COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA TURNPIKE COMMISSION
HARRISBURG, PENNSYLVANIA

Specifications
for
GENERATOR INSTALLATION
at the
Somerset Interchange
on the
THE PENNSYLVANIA TURNPIKE
in
SOMERSET COUNTY, PENNSYLVANIA

CONTRACT NO. EN-00009-03

APRIL, 2011
PENNSYLVANIA TURNPIKE COMMISSION
HARRISBURG, PENNSYLVANIA

SPECIFICATIONS

FOR

GENERATOR REPLACEMENT

AT THE

SOMERSET INTERCHANGE
TURNPIKE MILEPOST 109.9 EB/WB

ON THE

PENNSYLVANIA TURNPIKE

CONTRACT NO. EN-00009-03

Except as hereinafter modified, supplemented or changed, the Standard Specifications for this project are the Pennsylvania Department of Transportation Specifications, Publication 408,2007-7 dated October 1, 2010, and all revisions, modifications, and supplements.

TABLE OF CONTENTS

Pennsylvania Turnpike Commission Modifications

Modification of Section 100
General Provisions For Purchase Orders GPFP April 2011

Special Provisions SP June 2011
Supplemental Specifications SS June 2011

Prevailing Wage Predetermination
Pennsylvania Turnpike Commission
Harrisburg, Pennsylvania

GENERAL PROVISIONS FOR FACILITY PROJECTS

SECTION 101 — ABBREVIATIONS AND DEFINITIONS OF TERMS

101.01 MEANING OF TERMS - These specifications are generally written in the imperative mood. In sentences using the imperative mood, the subject, "the Contractor," is implied. Also implied in this language are "shall," "shall be," or similar words and phrases. In the Material sections, the subject may also be a Vendor, Fabricator, or Manufacturer, who may be supplying material, products, or equipment for use on the project. The word "will" generally pertains to decisions or actions of the Commission and/or Representative.

In these specifications or on the drawings, the following words or similar words refer to actions of the Commission and/or Representative, unless otherwise stated: "directed," "required," "permitted," "ordered," "designated," "prescribed." Also, the words "approved," "accepted," "acceptable," "satisfactory," "considered," or words with similar intent, mean by or to the Commission and/or Representative, subject to further review, as permitted by law or permitted elsewhere in these specifications.

In these specifications, reference to a subsection of the specifications includes all general requirements of the section of which the subsection is a part.

In these specifications, the words "or equal," referring to a product, material, or process, mean "equal as determined by the Commission and/or Representative."

In these specifications, the words, "as indicated," or "indicated" mean "as indicated or indicated on the prepared contract plans."

101.02 ABBREVIATIONS — The following is a list of abbreviations used in these specifications, in the proposal, and on the drawings. The list includes the meanings along with the abbreviations.

AAN American Association of Nurserymen
AASHTO American Association of State Highway and Transportation Officials
ACI American Concrete Institute
AGC Associated General Contractors of America
AI Asphalt Institute
AIA American Institute of Architects
AISC American Institute of Steel Construction
AISI American Iron and Steel Institute
AITC American Institute of Timber Construction
ANSI American National Standards Institute
API American Petroleum Institute
ASCE American Society of Civil Engineers
ASHRAE American Society of Heating and Refrigeration Engineers
ASLA American Society of Landscape Architects
ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Materials
AWG American Wire Gage
AWPA American Wood Preservers Association
AWS American Welding Society
AWWA American Water Works Association
101.03 DEFINITIONS

ACCEPTANCE CERTIFICATE — A letter of acceptance signed by the Chief Engineer may be issued.

ACTIVE WORK ZONE – The portion of a work zone where construction, maintenance, or utility workers are on the roadway or on the shoulder of the highway, and is adjacent to an open travel lane.

ADDENDUM - A public document issued before the receipt of bids, which revises, modifies or otherwise changes published specifications and contract documents.

ADDITIONAL WORK — Work, of a type already provided by the contract and for which the contract has established a unit price.
ADVERTISEMENT - The public announcement, required by law, inviting bids for work to be performed or for materials to be furnished. The Commission's Notice to Bidders may constitute the advertisement for a project of work.

AGENCY HEAD – The Chief Executive Officer of the Commission or authorized designee.

AIR TEMPERATURE - The measured temperature in the degrees Celsius (°C) (Fahrenheit (°F)) in the shade, not in the direct rays of the sun, and away from artificial heat.

AS-BUILT DRAWINGS - Changes are to be made in a neat and orderly manner in red marking and are to be true to applicable scales. The As-Built Drawings will become the property of the Commission at the completion of the project.

AWARD — The Commission's acceptance of a bid.

BID - The offer of a bidder to construct the project, at the prices bid or predetermined. For contracts, bids are submitted using either a compact disk or the internet.

BIDDER — Any individual, firm, partnership, corporation or joint venture, submitting a bid for the work contemplated and acting either directly or through an authorized representative.

BID FORMS - The Commission forms on which bids are prepared and submitted for the work.

BID GUARANTY - The security furnished with a bid, to guarantee that the bidder will enter into a contract, if the bid is accepted.

BUSINESS PARTNER - An individual, firm, partnership, or corporation that has a valid Registered Business Partner Identification Number issued by the Commission.

CALENDAR DAY — Every day shown on the standard calendar.

CHANGE ORDER - An order, signed by the Representative, authorizing the performance of additional or extra work, or extra work on a force-account basis, as specified in Sections 109.02 and 109.03.

CHIEF ENGINEER — The Engineer in charge of the Commission's Engineering Department or authorized designee.

CHIEF EXECUTIVE OFFICER – The Chief Executive Officer of the Commission or authorized designee.

COMMISSION — The Pennsylvania Turnpike Commission.

COMPACT DISK BID - A bid submitted on a compact disk using the Commission’s EBS Expedite software.

CONSULTING ENGINEER - The Engineer employed by the Commission as Consulting Engineer in accordance with Trust Indenture requirements.

CONTRACT — The written agreement between the Commission and the Contractor, or the Purchase Order issued to the Contractor for the construction of the project.
The contract includes the following: The executed Contract or Purchase Order; Plans; Specifications; Performance Bond; Payment Bond; Insurance Certificates; Notice to Proceed; and all change orders and supplemental agreements that are required to complete the construction of the project.

**CONTRACT ITEM (PAY ITEM)** — A specifically described unit of work for which a price is provided in the contract.

**CONTRACTING OFFICER** – The Chief Engineer or authorized designee.

**CONTRACTOR** — The individual, firm, partnership, corporation or joint venture awarded the contract; acting directly through agents or employees, or the Surety in case of default; or each participant in a joint venture.

**CROSS SECTIONS** - Graphic representations of the original ground and the proposed highway, at right angles to the centerline or base line.

**DEPARTMENT** — Pennsylvania Department of Transportation.

**DRAWINGS** — See "PLANS".

**ENGINEER** — An individual licensed and registered under the Laws of the Commonwealth of Pennsylvania designated by the Chief Engineer, acting directly or through a duly authorized representative, acting within the scope of the particular duties assigned or the authority given.

**EXPEDITE** - AASHTO’s EBS software approved by the Commission for bidding contracts.

**EXTRA WORK** — Work arising from changes which result in a significant increase or decrease in the cost of performing the work and work having no quantity and/or price included in the contract, that is determined by the Chief Engineer to be necessary or desirable to complete the project.

**FABRICATOR** - A firm, company, or individual supplying fabricated material for the project.

**FINAL INSPECTION** — The inspection, conducted by the Representative, to determine if the project, or any substantial portion thereof, has been satisfactorily completed, according to contract requirements.

**INSPECTOR** — The person authorized and assigned by the Representative to make inspections of contract performance and of material furnished.

**INSPECTOR-IN-CHARGE** — The person authorized by the Representative to be in immediate charge of inspecting the performance of work on the project.

**IN WRITING** - Communication between parties delivered or sent, and received, in the form of a written letter, e-mail, facsimile, telegram, or mailgram.

**JOINT VENTURE** - A legal association of contractors, limited to three participants, formed for the purpose of bidding and executing a common contract.

**LABORATORY** - The testing laboratory designated by the Commission.
MANUFACTURER - A firm, company, or individual manufacturing material for the project.

MATERIAL - Substances specified for use in the project construction.

MILESTONE DATE — The date on which a specific portion of physical contract work is to be completed, before the Required Completion Date of all contract work.

NOTICE TO PROCEED DATE — The date on the Purchase Order or the date on the Notice to Proceed letter.

ONLINE BID - A bid submitted via the internet using the Commission’s EBS.

PAYMENT BOND — The approved form of security, furnished by the Contractor and the surety, as a guaranty to pay promptly, or cause to be paid promptly, in full, such sums as may be due for all material furnished, labor supplied or performed, rental of equipment used, and services rendered by public utilities in, or in connection with, the work under contract.

PERFORMANCE BOND — The approved form of security, furnished by the Contractor and the surety, as a guaranty on the part of the Contractor to execute the work, in accordance with the terms of the specifications and contract.

PLANS — The approved documents or drawings, or exact reproductions of them, for construction of the project. The plans show the location, character, dimensions, approximate quantities, and other details of the prescribed work, including floor plans, elevations, sections and details; plans also include cited Standard Drawings. However, subsurface soil and geological data (e.g. the Soil Survey Report and Profile and Core Borings) are excluded from this definition.

PROJECT — All of the work described in the contract.

PROPOSAL — The documents, designated by the Commission, containing project requirements and other information upon which a bid for the project to be constructed is to be based. The proposal includes the Plans, Specifications, Special Provisions, referenced Standard Drawings, Addenda, and all other documents referred to therein, whether or not attached.

PURCHASE ORDER — The written agreement issued by the Commission to the Contractor for the completion of the project.

QUALITY CONTROL (QC) PLAN - A Contractor's or Vendor's prepared plan, submitted to and reviewed by the Representative, describing the proposed QC system. This plan contains, as a minimum, an inspection schedule, sample schedule, testing schedule, and required laboratory inspection reports.

