pilot lights shall be LED transformer-type for longer lamp life. Pilot device nameplates shall be engraved phenolic.
 5. The combination contactors' operating mechanism shall be mounted on the flange and shall have positive, non-teasing ON/OFF action. The handle shall be color-coded: red for (ON) and black for (OFF)
 6. The operating handle shall have provisions to lock the handle in the (OFF) position with a minimum of three (3) standard padlocks having 1/4-inch diameter shackles.
 7. Where indicated, a circuit breaker shall be provided. A manual push-to-trip button shall be provided to exercise the trip unit.
 8. Magnetically latched contactors shall be Eaton Class ECL15, circuit breaker combination contactor units or equal.

LIGHTING CONTACTORS

9. Enclosures shall be a NEMA type as indicated on the drawings.

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

END OF SECTION

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EXTERIOR LIGHTING

SECTION 16500

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps, drivers, and ballasts as required.

1.2 DEFINITIONS

- A. CRI: Color-rendering index
- B. HID: High-intensity discharge
- C. LED: Light emitting diode
- D. Luminaire: Complete lighting fixture, including driver/ballast housing if provided

1.3 SUBMITTALS

- A. For each luminaire and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, chips, drivers, ballasts, optical components, and accessories.
 - a. Photometric data shall be certified by a qualified independent testing agency.
 - 6. Drivers/ballasts, including energy-efficiency data.
 - 7. Lamps/chips, including life, output, and energy-efficiency data.
 - 8. Materials, dimensions, and finishes.

9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 10. Means of waterproofing light fixture enclosure and conduit penetrations.
- B. Qualification Data: For agencies providing photometric data for lighting fixtures.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data.
- E. Shop Drawings:
1. Exterior Luminaires:
 - a. Catalog data sheets and pictures
 - b. Luminaire finish and metal gauge
 - c. Lens material, pattern, and thickness
 - d. Candle power distribution curves in two or more planes
 - e. Candle power chart 0 to 90 degrees
 - f. Lumen output chart
 - g. Coefficients of utilization for zonal cavity calculations
 - h. Mounting details
 2. Lamps:
 - a. Voltages
 - b. Colors
 - c. Approximate life (in hours)
 - d. Approximate initial lumens
 - e. Lamp type and base
 3. Drivers/Ballasts:
 - a. Type
 - b. Wiring diagram
 - c. Nominal watts and input watts
 - d. Input voltage and power factor
 - e. Starting current, line current, and restrike current values
 - f. Sound rating
 - g. Temperature rating
 - h. Efficiency ratings
 - i. Low temperature characteristics
 4. Photo-Time Control:
 - a. Wiring diagram
 - b. Contact ratings

5. Photocells:
 - a. Voltage and power consumption
 - b. Capacity
 - c. Contacts and time delay
 - d. Operating levels
 - e. Enclosure type and dimensions
 - f. Temperature range

1.4 ALTERNATES

- A. Where the Contractor proposes to utilize lighting fixtures other than those specified on the drawings, he/she shall provide all of the following:
 1. Full color catalog cuts or the actual proposed fixture for the Owner and the Engineer to evaluate.
 2. An item-by-item checkoff of the physical construction features of the substitute versus the specified unit as follows:
 - a. Material type and thickness.
 - b. Dimensions (depth of troffers, depth of downlights, etc.)
 - c. Reflectance
 - d. Finish (interior and exterior)
 3. A point by point-maintained foot-candle layout on the project site plan at a scale of 1" = 20" minimum. The FC points shall be each 1/2" (10 feet). Foot-candle (FC) points shall be at grade utilizing 0.70 LLF. All fixtures shall be located as shown on the drawings.
 4. IES format photometric data in electronic format for the proposed lighting fixtures.
 5. Lens material, thickness, and pattern
 6. Driver/Ballast

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is a NRTL as defined by OSHA in 29 CFR 1910.7.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. The proposed manufacturers shall be qualified and specialized in the manufacturing and assembly of lighting fixtures for at least ten (10) years.

- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

1.6 WARRANTY

- A. Warranty Period for Luminaires: Five years from date of Substantial Completion.

1.7 SPARE PARTS

- A. Where applicable, furnish five spare lamps for each type of exterior lighting fixture.
- B. Where applicable, furnish one spare ballast for each type of exterior lighting fixture.
- C. Where applicable, furnish five fuses of each size and type of driver/ballast fusing utilized.

PART 2 – PRODUCTS

2.1 LIGHTING FIXTURES

- A. Lighting fixtures shall be as shown on the drawings and as detailed in the "Lighting Fixture Schedule".

2.2 BALLASTS FOR HID LAMPS, where applicable

- A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:
 - 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - 2. Minimum Starting Temperature: Minus 22 deg F.
 - 3. Normal Ambient Operating Temperature: 104 deg F.
 - 4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

2.3 HID LAMPS, where applicable

- A. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000K.

2.4 LED FIXTURES

- A. LED fixtures shall be UL or ETL listed as a whole assembly.
- B. Only LED chips from the following manufacturers shall be acceptable:

1. Philips
 2. Osram
 3. GE
 4. Nichia
 5. Cree
 6. Hitachi
 7. Xicato
- C. Submittal documents for LED fixtures must include the manufacturer's LM80 chip test results and LM79 fixture tests results.
- D. Fixture correlated color temperatures (CCT) shall be 3000K-4000K. Higher color temperatures are not acceptable.
- E. The color rendering index (CRI) shall be a minimum of 70 for outdoor fixtures.
- 3.1 LUMINAIRE INSTALLATION

- A. Provide all ballasts, sockets, brackets, channels, and other devices as required for proper installation, operation, and support of all fixtures. Fixtures shall be installed and supported in accordance with the manufacturer's recommendations.
- B. The Contractor shall install new wiring and/or junction boxes as needed for the proper installation of all fixtures.
- C. All fixture enclosures shall be grounded.
- D. All fixtures shall have lamps (where applicable) installed. Lamps that fail prior to final acceptance by the Owner shall be replaced with new lamps. Lamps that fail after final acceptance by the Owner shall be warranty items.
- E. Where exterior lights are mounted directly to a building, route all lighting conduits inside the building to a point opposite the fixture then extend the conduit through the wall to the fixture so that no conduit is exposed on the exterior of the building.
- F. All wall mounted exterior receptacle and light fixture back boxes shall be recessed into the wall.
- G. Where stanchion mounted fixtures are shown supported from handrails, the Contractor shall coordinate the installation with the handrail supplier and follow all installation recommendations. The Contractor shall also provide the supplier with all fixture details, including weights, proposed mounting heights, and proposed means of attachment to the handrail, for review. The required rigidity of the handrail system shall be maintained.

3.2 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment (i.e., Temflex Tape.).

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

END OF SECTION

INTERIOR LIGHTING

SECTION 16510

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Electrical Contractor shall furnish and install the following:
 - 1. Interior luminaires with lamps, drivers, and ballasts, as required.

1.2 DEFINITIONS

- A. CRI: Color-rendering index
- B. HID: High-intensity discharge
- C. LED: Light emitting diode
- D. Luminaire: Complete lighting fixture, including ballast housing if provided

1.3 REFERENCES

Error! Bookmark not defined.

- A. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
- B. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
- C. Uniform Building Code (UBC).
- D. Underwriters Laboratories, Inc. (UL):
 - 1. 595, Standard for Safety Marine-Type Electric Lighting Fixtures.
 - 2. 844, Standard for Safety Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.
 - 3. 924, Standard for Safety Emergency Lighting and Power Equipment.