QUALITY CONTROL (QC) SYSTEM - A system of controls, inspection, and tests, fully documented, providing reasonable assurance that all materials, products, and completed construction submitted for acceptance, conform to specifications.

REGULATIONS - The Commission will provide regulations applicable to the Turnpike.

REPRESENTATIVE - The authorized representative acting on behalf of the Chief Engineer.
REQUIRED COMPLETION DATE — The date on which all physical contract work, including any authorized additional or extra work, is to be completed. The Required Completion Date is: (1) the date which follows the Notice to Proceed Date by the number of calendar days allowed for contract completion shown in the contract plus any time extensions issued in writing by the Representative less any time reductions issued in writing by the Representative; or (2) the completion date shown in the contract plus any time extensions issued in writing by the Representative less any time reductions issued in writing by the Representative.

ROADSIDE DEVELOPMENT - Items for seeding, sodding, mulching, topsoiling, planting of ground covers, other planting, and items for erosion control.

SECRETARY - The Chief Engineer or authorized designee.

SHOP DRAWINGS - See WORKING DRAWINGS.

STANDARD DRAWINGS — Approved drawings, showing standard details, produced to be used repeatedly on projects.

STATE — The Commonwealth of Pennsylvania.

SUBCONTRACTOR - Any individual, partnership, firm or corporation, who/which undertakes, the partial or total construction of one or more items of project work, under the terms of the contract.

SUPERINTENDENT - The Contractor's authorized representative in charge of the work.

SUPPLIER - A firm, company, or individual supplying material for the project.

SURETY — A corporate body, which is bound with and for the Contractor, for the satisfactory performance of the Contractor's work and for the prompt payment in full for material, labor, equipment rentals, and utility services, as provided in the bonds.

TRAFFIC CONTROL PLAN — A developed method or scheme for safely and efficiently moving traffic through or around a work zone.

TURNPIKE – The Pennsylvania Turnpike.

UTILITY ADJUSTMENT - The act of placing, setting, replacing, resetting, relocating, adjusting, reconstructing, altering or removing a Utility Infrastructure.

UTILITY INFRASTRUCTURE - A public or private facility or structure, whether or not owned by a utility, that is or will be in, on, under, or over the project site or a waste or borrow area designated in the proposal, and that either must be placed, set, replaced, reset, relocated, adjusted, reconstructed, altered or removed in order for the contract work to be performed or otherwise interferes with the performance of the contract work.

VENDOR - A firm, company, or individual supplying material or services for the project.

WORK — The furnishing of material, labor, equipment, and other incidentals necessary or convenient to successful project completion, plus the fulfillment of all duties and obligations imposed by the contract.
WORKING DRAWINGS — Required shop drawings, erection plans, falsework plans, stress sheets, framework plans, cofferdam plans, bending diagrams for reinforcing steel, and any other supplementary plans or similar data, all prepared by the Contractor.

WORK ZONE – The area of a highway where construction, maintenance or utility work activities are being conducted and which are to have traffic-control devices installed according to Title 67 of the Vehicle Code.

SECTION 102 — BIDDING REQUIREMENTS AND CONDITIONS

102.01 BUSINESS PARTNER REGISTRATION - Unless otherwise stated, contractors are required to register with the Commission as a business partner to submit contract bids. To become a business partner, go to the Commission’s EBS homepage. Instructions for registration are available on the website. Contractors are not required to register as a business partner to submit purchase order bids.

102.02 INTERPRETATION OF APPROXIMATE ESTIMATE OF QUANTITIES — The estimate of quantities, shown in the proposal, and in the contract, is approximate and is shown only as a basis for the calculation upon which the contract award is to be made. The Commission does not assume any responsibility that the quantities will actually be required in the project construction, nor will the Contractor be allowed to plead misunderstanding or deception because of the quantity estimates or because of the character of the work, the location, or other conditions. The Commission reserves the right to increase, to decrease, or to omit any of the quantities of work. An increase or decrease of the quantities of the items will not be sufficient grounds for granting an increase in the unit prices bid, except as specified in Section 109.02. The Commission assumes no liability for material ordered and supplied in advance of any operation and not used on the project. Payment will be made only for those amounts of materials actually incorporated into the project. Remove any surplus materials from the site at no additional expense to the Commission.

102.03 EXAMINATION OF PROPOSAL, PLANS, SPECIFICATIONS, SPECIAL PROVISIONS, AND SITE OF WORK — The Commission's plans and specifications are complete and are prepared so any competent contractor is able to complete the proposed work. The bidder is required to carefully examine the proposal, plans, specifications, and project site and facility before submitting a bid. The submission of a bid will be considered proof that the bidder has made such examination and understands the conditions to be encountered; the character, quality, and quantities of work to be performed; the material to be furnished; and the requirements of the plans, specifications, and proposal. The Commission will make no allowance or concession for a bidder's failure to make the required examination.

If applicable, the proposed slope lines shown on the cross sections are approximate and are subject to revision and change by the Representative, depending upon the stability of material encountered during construction.

If subsurface conditions are shown on the drawings or in the specifications, subsurface soil and geological information indicated is based upon soundings, dug test pits, and/or test borings. Such information concerning the character of subsurface material is of a preliminary nature and has been obtained for the exclusive use of the Commission to aid in the project design. The information provided is representative of subsurface conditions only at the locations and depths where such information was obtained, and there is no expressed or implied agreement that uniformity of material exists between explored locations.

Subsurface material information may not necessarily be indicated on the drawings. The Contractor is required to examine and familiarize himself with the site and make such subsurface exploration as he deems necessary in connection with his bid. When applicable, core borings and related information made and developed for the exclusive use of the Commission in designing the project may, if the Contractor
wishes, be examined by him upon request to the Representative. This information is not guaranteed and reliance thereon by the Contractor will be at his own risk, and the Commission, in making this information available to the Contractor, assumes no liability for misinformation obtained therefrom or resulting from this interpretation thereof. Information will be available for examination at locations designated by the Commission.

102.04 PREPARATION OF CONTRACT BIDS –

(a) Submit properly completed bids for Commission construction work in the electronic bidding format (i.e., online or CD).

(b) Configure the electronic file for bidding to include Registered Business Partner Identification Number. For a joint venture bid, the lead joint venture will be required to furnish this information on behalf of the joint venture.

(c) Execute bids as follows:
When an item in the bid contains a choice to be made by the bidder, indicate this choice, according to the specifications for that particular item. When preparing the bid, leave blank the unit price(s) of the alternate(s) that are not bid. Thereafter, no further choice will be allowed.

1. Online Bid. Submit an online bid via the EBS website by using a business partner password with the security level of an authorized general partner or corporate officer properly designated to execute and attest to bids. For a joint venture bid, submit an online bid via the EBS website by using a business partner password with the security level of an authorized general partner or corporate officer properly designated to execute and attest to bids of the lead joint venture.

2. Compact Disk Bid. As an alternate to online submission, submit a CD bid by preparing the bid using the EBS Expedite software, furnished by the Commission. Submit the completed EBS Expedite bid file on a CD along with the required signature page(s). Sign the signature page(s), in ink. Type or legibly print the name of each signer under the signature. All other document submissions and addenda acknowledgement must be completed online.

If the bidder is a partnership, only one signature of an authorized general partner will be required.
If the bidder is a corporation, the signatures of authorized corporation officers, properly designated to execute and attest to contracts, are required. If the above signatures are not those of such authorized officers, attach a current power of attorney.
For a joint venture proposal, each participant is required to complete one signature page, as shown in the postscript at the bottom of the page.

(d) Anti-Collusion Requirements. The authorized signer of the bid, under penalty of perjury as provided in 18 Pa. C.S.A. Section 4904, or if applicable, 18 U.S.C., Section 1020, certifies that he or she is authorized to make and does make the following statement on behalf of the bidder:

1. The bid item prices and the total bid amount have been arrived at independently and without consultation, communication, or agreement for the purpose of restricting competition with any other contractor, bidder, or potential bidder.

2. Neither the item prices nor the total bid amount, and neither the approximate bid item prices nor approximate total bid amount, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.
3. No attempt has been made or will be made to solicit, cause, or induce any firm or person to refrain from bidding on this project, or to submit a bid higher than this bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.

4. The bid submitted by the bidder is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.

5. The bidder has not offered or entered into a subcontract or agreement regarding the purchase of materials or services from any firm or person, or offered, promised, or paid cash or anything of value to any firm or person, whether in connection with this or any other project, in consideration for an agreement or promise by any firm or person to refrain from bidding or to submit a complementary bid on this project.

6. The bidder has not accepted or been promised any subcontract or agreement regarding the sale of materials or services to any firm or person, and has not been promised or paid cash or anything of value to any firm or person, whether in connection with this or any other project, in consideration for this firm’s submitting a complementary bid, or agreeing to do so, on this project.

7. The authorized signer of the bid has made a diligent inquiry of all members, officers, employees, and agents of the bidder with responsibilities relating to the preparation, approval, or submission of this firm’s bid on the project and has been advised by each of them that he or she has not participated in any communication, consultation, discussion, agreement, collusion, act, or other conduct inconsistent with any of the statements and representations made in this Statement.

8. No attempt has been made to take any action in restraint of free competitive bidding in connection with the bid.

9. It is understood that if any incidents resulting in conviction or being found liable are specified in Section 102.04(d)10, the Pennsylvania Anti Bid Rigging Act, 73 P.S. 1611 et. seq. provided that it does not prohibit a governmental agency from accepting a bid from or awarding a contract to that person, but may be a ground for administrative suspension or debarment at the discretion of a governmental agency under rules and regulations of that agency.

10. The bidder, its affiliates, subsidiaries, officers, directors, and employees are not aware that they are currently under investigation by any governmental agency and have not in the last 3 years been convicted or found liable for any act prohibited by State or Federal law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as indicated on a separate page included with the bid.

The authorized signer of the bid hereby states that he or she understands and acknowledges that the above representations are material and important, and will be relied on by the Commission, in awarding the contract for which the bid is submitted. He or she and their firm understands that any misstatement in this statement is and shall be treated as fraudulent concealment from the Commission of the true facts relating to the submission of bids for this contract.

102.05 BID GUARANTY — Bid guaranty for the three (3) lowest responsive bidders will be retained by the Commission until the execution of a contract or issuance of a purchase order.
(a) **Contracts.** Submit an electronic bid bond from one of the approved vendors, in favor of and payable to the Pennsylvania Turnpike Commission, in an amount not less than 5% of the bid price, conditioning that the bidder will execute a contract for the work according to the proposal terms, within the prescribed time limit. Have a corporate surety, legally authorized to transact business in the State and satisfactory to the Commission, execute the bond. For a joint venture bid, an authorized general partner or corporate officer of the lead joint venture will be responsible for proper execution of the bid bond.

(b) **Purchase Orders.** All bids in excess of $100,000 must be accompanied by a Bid Bond in favor and payable to the Pennsylvania Turnpike Commission in an amount of not less than ten percent (10%) of the bid price. In lieu of a bond, the guaranty may be in the form of a bank cashier's or treasurer's check or a depositor's check certified by the bank of deposit.

102.06 **DELIVERY OF BIDS** — Submit bid(s) to the location designated, before the hour of the opening date shown in the proposal.
Submit purchase order bids in sealed envelopes furnished by the Commission.
Electronic online contract bids will not be accepted after the time for the opening date of the bids shown in the proposal.
Bids received after the time for opening of bids will be returned unopened to the bidder.

102.07 **WITHDRAWAL OR REVISION OF BIDS** —

(a) **Withdrawal of Bids Before Bid Opening.** Each bidder who submits a bid waives any right to withdraw it, except as provided herein. Bidders will be given permission to withdraw any bid, after it has been submitted to the Commission, if the bidder electronically withdraws or makes the request in person or by an accredited personal representative, by telephone, or in writing to the official in charge of the opening. Deliver requests for withdrawal to the official in charge of the opening before the time set for opening bids.

(b) **Revision of Bids Before Bid Opening.** A bidder will be allowed to revise a bid after it has been submitted, if the bidder electronically withdraws the bid, or appears in person or provides an accredited personal representative to make the revision. Present all such requests to the official in charge of the opening expeditiously so that the revision can be completed and the bid resubmitted before the time set for opening bids.

(c) **Withdrawal of Bids After Bid Opening.** Withdrawal of erroneous bids after the bid opening but before award based on bid mistakes will be allowed by the written determination of the Commission when the bidder requests relief and presents credible evidence that the reason for the lower bid price was a clerical mistake as opposed to a judgment mistake and was actually due to an unintentional arithmetical error or an unintentional omission of a substantial quantity of work, labor, material, or services made directly in the compilation of the bid. The request for relief and the supporting evidence must be received by the Commission within three business days after the bid opening but before the award of the contract.

The Commission will not allow a withdrawal of a bid if the withdrawal of the bid would result in the awarding of the contract on another bid of the same bidder, its partner or a corporation or business venture owned by or in which the bidder has a substantial interest. No bidder who is allowed to withdraw a bid shall supply any material or labor to or perform any subcontract or other work agreement for any person to whom a contract or subcontract is awarded in the performance of the contract for which the withdrawn bid was submitted without the written approval of the Commission.

102.08 **OPENING OF BIDS** — Bids will be opened and read publicly at the time, on the date, and at the place shown in the proposal. Bidders and/or their authorized representatives and other interested persons
are invited to be present.

In case of an emergency which causes evacuation of the building at the time of the bid opening, the official in charge of the bid opening will publicly announce any necessary changes in the time of depositing, opening, and reading of bids.

102.09 JOINT VENTURE - A joint venture bid will be considered a bid by each of the participants, jointly and individually, for the entire contract performance as a joint venture, according to the proposal terms and conditions.

In the proposal, contract, specifications, drawings, or any writing constituting a part of these, the term "Bidder" or "Contractor," or any other term intending to refer to "Bidder" or "Contractor," as defined in Section 101, will include and mean each participant in any joint venture.

Designate in the bid on the form titled 'Statement of Joint Venture Participation' the items in whole or in part, to be undertaken by each participant and their total respective proportionate amounts.

102.10 DISQUALIFICATION OF BIDDERS AND REJECTION OF BIDS —

(a) The following may be considered sufficient reasons for bidder disqualification and the rejection of the bid(s):

1. submittal of more than one bid for the same work from an individual, a firm, a partnership, an association, a subsidiary, an affiliate or a corporation under the same or different name;

2. evidence of collusion among bidders. Any participant in such collusion will receive no recognition as a bidder for future work of the Commission until the participant has been reinstated as a qualified bidder;

3. lack of competency, of adequate machinery, plant, or of other equipment;

4. inability, in the judgment of the Commission, to promptly complete the project,

5. failure to pay, or satisfactorily settle, all bills due for material furnished, for labor supplied or performed, for rental of equipment used, and for services rendered by public utilities;

6. failure to comply with any Commission prequalification regulations;

7. judgment of default under a previous contract;

8. contractor currently debarred by Federal or State Authority; or

9. material or intentional failure to comply with contract, drawings, or specifications, or material or intentional failure to adequately maintain and control traffic during construction on a previous contract.

(b) In addition, the Commission reserves the right to reject any or all bids if, in its judgment, the rejection is in the Commission’s best interest.

1. In addition, bids will be rejected for any of the following reasons:

1.a failure to submit the bid using the electronic format or the form furnished or approved by the Commission;
1.b failure to properly sign the bid, the required affidavits, or certificates, or any other required documents as specified in the proposal;

1.c completed EBS Expedite bid file is unreadable or contains errors;

1.d failure to include a price for each item on the bid schedule, except in the case of alternate bidding; in alternate bidding, failure to include a price for one of the required alternate items on the bid schedule;

1.e the inclusion of conditions or qualifications not provided for in the proposal; or

1.f failure to furnish the required bid bond.

1.g failure to submit Minority and/or Women Business Enterprise Participation Requirements as specified in the proposal; or

1.h failure to include all addenda in the completed EBS Expedite bid file.

2. In addition, bids may be rejected for the following reasons:

2.a the proposal was not furnished or approved by the Commission;

2.b part of the bid is detached;

2.c the bid contains omission(s) or alteration(s), addition(s) not specified, or deviation(s) of any other kind;

2.d the bid is materially unbalanced;

102.10 CHANGES WHILE BIDDING — During the bidding period, bidders may be furnished addenda for additions to or alterations of the plans or specifications, if any, which will be included in the work covered by the proposal and become a part of the contract documents.

102.11 REQUEST FOR INTERPRETATION OF PLANS, SPECIFICATIONS OR OTHER CONTRACT DOCUMENTS — If any prospective bidder on the proposed contract is in doubt as to the true meaning of any part of the plans, specifications or other proposed contract documents, he or she may submit to the designated contact person, no later than 10 days before the bid opening date, a written request for an interpretation thereof. The bidder submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by an addendum. The Commission will not be responsible for any other explanations or interpretations of the proposed documents.

102.12 ACCESS TO JOB SITE — To the extent necessary, Contractor's materials, supplies, on-site supervisory personnel and equipment will be granted toll-free access to the job site. Equipment necessary for the performance of the work under contract will be granted non-revenue passage. All equipment delivering materials necessary for the proper execution of the work under contract will be granted non-revenue privileges except common or contract carriers.

The Contractor's on-site supervisory personnel and vehicles for group transportation of personnel assigned to the performance of the work under contract will be provided non-revenue passage to and from the work area.

Provide group transportation for all non-supervisory personnel. Non-revenue privileges are not
extended to individual employees other than on-site supervisory personnel.

All vehicles entering the Turnpike System must obtain a toll ticket. If exiting at an interchange, the ticket and the Non-Revenue Card must be presented to the Toll Collector. If valid, the Card will be returned to the driver. If a driver exits at a location other than an interchange, the ticket(s) must be turned into their supervisor, on a daily basis. The supervisor will have the ticket(s) forwarded to the Commission's Fare Audit Department in Central Office. All drivers attempting to exit the system without a card must pay the appropriate toll with cash. Vehicles entering at locations other than an interchange may use the card when exiting at an interchange. Each vehicle entering or exiting the Turnpike system must have a valid non-revenue card specific to the project.

Overweight and oversized vehicles must obtain a permit number from the Commission's Safety Department prior to making the trip to and from the work site. Permit numbers can be obtained from the Safety Department by phone between 8:30 A.M. and 4:30 P.M., Monday through Friday.

Report all stolen cards immediately to the Card Control Center or the Communications Center located in the Turnpike's Administration Building, (717) 939-9551.

The Non-Revenue Cards will expire one month after the completion date of the contract.

Non-revenue passage is governed by State Police and Turnpike safety regulations.

Violation of any regulation governing the use of a Non-Revenue Card as well as any safety regulation could result in revocation of all non-revenue privileges.

To obtain Non-Revenue Cards, PTC Form 33-97, Contractor's Non-Revenue Card Application, must be completed and forwarded to the Representative at least 14 calendar days prior to the starting date of the work with the appropriate monies attached. A $50.00 deposit is required for each card. The deposit will be refunded when the card is returned to the Commission's Card Control Center. The deposit will not be refundable if the cards are returned to the Commission six months after the contract completion date. Additional cards may be obtained throughout the duration of the contract on an as-needed basis.

All interchange access requests are subject to the approval of the Representative.

The Commission reserves the right to limit the number of cards and/or revoke cards at any time during the course of the project.

It is the Contractor's responsibility to keep an accurate accounting of all passes issued to him for use on the project. All requests for non-revenue passes must be made through the General Contractor.

Final payment is subject to the return of all non-revenue cards.

SECTION 103 — AWARD AND EXECUTION OF CONTRACT

103.01 CONSIDERATION OF BIDS — After the bids are opened, the total bid amount in the schedule and the name of the apparent low bidder will be publicly announced.

A Compact Disk will supercede all Online Bids regardless of the time or order the bids were submitted.