1.4 SUBMITTALS

- A. Product Data: For each luminaire and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters
 - 2. Details of attaching luminaires and accessories
 - 3. Details of installation and construction
 - 4. Luminaire materials

5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. Photometric data shall be certified by a qualified independent testing agency.
 6. Drivers/ballasts, including energy-efficiency data.
 7. Lamps, including life, output, and energy-efficiency data.
 8. Materials, dimensions, and finishes.
 9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 10. Means of water proofing light fixture enclosure and conduit penetrations.
- B. Qualification Data: For agencies providing photometric data for lighting fixtures.
- C. Field quality-control test reports
- D. Operation and Maintenance Data
- E. Shop Drawings:
1. Interior Luminaires:
 - a. Catalog data sheets and pictures
 - b. Luminaire finish and metal gauge
 - c. Lens material, pattern, and thickness
 - d. Candle power distribution curves in two or more planes
 - e. Candle power chart 0 to 90 degrees
 - f. Lumen output chart
 - g. Coefficients of utilization for zonal cavity calculations
 - h. Mounting or suspension details
 2. Lamps:
 - a. Voltages
 - b. Colors
 - c. Approximate life (in hours)
 - d. Approximate initial lumens
 - e. Lamp type and base
 3. Drivers/Ballasts:
 - a. Type
 - b. Wiring diagram

- c. Nominal watts and input watts
 - d. Input voltage and power factor
 - e. Starting current, line current, and restrike current values
 - f. Sound rating
 - g. Temperature rating
 - h. Efficiency ratings
 - i. Low temperature characteristics
4. Photo-Time Control:
- a. Wiring diagram
 - b. Contact ratings
5. Photocells:
- a. Voltage and power consumption
 - b. Capacity
 - c. Contacts and time delay
 - d. Operating levels
 - e. Enclosure type and dimensions
 - f. Temperature range

1.5 ALTERNATES

- A. Where the Electrical Contractor proposes to utilize lighting fixtures other than those specified on the drawings, he/she shall provide all of the following:
1. Full color catalog cuts or the actual proposed fixture for the Owner and the Engineer to evaluate.
 2. An item-by-item checkoff of the physical construction features of the substitute versus the specified unit as follows:
 - a. Material type and thickness.
 - b. Dimensions (depth of troffers, depth of downlights, etc.)
 - c. Reflectance
 - d. Finish (interior and exterior)
 - e. Lens material, thickness, and pattern
 - f. Driver/Ballast
 3. An item-by-item comparison of the photometrics of the substitute versus the specified unit as follows:
 - a. Total efficiency
 - b. Coefficient of utilization at RCR 1 through 5 and reflectance of C-50%, W-50%, F-20%.
 - c. Space to mounting height ratio.

- d. IES format photometric data in electronic format for the proposed lighting fixtures.
- e. A point by point-maintained foot-candle layout on the specific area plans at the drawing scale. Foot-candle (FC) points shall be at the floor elevation. All fixtures shall be located as shown on the drawings.

1.6 UL COMPLIANCE

- A. Materials manufactured within scope of Underwriters Laboratories shall conform to UL Standards and have an applied UL listing mark.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. The proposed manufacturers shall be qualified and specialized in the manufacture and assembly of lighting fixtures for at least ten (10) years.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

1.8 WARRANTY

- A. Warranty Period for Luminaires: Five years from date of Substantial Completion.
- B. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion

1.9 SPARE PARTS

- A. Extra Materials: Furnish, tag, and box for shipment and storage the following spare parts:
 - 1. Where applicable, two spare ballasts of each type
 - 2. Where applicable, Two spare lamps of each type

PART 2 – PRODUCTS

2.1 LUMINAIRES

- A. Specific requirements relative to execution of work of this section is located in the “Lighting Fixture Schedule” on Drawings.
- B. Feed-through type, or separate junction box.
- C. Where applicable, Ballasts: Two-lamp when possible.
- D. Where applicable, tandem wired for three-lamp, fluorescent fixtures.
- E. Wire Leads: Minimum 18 AWG.
- F. Component Access: Accessible and replaceable without removing luminaire from ceiling.
- G. Emergency Lighting:
 - 1. Power Pack: Self-contained, 120/277-volt dual voltage transformer, inverter/charger, sealed lead acid battery, and indicator switch in accordance with UL 924.
 - 2. Lighted, push-to-test indicator.
 - 3. Capable of providing full illumination for 1-1/2 hours in emergency mode.
 - 4. Capable of full recharge in 24 hours, automatically upon resumption of normal line voltage.
 - 5. Capable of protecting against excess charging and discharging.
- H. Hazardous Classified Areas:
 - 1. UL or FM labeled for the area designation.
 - 2. Fixture Enclosure and Fittings: Copper-free, cast aluminum in accordance with UL Standard 844.

2.2 LAMPS

- A. Where applicable, provide lamps of a wattage and voltage as indicated in the lighting fixture schedule on the drawings. All Fluorescent lamps shall be cool white.
- B. Manufacturers:
 - 1. General Electric
 - 2. Sylvania

3. Phillips

2.3 BALLASTS

A. General:

1. Meet requirements for fixture light output, reliable starting, radio interference, total harmonic distortion, electromagnetic interference, and dielectric rating.
2. Certified by electrical testing laboratories to conform to Certified Ballast Manufacturer's specifications.
3. For use in exterior located ballasts to produce reliable starting of lamps at minus 20 degrees F at 90 percent of nominal line voltage.

2.4 LED FIXTURES

A. LED fixtures shall be UL or ETL listed as a whole assembly.

B. Only LED chips from the following manufacturers shall be acceptable:

1. Philips
2. Osram
3. GE
4. Nichia
5. Cree
6. Hitachi
7. Xicato

C. Submittal documents for LED fixtures must include the manufacturer's LM80 chip test results and LM79 fixture tests results.

D. Fixture correlated color temperatures (CCT) shall be 3000K-5000K. Higher color temperatures are not acceptable.

E. The color rendering index (CRI) shall be a minimum of 70 for outdoor fixtures and 82 for indoor fixtures.

2.5 LIGHTING CONTROL SYSTEM

A. Where indicated, install a lighting control system consisting of relay/contacter panel(s), control switches, occupancy sensors, photocells, and other controlling devices. The devices shall be connected by low voltage and line voltage wiring. The general operation of lighting and controlled loads shall include:

1. Interior lighting: Manual switch and occupancy sensor control on/off with automatic time scheduled shut off.
2. Scheduled on/off loads: Time on, time off by automatic time schedule with after hour override capability and shutoff.
3. Exterior lighting: Photocell or astronomic on/time off, time on/photocell or astronomic off.
4. Exterior security lighting: Photocell or astronomic on, photocell or astronomic off.

B. Submittals

1. Shop Drawings: Submit dimensional drawings of all lighting control system components and accessories.
2. One Line Diagram: Submit a one-line diagram of the proposed system configuration if it differs from that included in the contract drawings.
3. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, lighting control panels, relays, contactors, photocells, switches, occupancy sensors and daylighting controls.

C. Relay Panels

1. Lighting Control Panels shall be UL listed and consist of the following:
 - a. Enclosure/Tub: NEMA Type 1.
 - b. Cover: Surface or Flush as required, hinged, lockable and shall restrict access to line voltage section.
 - c. Interior: Barrier for separation of high voltage (class 1) and low voltage (class 2) wiring. It shall include intelligence boards, power supply and control relays. Clock display and keypad shall be mounted on interior cabinet door for easy user access and programming.
 - d. Panel shall accept up to eight single pole relays. Relays shall be individual latching relays with 20 Amp load contacts for ballast (including HID, magnetic, or electronic type ballasts), tungsten and general-purpose loads. Provide isolated auxiliary contacts for pilot light switching. Relays shall use quick connectors and be individually replaceable to facilitate ease of use.
 - e. Where indicated, panels shall provide space within the high voltage section of the enclosure to accommodate up to 12 multi-pole contactors. Two sections of DIN rail mounting shall be provided as standard. No field drilling or fabrication shall be required for mounting contactors or other accessories within the enclosure.
 - f. The lighting control panel shall provide a stagger up delay, override push buttons, pilot light outputs, and LED status light indicators for each relay or contactor control channel.