103.02 AWARD OF CONTRACT — After review, when a bid received has been determined by the Commission to be satisfactory, the contract will be awarded to the lowest responsive and responsible bidder within sixty (60) days from the opening date of the bids. Thirty-day extensions of the award date may be made by the mutual written consent of the Representative and the lowest responsive and responsible bidder. The Commission will base the award exclusively on the total bid and on compliance with all the bidding requirements. No prices will be negotiated due to any extensions.

Contract award on a joint venture bid will place upon the joint participants complete liability, jointly and individually, for contract performance.

Contracting corporations, which are chartered in a state other than Pennsylvania, as well as individuals or firms doing business under fictitious names, are required to register with the Secretary of the Commonwealth and obtain a certificate authorizing them to do business in Pennsylvania, before they can be awarded a contract.
103.03 CANCELLATION OF AWARD — The Commission reserves the right to cancel the award of any contract at any time when such cancellation is in the best interests of the Commission. In the event of such cancellation, the bid guaranty will be returned to the bidder immediately and payment will be made only for the documented costs of insurance and surety bonds required. No payment will be made for damages of any other kind including, but not limited to, lost profits.

103.04 SURETY BONDS —

(a) Contracts. When awarded the contract, furnish an electronic Performance Bond from one of the approved vendors, with sufficient surety or sureties, in an amount equal to 100% of the contract price. Have the bond specify that the contracted work will be completed in a manner satisfactory to the Commission. Have the bond state that the Commission is not liable for any expenses incurred through the failure to complete the work as specified, nor liable for any damages growing out of the carelessness of the Contractor, the Contractor's employees, or subcontractors. Also furnish an electronic Payment Bond from one of the approved vendors in the amount of 100% of the contract price. Have a corporate surety, legally authorized to transact business in the State and satisfactory to the Commission, execute both bonds. If the Commission decides the bond surety is unsatisfactory, promptly furnish any additional required security to protect the Commission’s interests and the interests of all persons, firms, or corporations who/which have furnished material, provided equipment on rental, or supplied/ performed labor or services on, or in connection with, the performance of the work for this contract.

For a joint venture bid, an authorized general partner or corporate officer of the lead joint venture will be responsible for proper execution of the bonds.

(b) Purchase Orders. Provide Payment and Performance Bonds for Purchase Order contracts only when the award exceeds the following limits:

- Payment Bond Greater than $5,000.00
- Performance Bond Greater than $25,000.00

Furnish a Performance Bond, with sufficient surety or sureties, in an amount equal to 100% of the contract price. Have the bond specify that the contracted work will be completed in a manner satisfactory to the Commission. Have the bond state that the Commission is not liable for any expenses incurred through the failure to complete the work as specified, nor liable for any damages growing out of the carelessness of the Contractor, the Contractor's employees, or subcontractors. Also furnish a Payment Bond in the amount of 100% of the contract price. Have a corporate surety, legally authorized to transact business in the State and satisfactory to the Commission, execute both bonds. If the Commission decides the bond surety is unsatisfactory, promptly furnish any additional required security to protect the Commission’s interests and the interests of all persons, firms, or corporations who/which have furnished material, provided equipment on rental, or supplied/ performed labor or services on, or in connection with, the performance of the work for this contract.

103.05 FAILURE TO EXECUTE CONTRACT - If the contract, together with the Surety Bonds and the Insurance Certificate(s) providing required insurance coverage is not properly executed and returned, the bid guaranty will be forfeited to the Commission as liquidated damages.

103.06 CANCELLATION OF CONTRACT - The contract may be cancelled by either party if the notice to proceed date is not within 30 days of award of the contract. Extension(s) of the 30-day period will be made only by mutual written consent of the parties to the contract provided such consent is given prior to the expiration of the 30-day period. Prices will not be renegotiated. The Commission also
reserves the right to cancel the contract any time prior to the Notice to Proceed date. If the contract is cancelled, payment will be made only for the documented costs of insurance and surety bonds required. No payment will be made for damages of any other kind including, but not limited to, lost profits.

103.07 ASSIGNMENT OF ANTI-TRUST CLAIMS - It is recognized that in actual economic practice, overcharges by suppliers resulting from violations of State or Federal anti-trust laws are in fact borne by the Commission. As part of the consideration for the award of the contract, and intending to be legally bound, the Contractor assigns to the Commission all right, title and interest in and to any current claims or claims hereafter acquired under State or Federal anti-trust laws relating to the subject matter of the contract.

103.08 RELATED AND CONTIGUOUS WORK — During the time the contract is in effect, Commission Maintenance Forces and other Contractors may be engaged in work related or contiguous to the work under contract. All forces will be required to cooperate to ensure satisfactory and timely completion of all of the work. In case of any dispute arising from related or contiguous work, the rights of the various parties involved will be established by the Representative in order to ensure completion of the various phases or portions of the work in general harmony.

The fact that other Contractors and persons may be doing work in or about the site of the work of this contract in no way or to any extent relieves the Contractor from liability for loss or damage to the work nor will the Commission assume any liability for loss attributable to delay caused by other Contractors.

SECTION 104 — SCOPE OF WORK

104.01 INTENT OF PLANS AND SPECIFICATIONS — The intent of the plans and specifications is to prescribe a complete project undertaken in accordance with the contract. Therefore, in accordance with the contract, furnish material, equipment, tools, labor, and incidental work complete in place, unless otherwise provided, and be responsible for the complete supervision, performance, and completion of the work.

The quantities indicated on the drawings and in the proposal are estimated quantities and may vary depending upon actual conditions encountered. The Commission assumes no liability for material ordered and supplied in advance of any operation and not used on the project. Payment will be made only for those amounts of materials actually incorporated into the project. Remove any surplus materials from the site at no additional expense to the Commission.

104.02 ALTERATION OF DRAWINGS OR WORK — The Commission reserves the right to order, at any time during the progress of the work, increases or decreases in quantities and alterations in the construction drawings or specifications as may be necessary or desirable. Any such order will be in writing by the Representative. Also, should any item contained in the proposal and contract be found unnecessary for the proper completion of the work, a written order will be given to eliminate such item from the contract. Such increases, decreases, eliminations, and/or alterations will not invalidate the contract, nor release the surety.

If the aforementioned changes in quantities or alterations of the construction documents will significantly increase or decrease the cost of performing the work directly affected, perform such work only when authorized in writing, as specified in Section 109.03(a). Payment for such work will be made under Section 109.03.

With the exception of advance warning signs, detour signs, work zone traffic control devices, and other items that may be specified in the contract, perform no work beyond the limits of the project, except as authorized in writing by the Representative.

If an item of work is eliminated, reimbursement of actual expenses will be made as specified in
Section 109.03(d). If the aforementioned changes in the quantities or alterations of the drawings are of such magnitude as to require a change in the time to complete the project, a time adjustment will be made in accordance with Section 108.05.

104.03 EXTRA WORK — Anticipate that extra work might be necessary in order to complete the project as contemplated. Perform extra work in accordance with the specifications and only when authorized in writing, as specified in Section 109.03. Compensation will be made as specified in Section 109.03.

104.04 CLEANING OF PROJECT SITE — Where applicable, remove silt and other deposits from newly constructed culverts, inlet, outlet and parallel ditches, bridges, and other drainage structures, including stream channels. Clean and remove surplus and discarded material, equipment, and temporary structures from the project and adjacent properties, including waste and borrow areas. Remove debris and objectionable material from areas used or disturbed by the construction operations on, or within sight of, the highway. Remove paint marks or spills, stains, rust marks, oil, or any other unsuitable marks, as directed. Restore waste and borrow areas.

Maintain the vegetation within the constructed slope limits, including waste and borrow areas, and leave the project in a presentable condition.

The project will not be considered complete until the above work has been completed.

104.05 DISPOSAL OF EXCESS EQUIPMENT AND WASTE MATERIAL — All excess, surplus and waste materials encountered or caused by the course of the work of this project not deemed salvageable by the Representative are to be removed from the Turnpike Right-of-Way immediately after being dismantled and their disposition is the responsibility of the Contractor, unless otherwise specifically directed by the Representative to deliver such items to the Maintenance Building designated by the Representative.

Provide copies of all arrangements, leases or other negotiations for the disposal of the unsuitable materials to the Representative. Be responsible for obtaining any permits necessary for proper disposal.

All labor, material, equipment, licenses, fees, permits and other work relative to the disposal of excess waste and unsalvageable material is the responsibility of the Contractor, and no separate nor additional payment will be allowed therefor.

104.06 UNEXPECTED HAZARDOUS WASTE - The encountering of hazardous waste will be considered a differing site condition, as specified in Section 109.02(b), unless the presence of such waste is indicated in the proposal or contract. Hazardous waste is defined as material meeting the definition of a hazardous waste or Toxic Substance Control Act, Regulated PCB Waste, as specified in 40 CFR 260 or 25 PA Code, Chapters 260 to 270, Hazardous Waste Regulations.

If unexpected hazardous waste is encountered at the site, the Representative will investigate the conditions, determine the extent of the affected area, and authorize the Contractor, in writing, to remove and dispose of the waste. Payment for such work will be made as specified in Section 109.03.

The Contractor will not be required to perform or arrange for any work relating to the removal and disposal of unexpected hazardous waste. If the Contractor elects not to perform authorized waste removal and disposal work, notify the Representative of that decision, in writing, within 2 working days of receipt of the Representative’s written authorization. Cooperate fully with the Commission and any authorized remediation Contractor, as specified in Section 105.07.

104.07 ADVERTISEMENT FORBIDDEN - Advertisements are not to be exhibited on the project. A sign bearing the name and address of the Contractor, not exceeding 3 feet x 6 feet, may be exhibited by the Contractor to identify his office building.
SECTION 105 — CONTROL OF WORK

105.01 AUTHORITY OF THE REPRESENTATIVE —

(a) General. The representatives and agents of the Pennsylvania Turnpike Commission, representatives of the Pennsylvania Department of Transportation and the Consulting Engineer, will be permitted at all times to inspect all work, materials, payrolls, records of personnel, invoices of materials and other relevant data and records.

To prevent disputes and litigation, the Representative will:

- determine the quantity of the kinds of work and the quality of material for which payment will be made under the contract;
- determine the answer to questions in relation to the project and its construction; and
- decide differences concerning the performance of the work covered by the contract.

All such determinations, decisions, directions and explanations necessary to complete, explain or make definite any provisions of the specifications and plans will be given promptly to the Contractor.

As a condition precedent to filing a claim directly against the Commission, submit notice of intent to claim to the Contracting Officer, in writing, within 10 days of the act or omission. This notice of intent will give the Commission the opportunity to investigate the claim and to maintain and document information for future resolution or litigation of the claim.

File the claim in writing with the Contracting Officer within 6 months of the date it accrues and not thereafter. If the Contractor fails to file the claim or does not timely file the claim, the Contractor is deemed to have waived its right to assert the claim in any forum. Claims not filed within the specified time period will be disregarded by the Contracting Officer. The claim, when filed, must state all grounds upon which the claim is based and must include a copy of the previously submitted notice of intent to claim.

The Contracting Officer will attempt to settle and resolve the claim with the Contractor. The Contracting Officer, at his or her discretion, may conduct a claim review meeting to attempt to settle and resolve the claim with the Contractor. If a claim review meeting is held, it will be attended by representatives of the Contractor and such Commission representatives as the Contracting Officer considers appropriate.

If the claim is not resolved by agreement between the Contracting Officer and the Contractor, the Contracting Officer will issue a determination in writing, regarding the claim and will mail it to the Contractor by first class mail. The determination will be mailed within 120 days of the date on which the Contracting Officer received the claim, unless the 120 day period is extended by consent of the Contracting Officer and the Contractor. If the Contracting Officer fails to issue a final determination within the 120 days, unless extended by consent of the Contracting Officer and the Contractor, the claim will be deemed denied. The determination of the Contracting Officer will be the final order of the Commission regarding the claim. The determination of the Contracting Officer will be conclusive and binding upon the Contractor unless the Contractor appeals the determination by filing a statement of claim with the Board of Claims within 15 days of the mailing date of the determination, or, if no extension is agreed to by the Contracting Officer and the Contractor, within 135 days of the receipt by the Contracting Officer of the claim, whichever occurs first.

(b) Authority to Suspend Work. The Representative may suspend the work, wholly or in part, for the following reasons:
failure to carry out orders;

· failure to comply with any provisions of the contract; or

· unforeseen conditions not anticipated in estimating the contract time necessary for the completion of the work.

Written notification will be given of the suspension and the reason(s) for the suspension.

(c) Review and Acceptance. Review and acceptance by the Commission as specified, stated, or indicated in the contract will be made on the basis of limited, general inspections.

It is understood that, because of such limited reviews, ultimate responsibility for the satisfactory completion of the project, including but not limited to:

· the quality of all materials;

· the quality of all workmanship;

· compliance with all terms of the contract;

· sufficiency, correctness, and accuracy of all working or shop drawings; and

· sufficiency of all QC Plans,

rests solely with the Contractor. Notwithstanding review and/or acceptance, save and hold harmless the Commission from the consequences of all defective work as well as all defects, errors and omissions in the working or shop drawings, QC Plans, and plans of every other kind prepared by the Contractor.

105.02 DRAWINGS — The following drawings, when applicable, are required to perform the work:

(a) Contract Drawings. These drawings will be furnished. Keep one set of the drawings available on the project.

(b) Standard Drawings. Section 101.03

(c) Working and Shop Drawings. The sections and dimensions shown on the contract drawings are typical sections and dimensions which are applicable to the greater part of the work. Make all working or shop drawings which may be required in addition to the contract drawings. Submit five (5) copies of all working or shop drawings made by the Contractor to the Representative for his acceptance which acceptance, if given, will be indicated by his countersigning two (2) sets of such working or shop drawings and returning the same to the Contractor. Should the working or shop drawings not be accepted by the Representative, the Representative will return one (1) set of such working or shop drawings with the necessary corrections, revisions and additions indicated thereon; and the Contractor will make such revisions and additions and again submit five (5) copies of drawings for the acceptance of the Representative. No work called for by said working or shop drawings is to be done until the acceptance of the Representative is obtained which will be given or refused within thirty (30) days after delivery to him at his office of such drawings. The acceptance of shop drawings by the Representative does not relieve the Contractor of the responsibility for the accuracy of such working or shop drawings.
Immediately upon final acceptance of such working or shop drawings by the Representative, furnish the Representative with such additional shop drawings showing any as-noted conditions and submit to the Representative upon completion of affected operation but before the completion of the project work. These reproducible drawings may be prepared in ink on 3 mil. minimum thickness Mylar sheets or in such equivalent manner and with such material as will be acceptable to the Representative and satisfactory for permanence and reproduction.

Thoroughly check each shop drawing or other required submissions before submission to the Representative. Place the following certification on every sheet of every submission:

"WE HEREBY STATE THAT WE HAVE REVIEWED, INSPECTED AND CHECKED THE INFORMATION SUBMITTED AND CERTIFY FOR ITS ACCURACY AND COMPLIANCE WITH THE PLANS, SPECIFICATIONS AND SURROUNDING CONDITIONS."

____________________________________________
Contractor

(per) ____________________________________________
Signature

____________________________________________
Date

Properly label samples, drawings and catalog cuts submitted for review to indicate the specific service for which materials or equipment are to be used and the referenced section, page and paragraph number of the specifications and/or applicable drawing number.

If any aspect of a submittal deviates from the requirements of the contract drawings or specifications, note such deviation in writing at the time of submission.

All drawings and calculations for formwork, shoring or load-bearing falsework submittals are to be signed and sealed by a Professional Engineer registered in the State.

(d) As-Built Drawings. Make changes in a neat and orderly manner and in "Red Marking". Changes must be true to scales applicable to the Drawings. Upon completion of the project, the As-Built Drawings become the property of the Commission.

Payment for preparation of the As-Built Drawings is incidental to the project.

105.03 CONFORMITY WITH DRAWINGS AND SPECIFICATIONS —

(a) General. Perform work within reasonably close conformity to the lines, grades, dimensions, and indicated details, and/or as specified.

(b) Determination by the Representative. For each individual case, the Representative will determine the limits of reasonably close conformity; the judgment given will be final and conclusive.

If it is determined that material or the finished product in which the material was used is not within reasonably close conformity, but that reasonably acceptable work has been produced, the Representative will then determine if the work will be accepted and remain in place. In this event, written documentation will be provided for acceptance by required contract modification, and/or to provide for an appropriate
adjustment in the contract price for such work or material.
If it is determined that material or the finished product is not within reasonably close conformity and has resulted in an inferior or unsatisfactory product, remove or replace it.

(c) Certification of Falsework Adequacy. Have a Professional Engineer, registered in the State, certify that the falsework system has been assembled as shown on the Professional Engineer's signed and sealed falsework drawings prepared in accordance with Section 105.02(c). Submit the certification to the Representative before placing loads on the falsework.

105.04 COORDINATION OF DRAWINGS AND SPECIFICATIONS — Perform the work in accordance with the intent of the drawings and specifications. Do not take advantage of any error on/or omission in the drawings or discrepancy between the plans and specifications. In the event such an error, omission, or discrepancy is discovered, immediately notify the Commission. Failure to notify the Commission will constitute a waiver of all claims for misunderstandings, ambiguities, or any other reasons resulting from the errors, omissions, or discrepancies. When required, corrections and interpretations necessary for the fulfillment of the drawings and specifications will be made. Do not use scaled measurements where dimensions on the drawings are given or can be computed.

If any special provisions, supplemental specifications or information on the plans conflict with these general conditions, the special provisions, supplemental specifications or information on the plans will govern. If any conflict exists between any portion of the plans designed specifically for this project and any portion of Standard Drawings, the former will govern.

When required, the Representative will determine and order, in writing, any modifications or changes in the plans, Standard Drawings, or specifications to update, adjust, accept, or complete the work contemplated by the contract as specified in Section 104.02. Wherever reference specifications or publications are specified, comply with the issue or edition (including interim AASHTO specifications and ASTM tentative designations) in effect on the date bids are opened, unless the date or year is indicated or specified. If there is a conflict between a cited title and a cited number, the title will take precedence over the section number.

Anything mentioned in the Specifications or Special Provisions and not shown on the drawings or shown on the drawings and not mentioned in the Specifications or Special Provisions will be like effect as if shown or mentioned in both. In case of difference between drawings and Supplemental Specifications or Special Provisions, the Supplemental Specifications or Special Provisions will govern.

105.05 RESPONSIBILITY OF CONTRACTOR —

(a) General. Keep direct control of the contract and see that the work is properly supervised and is performed satisfactorily and efficiently. Supervise the work personally or appoint a competent superintendent or representative to be on the project at all times. Give this superintendent or representative the authority to receive orders and directions; to execute orders and directions without delay; and to make arrangements for all necessary material, equipment, and labor.

Keep on the project, at all times, a copy of the plans, a copy of the specifications, and a copy of the contract.

The Commission is not responsible for the Contractor's satisfactory completion of the contract work as a consequence of the presence of Commission representatives or inspectors and their inspection.

(b) Gratuities and Penalties. Do not give or offer, or allow agents, employees, or representatives to give or offer, either directly or indirectly, money, property, entertainment, or other valuable things, to any employee or representative of the Commission for any reason, purpose, or cause, or as an inducement, bribe, or reward for doing or omitting to do any act, or for showing any favor or disfavor in relation to
any matter relating to the contract. Any such action will constitute a violation of the contract. Upon satisfactory proof to the Chief Engineer of such violation, the Commission may terminate performance of the work and take steps to complete the project, as specified in Section 108.07.

105.06 PUBLIC OR PRIVATE FACILITIES AND STRUCTURES ON THE PROJECT —

(a) Utility Infrastructure and Utility Adjustments Interfering with Contract Operations. Before submitting a bid for the project, examine the project site and any waste or borrow sites designated in the proposal to determine the location of all Utility Infrastructure and the need for any Utility Adjustments. The Commission has indicated in the contract documents such Utility Infrastructure and Utility Adjustments as have been brought to its attention. The Commission is not responsible for waste and borrow areas not designated in the contract documents. Accept the responsibility and risk relating to the conditions to be encountered regarding Utility Infrastructure and Utility Adjustments that are indicated in the contract documents or that can be ascertained from a careful pre-bid examination of the project site for any waste or borrow sites designated in the proposal.