- g. The clock shall have a backlight display, user keypad and shall provide 8 channels of time or astronomical control. Preprogrammed lighting control scenarios shall include: scheduled on/off, manual on/scheduled off, manual on/automatic switch sweep off, astronomic or photocell on/off and astronomic or photocell control with scheduled on/off. Time clock shall provide up to 42 holidays, automatic daylight savings adjustment, astronomic coordinates by major cities, and help screens. Program memory shall be non-volatile, and clock shall retain time keeping during power outages for at least 48 hours.
- h. The panel shall have 8 universal switch inputs that are low voltage, self-configuring and shall not require programming to accept momentary on/momentary off switch, push button switch (cycling), maintained switch or 24VDC signals from occupancy sensors, photocells, or other interfacing devices.
- i. Occupancy sensor and time control shall be integrated to allow occupancy sensor control after hours with hold on of lighting during occupancy scheduled time. During occupied time, control scenarios shall be selectable for time schedule of lighting on or occupancy sensor detection of lighting on initially and then hold on of lighting during occupied hours. Control shall provide selectable occupancy sensor blink warning prior to shut off and adjustable occupancy sensor time delay from the time clock keypad.
- j. After-hour interior lighting shut off control shall provide a full duration override time of 1 to 240 minutes with a warning blink five minutes prior to shutting the lighting off. An impending shut off will be cancelled and the override period re-initialized through the operation of any assigned switch input.
- k. After-hour interior lighting shut off control may be by line voltage power interrupt control to automatic control switches. The lighting control relay panel shall provide a warning blink signal to automatic control switches, thus allowing a five-minute delay prior to shutting off lighting. The lighting shut off event may be cancelled by pressing the automatic control switch push button. The lighting control panel time clock shall provide periodic lighting sweep signals to shut off automatic control switches.

2. Approved Manufacturers

- a. Watt Stopper/Legrand
- b. Or Equal

PART 3 – EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Provide all ballasts, sockets, brackets, channels, and other devices as required for proper installation, operation, and support of all fixtures. Fixtures shall be installed and supported in accordance with manufacturer's recommendations.

- B. The Electrical Contractor shall install new wiring and/or junction boxes as needed for the proper installation of all fixtures.
- C. All fixture enclosures shall be grounded.
- D. All fixtures shall have lamps (where applicable) installed. Lamps that fail prior to final acceptance by the Owner shall be replaced with new lamps. Lamps that fail after final acceptance by the Owner shall be warranty items.

3.2 LUMINAIRES

- A. General:
 - 1. Install in accordance with manufacturer's recommendations.
 - 2. Provide proper hangers, pendants, and canopies as necessary for complete installation.
 - 3. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building required to safely mount.
 - 4. Install plumb and level.
 - 5. Mounting heights shown for wall mounted or pendant mounted luminaires are measured from bottom of luminaire to finished floor or finished grade, whichever is applicable.
 - 6. Install each luminaire outlet box with galvanized stud.
- B. Pendant Mounted:
 - 1. Provide swivel type hangers and canopies to match luminaires, unless otherwise noted.
 - 2. Space single-stem hangers on continuous-row fluorescent luminaires nominally 48 inches apart.
 - 3. Provide twin-stem hangers on single luminaires.
- C. Finished Areas:
 - 1. Install symmetrically with tile pattern.
 - 2. Locate with centerlines either on centerline of tile or on joint between adjacent tile runs.
 - 3. Install recessed luminaires tight to finished surface such that no spill light will show between ceilings and sealing rings.
 - 4. Combustible Low-Density Cellulose Fiberboard: Provide spacers and mount

luminaires 1-1/2 inches from ceiling surface or use fixtures suitable for mounting on low density ceilings.

5. Junction Boxes:

- a. Flush and Recessed Luminaires: Locate minimum 1 foot from luminaire.
- b. In concealed locations, install junction boxes to be accessible by removing luminaire.

6. Wiring and Conduit:

- a. Provide wiring of temperature rating required by luminaire.
- b. Provide flexible steel conduit.

7. Provide plaster frames when required by ceiling construction.

8. Independent Supports:

- a. Provide each recessed luminaire with two safety chains or two No. 12 soft-annealed galvanized steel wires of length needed to secure luminaire to building structure independent of ceiling structure.
- b. Tensile strength of chain or wire, and method of fastening to structure shall be adequate to support weight of luminaire.
- c. Fasten chain or wire to each end of luminaire.

D. Unfinished Areas: Locate luminaires to avoid either conflict with other building systems or blockage of luminaire light output.

- 1. Fixture Suspension: Provide 3/8-inch threaded steel hanger rods.
- 2. Attachment to Steel Beams: Provide flanged beam clips and straight or angled hangers.

3.3 LAMPS, where applicable

- A. Provide in each fixture, the number and type for which the fixture is designed, unless otherwise noted.

3.4 BALLASTS, where applicable

- A. Install in accordance with manufacturer's recommendations.
- B. Utilize all ballast mounting holes to fasten securely within luminaire.
- C. Replace noisy or defective ballasts.

3.5 CLEANING FOLLOWING CONSTRUCTION

- A. Remove all labels and other markings, except UL listing mark.

- B. Wipe luminaires inside and out to remove construction dust.
- C. Clean luminaire plastic lenses with antistatic cleaners only.
- D. Touch up all painted surfaces of luminaires and poles with matching paint ordered from manufacturer.
- E. Replace all defective lamps, if applicable, at time of Substantial Completion.

END OF SECTION

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HANOVER TOWNSHIP

POLICE DEPARTMENT

VEHICLE STORAGE BUILDING

WASHINGTON COUNTY

WIDMER ENGINEERING No: 25671
MARCH 2026

PENNSYLVANIA

PROJECT LOCATION - 11 MUNICIPAL DRIVE
BURGETTSTOWN, PA 15021



LOCATION MAP

SOURCE: PASDA AERIAL MAPPING - 53001250PAS
SCALE: NOT TO SCALE

CALL BEFORE YOU DIG!

PENNSYLVANIA ACT 287 REQUIRES
3 WORKING DAYS NOTICE FOR
CONSTRUCTION PHASE AND 5 WORKING
DAYS IN DESIGN STAGE - STOP - CALL

PENNSYLVANIA ONE CALL SYSTEM, INC.

1-800-242-1776
OR 811

PENNSYLVANIA ONE-CALL:

1. ALL UNDERGROUND UTILITIES ARE SHOWN AT APPROXIMATE
LOCATIONS. EXACT LOCATIONS, DEPTH, AND SIZE OF ALL
EXISTING UTILITIES IN THE PROJECT AREA SHALL BE FIELD
VERIFIED BY THE CONTRACTOR WITH A REPRESENTATIVE FROM
THE APPROPRIATE UTILITY COMPANY. THE CONTRACTOR SHALL
BE RESPONSIBLE FOR NOTIFYING ALL UTILITY COMPANIES AT
LEAST SEVENTY-TWO (72) HOURS BEFORE ANY WORK IS
COMMENCED AT THE PROJECT SITE.