Upon execution of the contract, inform all public service companies, individuals, and others owning or controlling any facilities or structures within the limits of the project, which may have to be relocated, adjusted, or reconstructed, of the plan of construction operations. Give due notice to the responsible party in sufficient time for that party to organize and perform such work in conjunction with or in advance of construction operations.

Cooperate with the Utility Infrastructure owners and the owners of all waste and borrow areas not on the project site. Make arrangements for Utility Adjustments necessary to perform work as indicated in the contract documents. Arrange and perform contract work in and around such Utility Infrastructure in accordance with recognized and accepted engineering and construction practices and in a manner that assists the Utility Infrastructure owners in their required Utility Adjustments.

Refer to the provisions of Act 287-1974, which specifies project responsibilities in regard to public health and safety during excavation and demolition operations in areas of underground utilities.

(b) Delays in the Performance of Work. No additional compensation will be paid because of an impact to the contract work from Utility Infrastructure and Utility Adjustments unless the Contractor establishes, to the satisfaction of the Representative and the Chief Engineer, that the impact was unforeseen and unforeseeable by a reasonable contractor; that losses could not have been avoided by the judicious handling of forces, equipment and plants, or by reasonable revisions to the schedule of operations; and that the impact has resulted in a documented increase in the cost of performing the contract work, in which case only delay damages will be paid as specified in Section 110.

The following are conditions precedent to the right, if any, of the Contractor to an adjustment in compensation:

Schedule and conduct a coordination meeting(s) before beginning construction. The Commission must be notified at least 14 calendar days before the meeting to ensure representation. Failure to notify the Commission will waive any right to an adjustment in compensation. The meeting(s) will include all Utility Infrastructure owners. At this meeting(s), be prepared to discuss: the project schedule; all project milestones and required completion dates and all activities related to Utility Infrastructure and Utility Adjustments and; how the project schedule differs from the utility relocation schedule prepared by the Commission during project design. Incorporate appropriate information from this meeting(s) into the project schedule as specified in Section 108.02(b) or the Scheduling Special Provision, if applicable. Provide a written record of the meeting(s).

Comply with the requirements specified in Section 110.
(c) **Damage to Utility Infrastructure.** Compensate the owner for all cost of repairing, replacing, or resetting any facility or structure damaged or disturbed by contract construction as specified in Section 107.07.

**105.07 COOPERATION BETWEEN CONTRACTORS** — The Commission reserves the right to contract for and perform other work on or near the work covered by the contract.

If separate contracts are awarded within the limits of, or adjacent to, any one project, conduct the work to avoid interfering with or hindering the progress or completion of the work being performed by other contractors. As directed, cooperate with contractors working on the same project. Satisfactorily join work with and in proper sequence with the work of others.

Assume all liability in connection with the contract. Protect and save harmless the Commission from all damages or claims that may arise because of inconvenience, delay, or loss experienced because of the presence and operations of other contractors working within or outside the same project limits.

Contractors working on either the same or adjacent projects are to cooperate with each other as part of their own scope of work and as directed. Without in any way limiting the foregoing requirement, cooperate and coordinate to the extent necessary to satisfactorily conclude all work essential for the operation of the Turnpike. The comfort and safety of the Turnpike customer is of paramount importance for the good of the Turnpike. The Commission reserves the right to alter or otherwise adjust the quantity of work items to be performed in this area. Include all considerations, financial and otherwise, resulting from this requirement herein to interface, coordinate, and cooperate with other contractors working the same or other areas, as well as with the Commission and its authorized representative.

Arrange the work and place and dispose of the materials being used so as not to interfere with the operations of the other contractors within the limits of, or adjacent to the project.

If any part of the work depends on proper execution or results upon the work of any other contractor, within 2 working days of the start of the work, inspect the work of the other contractors and report in writing to the Commission any apparent discrepancies, interferences, defects, or delays in such work that render it unsuitable for such proper execution and results. Failure to so inspect and report will constitute an acceptance of the other contractor's work as fit and proper to receive this work, except as to defects which may develop in the other contractor's work after the execution of the work hereunder.

Whenever conflict between necessary working operations exists, the Representative will be the sole and final authority for determining priorities relative to schedule and work to be performed. The decision of the Representative will be final and binding on all concerned and work will be performed as directed at no additional costs to the Commission for the alteration and adjustment of schedule and work item quantities.

If any contractor does not complete the various portions of the work in general harmony, and another contractor is caused damage or injury by the failure to so act in harmony, the contractor damaged or injured is to settle with the contractor causing the damage or injury by agreement or arbitrate such claim or disputes. The Commission, however, is not liable to any contractor for any increased costs or damages resulting from the defective work, interference, final construction decisions, failure to coordinate and cooperate, or delays of other contractors.

**105.08 CONSTRUCTION SURVEYING** — Where applicable, the Commission will furnish data relative to permanent survey reference for horizontal and vertical controls in the project area.

All offset stakes required for proper control of alignment, grade, slope and elevation will be furnished and placed by the Contractor and to the extent necessary for construction as shown by the drawings and as specified.

Locate all building lines at corners and centers, test and check all elevations and levels, locate levels and plumb lines of walls, beams and columns and other parts of the construction as work progresses.

Employ a Professional Land Surveyor, registered in the State, to perform all survey work for construction. Assume full responsibility for all dimensions, elevations and the setting of lines and grades required for construction.
Assume full responsibility for all dimensions, elevations and the setting of necessary lines and grades relating to the construction required.

The Commission reserves the right to check the Contractor's engineering and surveying work at any time during the course of the project. Survey notes and notebooks pertinent to the construction of the project will become the property of the Commission upon the completion of the work.

Be responsible for the preservation of all survey points, line, grade and elevation existing or required for construction. Re-establishment of permanent references destroyed by the Contractor's operations is the responsibility of the Contractor. Re-establishment of such permanent references will be to the satisfaction of the Representative, and copies of all survey notes relative to such work will be furnished to the Commission before the completion of the project.

Unauthorized deviation from controls for required construction will not be the basis for claim for additional compensation.

Payment for this work is incidental.

105.09 AUTHORITY AND DUTIES OF INSPECTOR-IN-CHARGE — The Inspector-in-Charge will have immediate responsibility for administering the performance of work on the project.

In case a dispute arises concerning material to be furnished or the manner of performing the work, the Inspector-in-Charge will have authority to reject material or suspend the work until the question at issue can be referred to and be decided by the Representative. A rejection of material or suspension of work will be confirmed by written notice from the Representative.

105.10 INSPECTION OF WORK — The work will be subject to the inspection of the Representative or authorized representatives. Provide them access to the work and furnish them with every reasonable facility for determining whether the work being performed or which has been completed is in accordance with the requirements of the plans, specifications, and contract, except as otherwise provided. Provide all labor and equipment necessary for such examination.

Should the work thus exposed or examined prove satisfactory, the uncovering or removing and restoring of the uncovered or removed work will be paid for, as specified in Section 109.03, except the incidental work for testing the depth of base and surface courses and pavement will not be paid for separately. Should the work exposed or examined prove defective or unsatisfactory, promptly uncover or remove and satisfactorily restore the defective or unsatisfactory work, at no expense to the Commission.

When any unit of government or political subdivision, or any public or private corporation, is to pay a portion of the cost of the work covered by the contract, the respective representatives will have the right to inspect the work. Such inspection will not make any unit of government or political subdivision, or any public or private corporation, a party to this contract and will in no way interfere with the rights of either party to this contract.

105.11 DUTIES OF THE INSPECTOR — Authorized inspectors, who perform their duties under the direction of the Representative, will be assigned to the project.

Execute work under the observation and subject to examination of an inspector(s); carry out such work during the normal working hours of the day, unless specifically directed otherwise. If work is performed during nighttime hours with permission, provide sufficient artificial lighting to assure proper inspection and workmanship.

The inspector is not authorized to do the following: revoke, alter, enlarge, relax, or release any requirements of the specifications; approve or accept any portion of the work; or issue instructions contrary to the plans and specifications.

The presence of the inspector during the performance of any work on the project will not relieve the Contractor of the responsibility for work that is later determined by the Representative to be defective.
105.12 **DEFECTIVE WORK AND MATERIAL** — If any work and/or material does not meet the requirements of the plans and specifications, or is not within reasonably close conformity as determined by the Representative, such work and/or material will be declared defective.

Unless otherwise specified, remove and replace or repair, as directed, work damaged by any causes during construction, at no expense to the Commission.

105.13 **MAINTENANCE OF PERFORMED WORK** — Maintain the performed work during construction and until the date of physical work completion, as specified in Section 109.05(a), at no additional cost to the Commission.

Provide continuous and effective work with adequate equipment and forces to keep roadway, structures, facilities and equipment in satisfactory condition at all times.

If at any time, performed work is not maintained, the Commission reserves the right to enter upon the project and perform such work considered necessary for employee safety, facility operations and traffic accommodation and to deduct the cost thereof from any money due or to become due.

The Contractor is specifically required to maintain completed portions of work until acceptance by the Commission. Conduct operations in such a manner as will prevent damage to completed work.

Repair of completed work damaged as a result of Turnpike or traffic accidents will be the responsibility of the Commission. Repairs of completed work damaged from any other cause or by the Contractor's equipment or operation will be the responsibility of the Contractor.

105.14 **BORROW AREAS AND WASTE AREAS** — The Contractor is responsible for proper disposal of all excess excavation and waste material.

Remove and properly dispose of off the Turnpike right-of-way all unsuitable material, including, but not limited to, tree stumps and earth excavation, and any excess excavation.

Locate proposed areas off the Turnpike right-of-way for obtaining borrow material and/or areas for disposal of waste material. Locate waste, borrow, or staging areas inside or outside of the right-of-way in upland areas not impacting Waters of the United States, including jurisdictional wetlands, unless already authorized by the U.S. Army Corps of Engineers and DEP. Situate areas so cross sections may be taken to measure the volume of material removed or deposited. Before cross sectioning borrow areas, remove topsoil and stockpile it for replacement when removal of borrow material has been completed.

Secure all necessary approvals and permits from applicable government agencies. Waste and borrow areas that impact Waters of the United States are prohibited unless already permitted, as agreed to with the U.S. Army Corps of Engineers. Submit to the Commission and County Conservation District(s) a plan and narrative depicting the erosion and sedimentation controls which will be utilized at the waste and/or borrow site(s). The plan and narrative must be prepared in accordance with the current provisions of PaDEP Chapter 102, Erosion and Sediment Control and the Program Manual, as amended. Do not utilize any proposed waste and/or borrow site(s) until all applicable approvals and permits are obtained. Copies of all applicable approvals and permits must be provided to the Commission.

Negotiate with the owner(s) of property to be utilized and submit one copy of the executed agreement to the Representative prior to starting work. Have the agreement provide for cleaning and leaving the premises and area in a well-drained and, if required, smoothly graded condition, blending into the existing topography. Scarify, lime, fertilize, seed, and mulch any disturbed areas with material, and formulae, at rates typical for the project.

Perform the clean fill determination for all borrow materials entering the construction right-of-way by completing and submitting the Environmental Due Diligence Form EDD-VI, and, if necessary, Form EDD-VII to the Commission for acceptance.

All labor, material, equipment, work, and permits required for disposal of waste material is incidental to the project. The Contractor is also responsible for any environmental remediation, mitigation and defense of environmental claims or actions including fines resulting from the use of any waste and/or borrow area(s).
105.15 ARCHEOLOGICAL AND HISTORICAL FINDINGS - In areas where remains of prehistoric people's dwelling sites or where artifacts of historical or archeological significance are encountered, discontinue construction operations in the general area. Contact will be made with the State Historical and Museum Commission to determine how to proceed. When directed, satisfactorily excavate the site to preserve the artifacts encountered, then remove them for delivery to the custody of the Pennsylvania Historical and Museum Commission. In the event construction operations are halted or delayed because of archeological or historic findings, appropriate adjustments will be made in the contract time as specified in Section 108.05. Such site excavation will be considered extra work as specified in Section 104.03.

105.16 COAL OR VALUABLE MINERAL FINDINGS - If coal or other valuable minerals are uncovered, during prosecution of the work, that are not addressed by contract special provisions, store and handle the coal and other valuable minerals according to the directions of the Representative. Do not claim or assume ownership rights.

If direction is given to handle and dispose of the material in a manner other than as unsuitable material, the contract time and contract price may be adjusted as described in Section 109.02.

SECTION 106 — CONTROL OF MATERIAL

106.01 GENERAL — Use material complying with the requirements of these specifications. At the preconstruction conference, submit a list of material to be sampled and tested by the Contractor.

Refer to the provisions of Act 226 - 1968, concerning the purchase of aluminum and steel products produced in a foreign country.

In accordance with the provisions of Act 3 - 1978, as amended by the Act 161 1982, and the Act 144-1984, use or furnish only steel products produced in the United States in the performance of the contract or any subcontract.

Following Notice to Proceed, furnish to the Commission a complete statement of the project construction material's origin, composition, and manufacture.

With each shipment of steel products delivered to the project site, provide the Inspector-in-Charge the following:

- For unidentified steel products, documentation such as invoices, bills of lading, and mill certification that the steel was melted and manufactured in the United States.

- For a steel product identifiable from its face, certification that Section 4 of the Act has been complied with.

- For fabricated steel delivered to the project site, furnish copies of mill orders and shipping statements, as directed. Show the weights of the individual members on the statement, if directed. Assure that the fabricator presents the Commission's shop inspector with a copy of the shipping invoice to be stamped for verification of inspection and approval of steel items before shipment. Forward the stamped copy with the shipment for the project file. Mill certifications will be reviewed, approved and returned to the fabricator by the shop inspector. Department Form CS-4171, Certificate of Compliance, is required for all shipments of fabricated structural steel.

The provisions of this act will not be waived unless the Chief Engineer has determined, under authority granted in Section 4(b) of the act, that a certain steel product or products is not produced in the United States in sufficient quantities to meet contract requirements. Such a determination will be set forth in the proposal, or in an addendum to the proposal.
Steel products are defined as products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, otherwise similarly processed, or processed by a combination of two or more of these operations from steel made in the United States by the open hearth, basic oxygen, electric furnace, Bessemer, or any other steel-producing process. Included are cast iron products and machinery and equipment as listed in United States Department of Commerce Standard Industrial Classification 25, 35, and 37 and made of, fabricated from, or containing steel components. If a product, as delivered to the project, contains both foreign and United States steel, such product is considered 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.

No payment will be made on the contract when unidentified steel products are supplied, until the hereinbefore requirements are met.

Any payments made that should not have been made may be recoverable from a manufacturer or supplier as well as from a contractor or subcontractor.

Any person who willfully violates the Act will be prohibited from submitting bids for any contract for a period of five (5) years from the date of determination that a violation has occurred. In the event the person who violates the provisions of Section 4(A) is a subcontractor, manufacturer or supplier, such person will be prohibited from performing any work or supplying any materials to the Commission for a period of five (5) years from the date of determination that a violation has occurred.

If steel products are used as a construction tool and will not serve a permanent functional use in the project, compliance with Act 3 - 1978, as amended by the Act 161- 1982, and the Act 144-1984, is not required.

When standard manufactured items are specified and these items are identified by gage, unit weight, section dimensions, or similar characteristics, their identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by specified tolerances, industry established manufacturing tolerances will be accepted.

The term "gage," when used in connection with the measurement of metal, plates, sheets, or wire, will be applied as follows:

- **Uncoated Plates or Sheets** — U. S. Standard Galvanized Plates or Sheets — AASHTO-M167 or M218. Aluminum Sheets — AASHTO-M197

- **Steel Wire** — AASHTO-M32

The Contractor's statement of the origin, composition and manufacture of materials to be used in construction of the project is to be submitted on the Contractor's Material Source Statement.

In addition to those instances when the use of domestic materials is required by law, preference will be given to the use of domestic materials. Non-domestic construction materials will not be used without the prior consent of the Representative.

**106.02 MATERIAL —**

(a) **Preliminary Acceptance.** Have the source of material supply accepted before delivery is started. When indicated or directed, submit representative preliminary samples of the material. Submit samples of the kind and quality specified, for examination or test. Obtain written acceptance of the quality of the samples before obtaining material from the source of supply. Unless otherwise indicated or directed, representative samples of material requiring laboratory tests will be taken. Use such material only after written acceptance has been received from the Representative, and only so long as the material complies with the requirements. If material from a previously accepted source of supply does not produce specified products, furnish material from other acceptable sources.
(b) Inspection. Inspect material and store only that material meeting specification requirements for project use. Do not unload questionable material, until accepted by the Commission. Do not incorporate with other material previously accepted. When the grading and the quality of the material delivered to the project does not conform to the grading or quality as inspected and tested, the Commission reserves the right to reject the material at the work site. As required, furnish necessary assistance to the inspector in obtaining samples.

Allow designated Commission representatives to inspect material being used, or intended to be used, at any time before, during, or after material preparation, while being used during the progress of the work, or after the work has been completed. Furnish or arrange with producers or manufacturers to provide necessary material, labor, tools, and equipment for such inspection.

Inspections and tests, if made at any point other than the point of incorporation in the work, will not guarantee acceptance of the material. Inspection and testing performed by the Commission will not relieve the Contractor's responsibility for quality control.

(c) Standard of Quality. Wherever in these specifications an article or material is defined by describing a proprietary product or by using a trade name of the manufacturer or vendor, the term "or approved equal", if not inserted, is implied and assumed in all cases as signifying that the specifications will be interpreted liberally. Accordingly, it is to be understood that any reference to a particular manufacturer's product either by name or by limiting description has been made solely for the purpose of more clearly indicating the minimum standard of quality desired, and any other make substantially similar and performing as effectively the duties imposed by the general design will be approved as equal and satisfactory.

106.03 TESTS AND ACCEPTANCE OF MATERIAL —

(a) Responsibility. Material will be accepted on the basis of inspection, testing or certification, as directed.

Make or have made tests of samples of material, unless otherwise designated, in accordance with methods described in the specifications or, if the required method is not described, make the tests in accordance with Standards and/or Tentatives of ASTM, or other testing procedures adopted by the Commission.

Provide the necessary personnel to assist in collecting and transporting samples to the site of the test for the verification of the accuracy of scales, measures and testing equipment.

(b) QC. Maintain a QC system that provides reasonable assurance that material, products and completed construction submitted for acceptance conform to contract requirements whether self-manufactured, processed or procured from subcontractors or vendors. When specified, submit for review a plan of the QC system to be used. Perform or have performed the inspections and tests required to substantiate product conformance to contract requirements. Perform or have performed all inspections and tests and make them available for review throughout the contract life. Procedures will be subject to review of the Commission before the work is started. Charts and records documenting the quality control inspections and tests will become the property of the Commission upon completion of the work.

(c) Certification. When specified, submit dated certification, Form CS-4171 supplied by the Commission, from the manufacturer, fabricator or producer that items furnished meet specifications.

Unless otherwise directed, retain the original, signed certification at the manufacturer's, fabricator's, or producer's location. Send a copy of the original certification to the project with each shipment. Do not incorporate any material in the work, unless approved by the Representative, until a properly completed certification arrives on the project.
Notify the manufacturer, fabricator, or producer of these requirements. Accept responsibility for all certifications for all materials arriving at the project site. Materials delivered to the project site that are of questionable quality may be sampled, tested, and approved by the Commission before incorporation in any work. Random quality assurance samples may be selected by the Representative from the material delivered to the project site or at the place of supply before delivery.