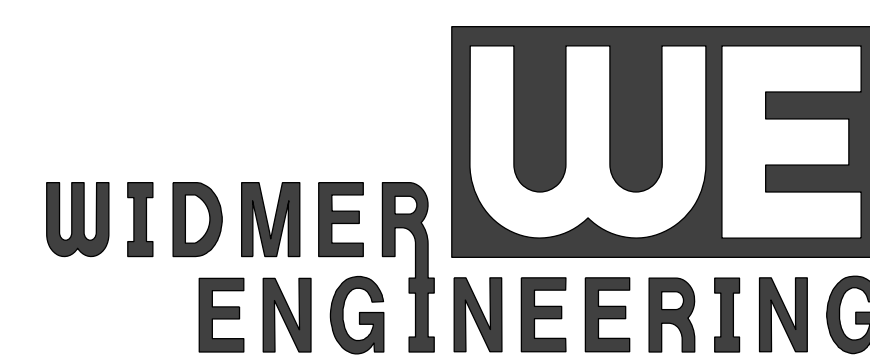
PENNSYLVANIA ONE-CALL: 1-800-242-1776 OR 811

NOTE: THIS BUILDING COMPLIES WITH THE 2021 INTERNATIONAL BUILDING CODE

INTERNATIONAL BUILDING CODE - CODE COMPLIANCE REVIEW		
CODE	DESCRIPTION	APPLICATION
CHAPTER 3	MIXED USE AND OCCUPANCY	
311.3	UTILITY AND MISCELLANEOUS GROUP U	PRIVATE GARAGE = 2,466.37 SQ. FT.
CHAPTER 5	GENERAL BUILDING HEIGHTS & AREA	
503	ALLOWABLE HEIGHT & BUILDING AREA	GROUP U CONSTRUCTION, TYPE V-B NON SPRINKLER, ALLOWED 1-STORY, HEIGHT ALLOWED IS 40', AREA ALLOWED IS 5,500 SF ACTUAL 1-STORY, HEIGHT IS 14'-2", AREA IS 2,466.37 SF
CHAPTER 6	TYPES OF CONSTRUCTION	
602.3	TYPE V-B	ONE STORY WOOD FRAME CONSTRUCTION
CHAPTER 7	FIRE RESISTANCE CONSTRUCTION	
		NOT REQUIRED AS PER TABLE 601 TYPE V-B - 0 HOUR FIRE RATING PROPOSED THROUGHOUT
CHAPTER 8	INTERIOR FINISHES	
T 803.5	CLASS A - FLAME SPREAD 0-25 MINIMUM	INTERIOR FINISHES
CHAPTER 9	FIRE PROTECTION SYSTEMS	
903	AUTOMATIC SPRINKLER SYSTEM	SPRINKLERS ARE NOT REQUIRED
906	PORTABLE FIRE EXTINGUISHERS	NONE REQUIRED
CHAPTER 10	MEANS OF EGRESS	
1003.2	MEANS OF EGRESS CEILING HEIGHT	MINIMUM 7'-6"
1004	OCCUPANCY LOAD	UTILITY AND MISCELLANEOUS GROUP U OCCUPANCY - PRIVATE GARAGE 2,466.37 SF- OCCUPANCY LOAD 1 PER 200 GROSS) MAX = 13 PEOPLE OCCUPANT LOAD = 13 OCCUPANTS
1005	MINIMUM EGRESS WIDTH	DOORS = 2.6" MINIMUM PER 13 OCCUPANTS (0.2 INCH X 13 OCCUPANTS = 2.6 INCHES MINIMUM) MINIMUM 36" WIDE EXITS PROVIDED
1006	NUMBER OF EXITS AND EXIT ACCESS DOORWAYS	MINIMUM OF 1 EXITS REQUIRED, MAXIMUM COMMON PATH OF TRAVEL IS 100'
1008	MEANS OF EGRESS - ILLUMINATION	1 - FOOT CANDLE @ FLOOR, EXISTING CORRIDORS, ON INTERIOR AND EXTERIOR OF EGRESS DOORS
1010	MEANS OF EGRESS - DOORS	32" MINIMUM CLEAR WIDTH, 80" MINIMUM CLEAR HEIGHT, SIDE SWING WITH EXIT DISCHARGE, FLOOR OR LANDING ON EACH SIDE, THRESHOLDS <f", PANIC HARDWARE AT 34-38" AFF., 36" > 32" O/C.
1013	EXIT SIGNS	AT ALL REQUIRED EXITS (NOTED ON PLANS)
1017.2	EXIT ACCESS TRAVEL DISTANCE	GROUP U WITHOUT SPRINKLERS = 300'
1020.1	CORRIDOR FIRE - RESISTANCE RATING	OCCUPANT LOAD > 30 WITHOUT SPRINKLER SYSTEM REQUIRES 1 HR FIRE RATING - WITH SPRINKLER SYSTEM REQUIRES A 0 HR FIRE RATING
1020.2	CORRIDOR WIDTH	NOT LESS THAN 36" WITH AN OCCUPANT LOAD LESS THAN 50
1022	NUMBER OF EXITS	MINIMUM OF 1 EXIT REQUIRED
SNOW LOAD IS 40 PSF AND WIND LOAD IS 110 MPH		

TABLE OF CONTENTS

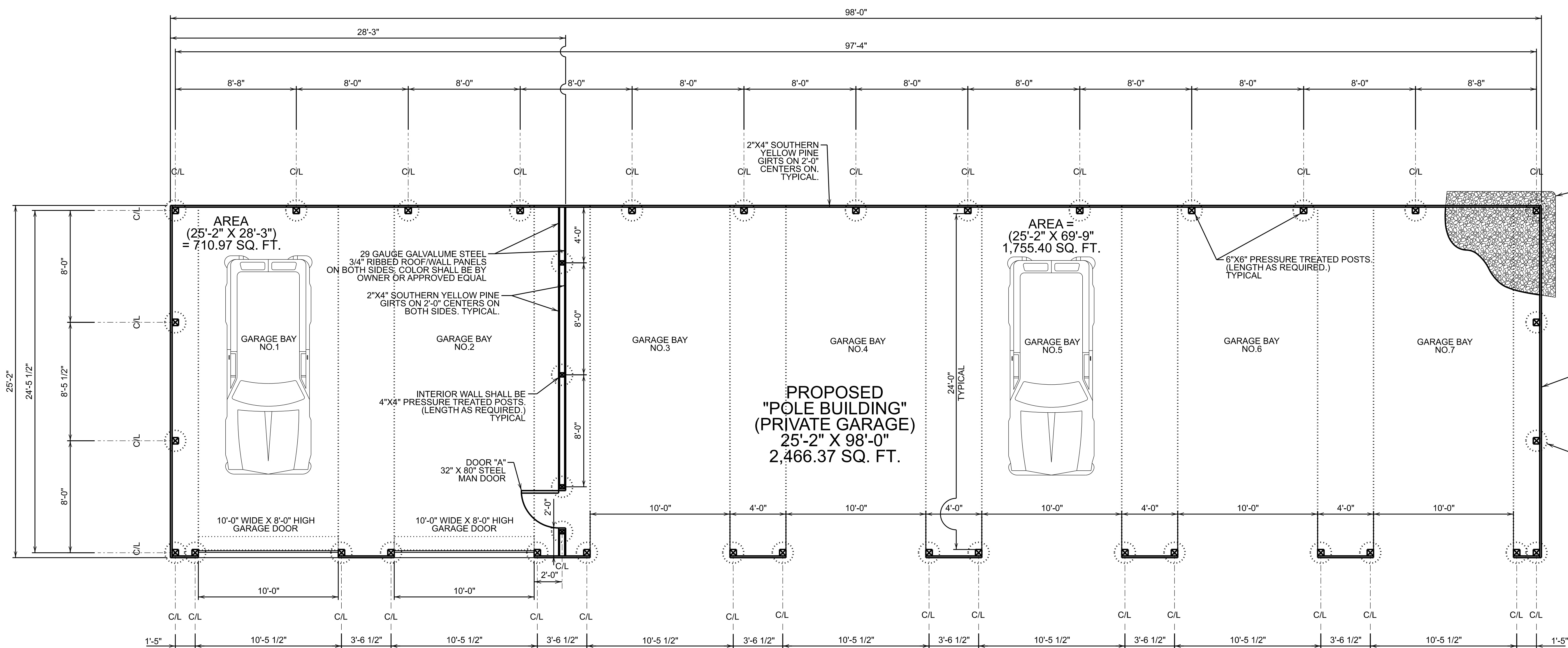
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2 OF 4	25671-02	BUILDING ELEVATIONS AND DETAILS
3 OF 4	25671-03	ELECTRICAL/LIGHTING PLAN
4 OF 4	25671-04	BUILDING FRAMING SECTIONS AND DETAILS
1 OF 1	25671-01	SITE PLAN



INC.

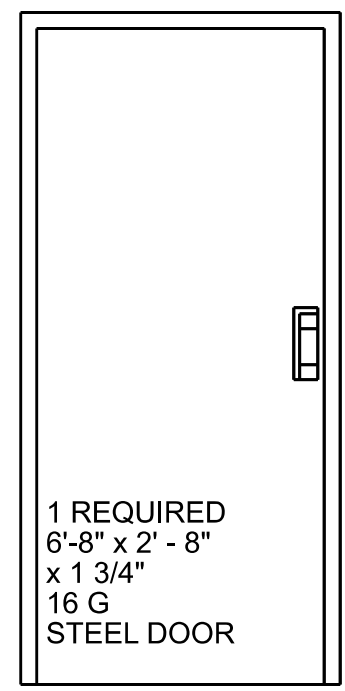
CONSULTING ENGINEERS
806 LINCOLN PLACE, BEAVER FALLS, PA 15010

CONTACT PERSON:
TONY F. SADAKA P.E.
WIDMER ENGINEERING, INC.
806 LINCOLN PLACE
BEAVER FALLS, PA 15010
PHONE: 724-847-1696



PROPOSED
"POLE BUILDING"
(PRIVATE GARAGE)
25'-2" X 98'-0"
2,466.37 SQ. FT.

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



DOOR "A"

WITH THRESHOLD, 6" x 3' - 0"
LITE "M.A.L." DESIGN TRIM
DOOR CLOSER: DOR-O-MATIC SC-61 SERIES
WITH COVER
DOOR HANDLE: MORTISE LOCK DEVICE NT
MONARCH F-17-M & SERIES 19 L-CONTROL
WITH LOCK CYLINDER

NOTES ON DOORS, FRAMES, AND TRIM:

- CHECK PLANS FOR DOOR SWINGS.
- ALL TRIM SHALL BE STAINLESS STEEL AS MANUFACTURED BY STEELCRAFT, INC. OR SARGENT.
- ALL DOORS & FRAMES TO BE PRIME-COATED & AS MANUFACTURED BY STEELCRAFT, INC. FRAMES SHALL BE 14 GAUGE HOT-DIPPED GALVANIZED (BOTH SIDES). GENERAL CONTRACTOR TO FINISH WITH 2 COATS OF APPROVED ENAMEL.
- PUSH AND PULL DOOR PLATES SHALL BE LABELED PUSH/PULL ACCORDINGLY
- PROVIDE ADDITIONAL FRAMING AS REQUIRED FOR OPENINGS

NOTE:
BUILDING ADDITION SHALL HAVE NO PLUMBING OR HVAC INSTALLED

NOTE:
EXTERIOR DOOR SHALL HAVE PANICK BARS

COMPLIANCE NOTES:

- CONSTRUCTION OF THIS BUILDING SHALL COMPLY WITH THE 2021 INTERNATIONAL BUILDING CODE.

FLOOR OF BUILDING SHALL BE 8" THICK PADOT NO.3 STONE WITH 2" OF PADOT NO.2A STONE PLACED ON TOP AND COMPACTED IN. STONE SHALL BE PLACED OVER CLASS IV GEOTEXTILE MATERIAL (GRAVEL SHALL EXTEND 1'-0" BEYOND OUTSIDE OF BUILDING)

29 GAUGE GALVALUME STEEL 3/4" RIBBED ROOF/WALL PANELS. COLOR SHALL BE BY OWNER OR APPROVED EQUAL

18" DIA. POST FOUNDATION SHALL BE INSTALLED TO A MINIMUM DEPTH OF 3'-0" TYPICAL. SEE DETAIL.

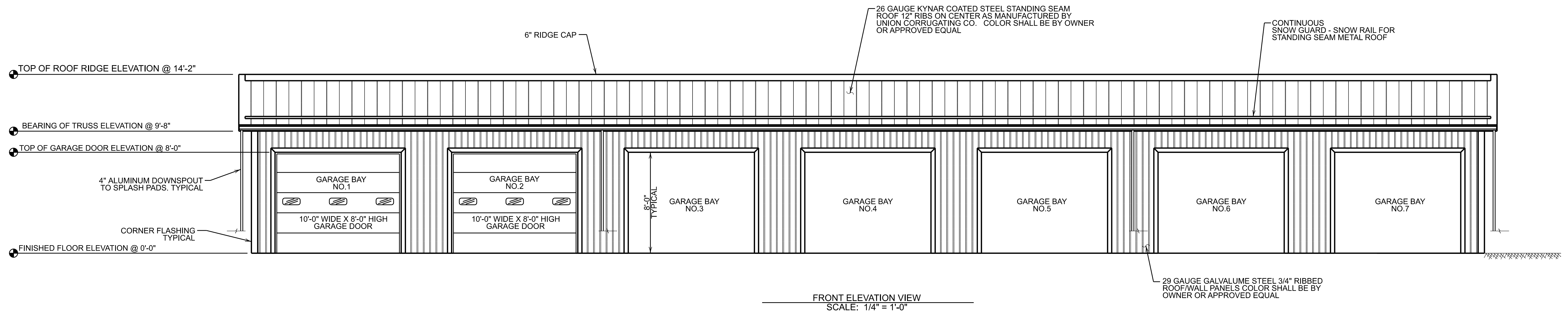
REVISIONS	DATE	BY	CHK

PREPARED BY: **WE**
WIDMER ENGINEERING
INC.
806 LINCOLN PLACE, BEAVER FALLS, PA 15010

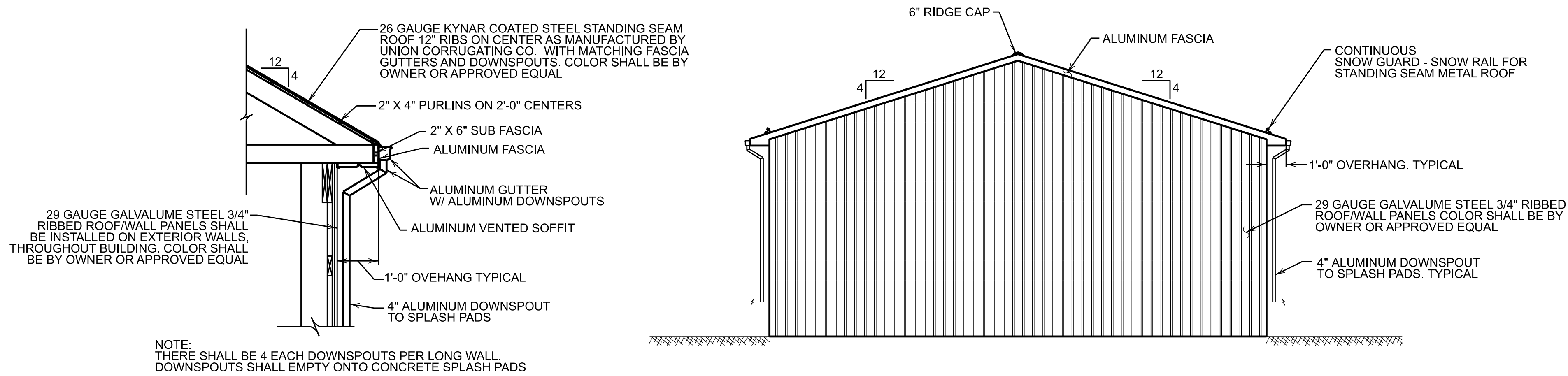
FLOOR PLAN
HANOVER TOWNSHIP POLICE DEPARTMENT
VEHICLE STORAGE BUILDING
SITUATE IN:
WASHINGTON COUNTY, PENNSYLVANIA

PROJECT #:	25671
FIELD BOOK #:	
DRAWN:	VJE
CHECKED:	KLB
DATE:	MARCH 2026
SCALE:	AS NOTED

CONTACT PERSON:
TONY F. SADAKA P.E.
WIDMER ENGINEERING, INC.
806 LINCOLN PLACE
BEAVER FALLS, PA 15010
PHONE: 724-847-1696

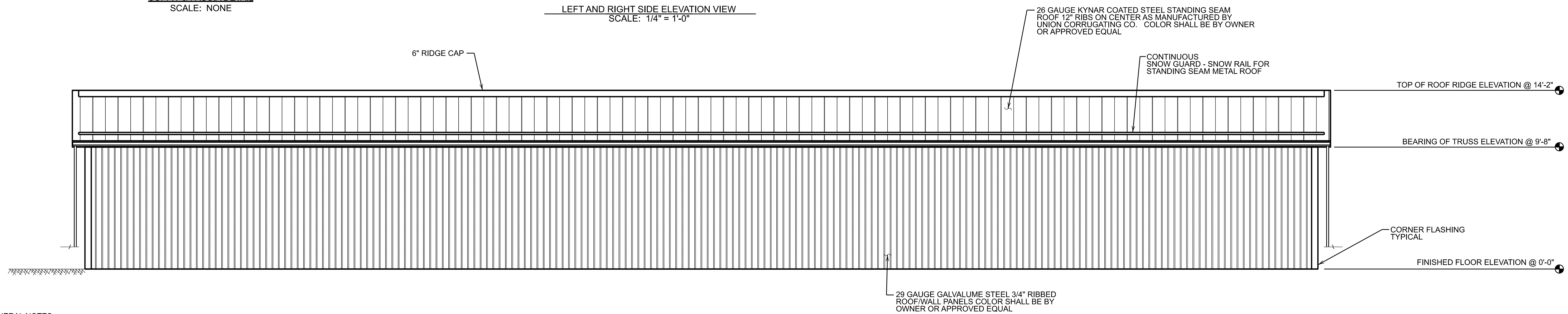


FRONT ELEVATION VIEW
SCALE: 1/4" = 1'-0"



SOFFIT & FASCIA DETAIL
SCALE: NONE

LEFT AND RIGHT SIDE ELEVATION VIEW
SCALE: 1/4" = 1'-0"



REAR ELEVATION VIEW
SCALE: 1/4" = 1'-0"

GENERAL NOTES:

- ALL COLORS SHALL BE BY OWNER.
 - GARAGE DOORS SHALL BE SECTIONAL STEEL DOORS, MODEL 2415, AS MANUFACTURED BY WAYNE DALTON AND AS SPECIFIED BELOW:
- SIZES: 10' - 0" (W) X 8' - 0" (H); QUANTITY = 2
 COLOR: EXTERIOR (BY OWNER), INTERIOR (BY OWNER)
 OPERATOR: MODEL SEL + PLUS (SIDE MOUNT), 3/4 HP, 115 V, SINGLE PHASE TRACK: 2" STANDARD WITH SUPPORT ANGLES AS REQUIRED.

- REQUIRED OPTIONS:
- PUSH-BUTTON CONTROL STATION
 - RADIO RECEIVER WITH 3 CHANNEL TRANSMITTER
 - PNEUMATIC BOTTOM SENSING EDGE
 - THERMAL GLAZING (3 PER DOOR)
 - FLEXIBLE VINYL JAMB SEAL

CONTRACTOR SHALL SUPPLY AND INSTALL LUMBER FOR FRAMING AS REQUIRED AROUND EACH DOOR OPENING FOR MOUNTING DOOR TRACK, ETC. FOR A COMPLETE OPERATING SYSTEM.

NOTE: CONTRACTOR SHALL INSTALL ALL NECESSARY TRIM/FLASHING FOR GARAGE DOORS, MAN DOORS, CARPORTS ETC.

REVISIONS	TYPE	BY	CHK

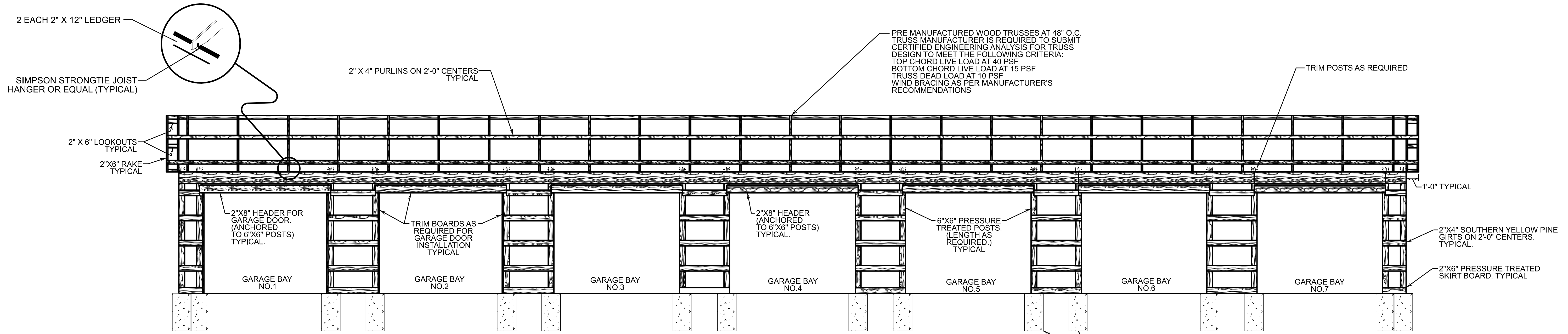
PREPARED BY: **WE**
WIDMER ENGINEERING, INC.
 806 LINCOLN PLACE, BEAVER FALLS, PA 15010

BUILDING ELEVATIONS AND DETAILS
 HANOVER TOWNSHIP POLICE DEPARTMENT
 VEHICLE STORAGE BUILDING
 WASHINGTON COUNTY, PENNSYLVANIA

PROJECT #:	25671
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SHEET NUMBER
2 OF 4

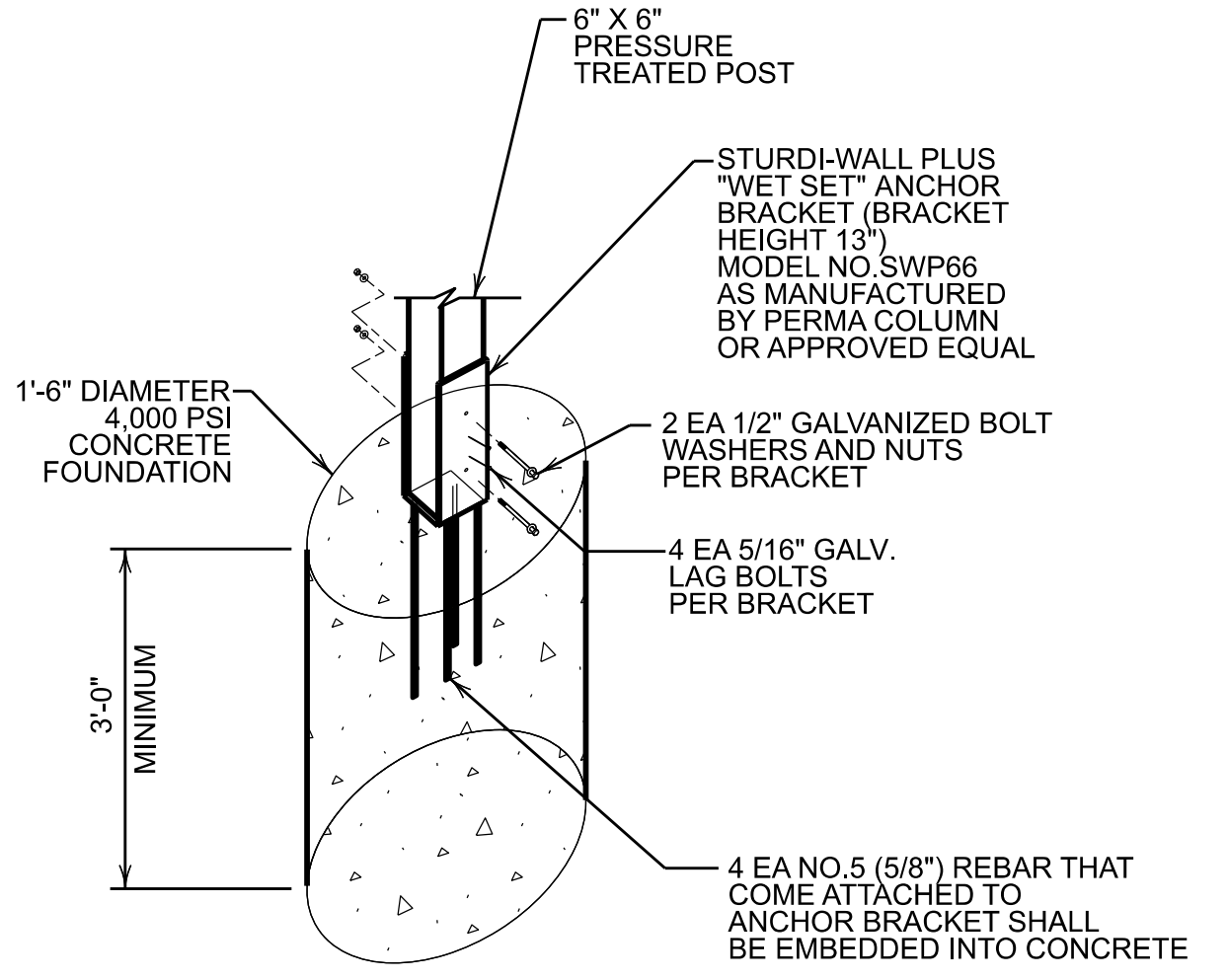
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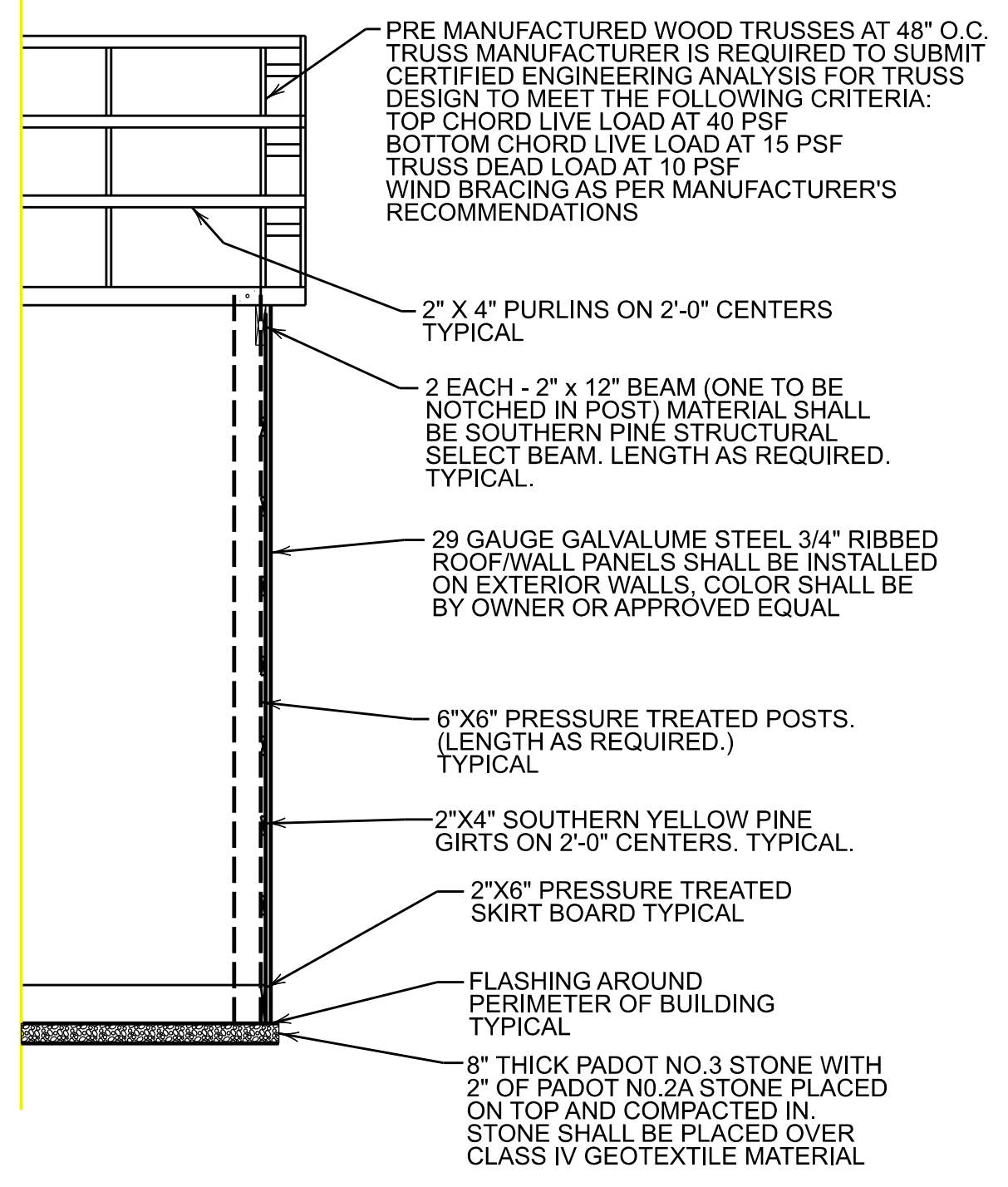
FRONT FRAMING ELEVATION
SCALE: 1/4" = 1'-0"

POST FOUNDATION SHALL BE INSTALLED TO A MINIMUM DEPTH OF 3'-0". SEE DETAIL THIS SHEET. TYPICAL

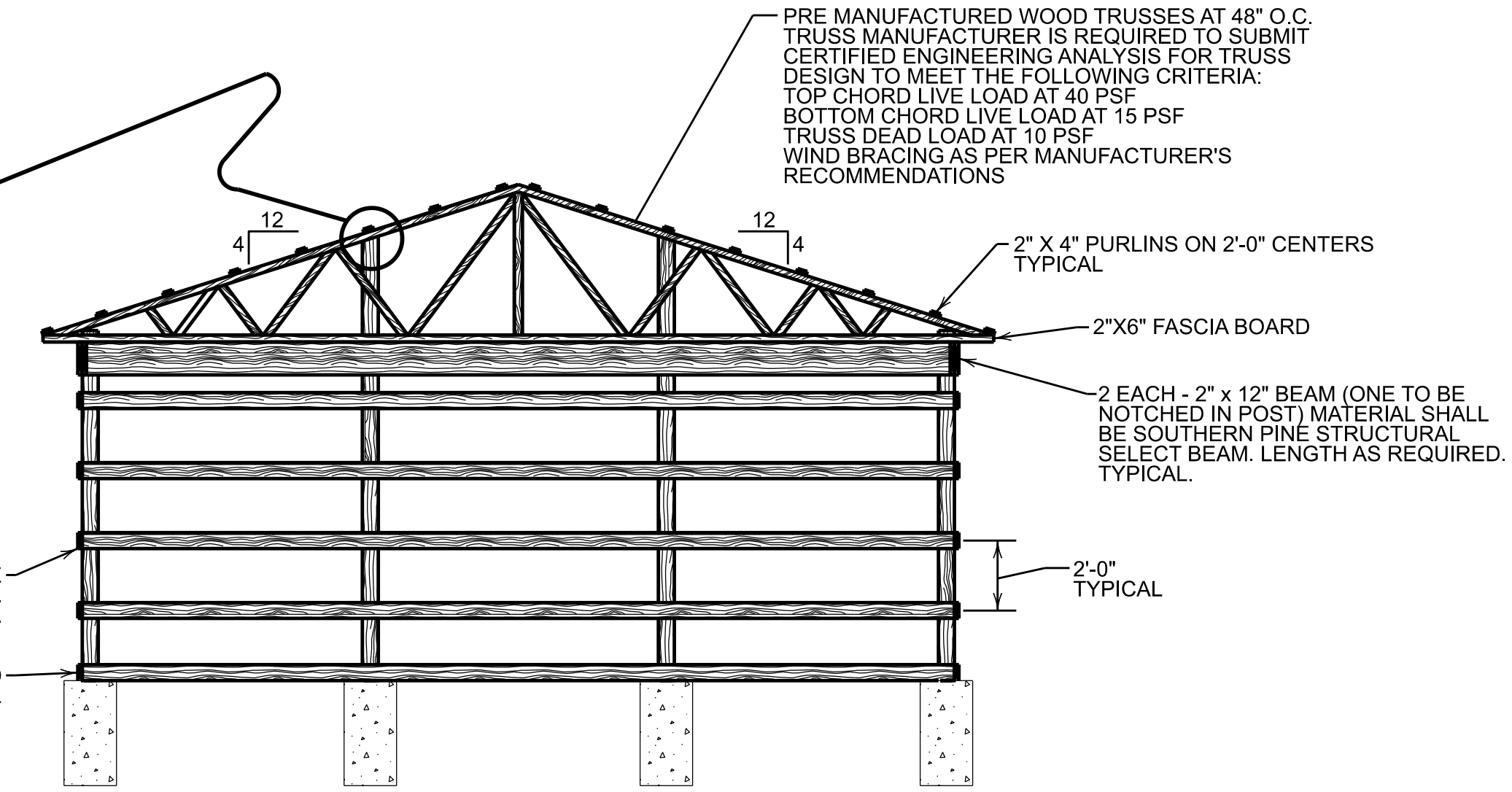
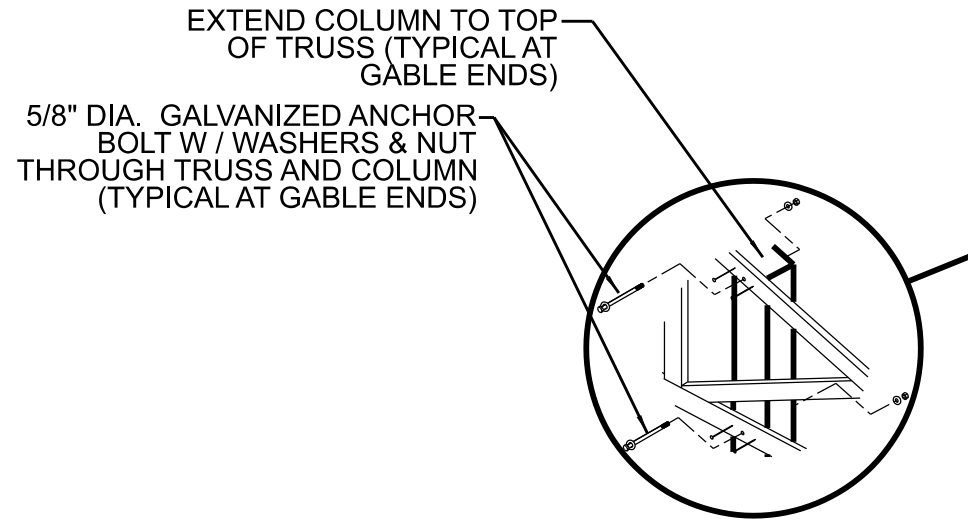
NOTE: INTERIOR WALL SEPERATING GARAGE BAY NO. 2 AND GARAGE BAY NO. 3 SHALL HAVE 29 GAUGE GALVALUME STEEL 3/4" RIBBED ROOF/WALL PANELS INSTALLED ON BOTH SIDES OF WALLS. COLOR SHALL BE BY OWNER OR APPROVED EQUAL



POST FOUNDATION DETAIL
SCALE: NONE



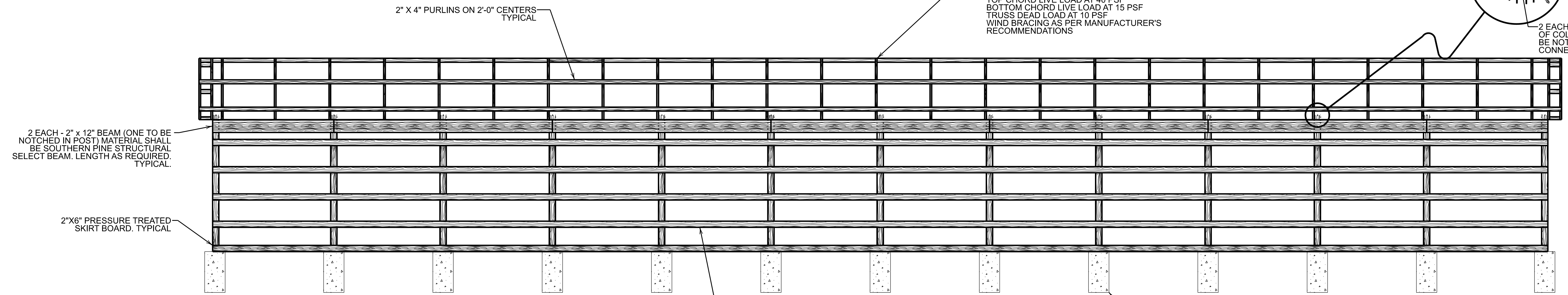
TYPICAL WALL SECTION
SCALE: NONE



LEFT AND RIGHT SIDE FRAMING ELEVATION
SCALE: 1/4" = 1'-0"

5/8" DIA. GALVANIZED ANCHOR BOLT W/ WASHERS & NUT THROUGH COLUMN

NOTE: EVERY OTHER ROOF TRUSS SHALL BE ANCHORED TO 6" X 6" POSTS ON REAR OF BUILDING
2 EACH 2" X 12" LEDGER ON OUTSIDE OF COLUMN INTERIOR LEDGER SHALL BE NOTCHED INTO 6" X 6" POST. CONNECTED AS INDICATED.



REAR FRAMING ELEVATION
SCALE: 1/4" = 1'-0"

REVISIONS	DATE	BY	CHK

PREPARED BY: **WIDMER ENGINEERING, INC.**
806 LINCOLN PLACE, BEAVER FALLS, PA 15010

BUILDING FRAMING SECTIONS AND DETAILS
HANOVER TOWNSHIP POLICE DEPARTMENT
VEHICLE STORAGE BUILDING
WASHINGTON COUNTY, PENNSYLVANIA

PROJECT #:	25671
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