106.04 STORAGE OF MATERIAL — Store material to assure preservation of specified quality and fitness for the work.

Stored material, even though accepted before storage, may again be inspected before use in the work. Locate stored material to facilitate prompt inspection and control.

Do not use private property for storage purposes without written permission of the owner or lessee. Make copies of this permission available to the Commission. Restore storage sites to conditions acceptable to property owners and the Commission.

Allocation of areas on the right-of-way for equipment and material storage will be made by the Representative. Any additional area required is to be obtained off Turnpike property by the Contractor at his own expense. Prepare the area designated for equipment and material storage, and upon completion of the contract, restore the site to its original condition.

106.05 UNACCEPTABLE MATERIAL — Material not conforming to the requirements of the specifications, whether in place or not, will be rejected. Remove such material promptly from the site of the work, unless otherwise directed. Do not return rejected material to the work site until defects have been corrected and the material has been accepted for use.

106.06 COMMISSION FURNISHED MATERIAL — The Commission will furnish material, when specified in the proposal, in the quantities required. Material will be delivered or made available at the point specified.

The cost of handling and placing material after delivery will be included in the contract price for the item.

After delivery and acceptance by the Contractor, the cost of replacing material due to shortages, deficiencies, or damage, including demurrage charges, will be deducted from money due or to become due.

106.07 PENNSYLVANIA TRADE PRACTICES ACT —

(a) General. Pursuant to the Pa. Trade Practices Act, Act 226-1968, the Commission will not specify, purchase, or permit to be furnished or used in any contract aluminum or steel products as set forth below made in the countries set forth below.

The Commission may utilize the discretionary waiver provision of Act 3-1978 as to steel products. As to aluminum products, if the sole source is from a banned country relief may be permitted under the Statutory Construction Act, 1 Pa. C.S. 1901 et seq.

1. Brazil: Welded carbon steel pipes and tubes; carbon steel wire rod; tool steel; certain stainless steel products including hot-rolled stainless steel bar; stainless steel wire rod and cold-formed stainless steel bar; pre-stressed concrete steel wire strand; hot-rolled carbon steel plate in coil; hot-rolled carbon steel sheet and cold-rolled carbon steel sheet.

2. Spain: Certain stainless steel products, including stainless steel wire rod, hot-rolled stainless steel bars and cold-formed stainless steel bars; pre-stressed concrete steel wire strand; certain steel products including hot-rolled steel plate, cold-rolled carbon steel plate, carbon steel structural shapes, galvanized carbon steel sheet, hot-rolled carbon steel bars and cold-formed carbon steel bars.


SECTION 107 — LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.01 LAWS TO BE OBSERVED — At all times, observe and comply with the following, and post as required: all Federal, State, and local laws, ordinances, and regulations which affect the conduct of the work or which apply to employees on the project; all orders or decrees which have been or may be enacted by any legal bodies or tribunals having authority or jurisdiction over the work, material, employees, or contract. Protect and indemnify the Commission and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, including violations by contractor employees.

107.02 PERMITS, LICENSES, AND TAX RESPONSIBILITY —

(a) Permits and Licenses. Purchase and submit copies of permits and licenses. At the job site, post notices necessary for the proper and lawful performance of the work, in accordance with such permits and licenses. Do not start work until signing and submitting all documentation required to become a transferee/co-permittee for all applicable permits required for the project.

(b) Tax Responsibility. Ascertain the possible existence, scope and coverage of any local subdivision tax, sometimes called an occupation tax, wage tax, income tax, franchise tax, or excise tax on the construction operations within the limit of the political subdivision imposing such tax. Also indemnify and save harmless the Commission and its agents from liability for the collection and payment of any taxes assessed and levied by the constituted authority, including upon Contractor agents, employees, and/or representatives in connection with the performance of work on the project.

(c) Vehicle Registration. Attention is directed to 75 P.S. 1302(a) and 1303(a), (b), which requires vehicles to be registered in Pennsylvania when used on a project which is being built under traffic or where the vehicles are operated on a public highway opened to traffic.

(d) Sales Tax. Contact the Pennsylvania Department of Revenue or the Internal Revenue Service to determine the applicability of taxes. Relevant exemption numbers and certificates are available on request.

107.03 PATENTED DEVICES, MATERIAL, AND PROCESSES — If any design, device, material, or process covered by letters of patent or copyright is used, provide for use by suitable legal agreement with the patentee or owner. Indemnify and save harmless the Commission from any claims for infringement, by reason of the use of any patented design, device, material, process, or any trademark or copyright, and indemnify the Commission for any costs, expenses, and damages which it may be obliged to pay by reason of any infringement, at any time during the performance or after the completion of the work. These provisions also apply to the surety.

107.04 RESTORATION OF SURFACE OPENED BY PERMIT — Do not allow any opening to be made within the right of way unless a valid permit is presented authorizing the opening. For such an opening, made before the date upon which the work provided for in the contract is finally accepted, repair at the time and in the manner directed in writing by the Representative.
**107.05 SANITARY PROVISIONS** — Provide and maintain, in a neat and clean condition, sanitary facilities for the exclusive use of personnel on the project. Dispose of all wastes, both sewage and wastewater, in a manner approved by the DEP. As required, obtain permits from local municipalities to install temporary toilet facilities.

**107.06 OCCUPATIONAL SAFETY AND HEALTH** — Comply at all times with applicable Federal, State, and local laws and regulations, provisions, and policies governing safety and health, including the Federal Construction Safety Act (Public Law 91-54), 29 CFR Chapter XVII, Part 1926 Occupational Safety and Health Regulations for Construction, and the Occupation Safety and Health Act (Public Law 91-596), 29 CFR Chapter XVII, Part 1910 Occupational Safety and Health Standards for General Industry, and subsequent publications updating these regulations. In addition, all crane operators must be certified to operate the specific crane in use on the project. They must be in possession of a current CCO license (Certified Crane Operator) valid for the type of crane intended to be used.

Take any other needed action or proceed as directed, to protect the life, health, and general occupational welfare of personnel employed on the project. Provide confined space training on the proper use of the testing equipment and all safety procedures to ensure a safe operation to Contractor personnel and Commission Representatives required to access the area for inspection purposes and provide all safety and testing equipment required by 29 CFR 1910.146, to both Commission Representatives and Contractor personnel to ensure the safety of all workers and inspectors during construction operations and inspection operations of any confined spaces. Also, provide proof of training, such as a course sign-in sheet or certificate of training. Provide appropriate rescue services, personnel, and equipment as per 29 CFR 1910.146(k).

If, in the Representative's opinion, employees are exposed to extraordinary conditions which could or do constitute a hazard, modify such equipment, devices, and job procedures to insure protection against the hazard or to reduce the risk to the employees engaged in project work.

All areas of a project will be hard hat areas. Require all persons within the project limits to wear protective headgear, including persons in cement concrete and bituminous concrete plants operated exclusively for a project, even though the plant(s) may be remotely located.

At the preconstruction conference, submit a written Project Safety Program. Include at a minimum, the following procedures and information:

- A procedure to document lost time.
- Detailed confined space mitigation procedures and safety procedures as required by 29 CFR 1910.146 including procedures for conducting air monitor calibrations as required by the equipment manufacturer’s instructions and a written Confined Space Entry Permit system.
- Provide air monitoring equipment calibration documentation, for spaces that have actual or potential atmospheric hazards.
- Written verification of rescue services availability and qualifications for permit-required confined spaces.
- Written verification of annual training for internal/contractor employed rescue team if these services are provided by the contractor for permit-required confined spaces. Provide a list of employees that attended the training and the dates they attended.
- Provide a procedure for assuring compliance by subcontractors and suppliers working within the project’s limit of work.

All costs associated with the preparation and implementation and updates of Project Safety Program and complying with the requirements are incidental.
Give special emphasis to providing safeguards for any specially or unusually hazardous operations and health hazards. Include initial indoctrination and continuing instructions for all employees to enable them to perform work in a safe manner. Include in the instruction project safety practices, manner of reporting accidents, availability of medical facilities, and explanation of individual responsibility for accident-free operations.

For multi-season projects with a contract amount $\geq$ $5,000,000.00$, provide and maintain one scoreboard safety sign 1200 mm (4 feet) wide by 900 mm (3 feet) high to identify the number of days worked on the project without a lost time accident. Imprint on the sign, the name of the contractor and an appropriate safety message. Prominently display on the sign the following:

a. Contractor's name and address.

b. Display in 100 mm (4-inch) letters (***) days worked since last lost-time injury.

NOTE: "(***)" – Space for three (3) removable numbers; numbers to include subcontractors.

Place the sign in a prominent location at the project site. Update the sign at least bi-weekly.

Immediately take corrective action, upon notification by the Representative of any noncompliance with the provisions of this section. Upon receipt of this notice, failure or refusal to promptly comply will cause a written order to be issued, stopping all or part of the work until the corrective action has been taken. Claim for an extension of time, costs, or damages because of the time lost due to any such stop orders will not be considered.

Require all persons to wear ANSI/ISEA 107-2004 Class 2 or Class 3 certified high-visibility safety vests or jackets with reflective stripes when working within the Commission’s right-of-way or while in work zones adjacent to traffic.

107.07 CARE OF PUBLIC AND PRIVATE PROPERTY — Do not damage overhead and underground facilities and structures or property within or adjacent to the project. Use special care in the performance of the work in order to avoid interference or damage to operating utilities or plants; however, where there is any possibility of interference or damage, make satisfactory arrangements with responsible corporate officers of the utilities or plant, covering the necessary precautions to be used during the performance of the work. Make these arrangements, subject to review, before work is started.

Protect all land monuments and property markers which are to be affected by the construction until they have been correctly referenced by the Commission. Beyond the construction area, reset monuments and markers which are disturbed by contract operations, either during the construction of the project or otherwise, when and as directed.

Promptly make restitution for or satisfactorily repair or restore damaged public or private property. Protect trees to be left standing. If these existing trees to be left standing are damaged, satisfactorily repair or replace them, at no expense to the Commission, or compensate the Commission for the damage by an equitable monetary amount as determined by, or agreed with, the Commission.

107.08 PUBLIC USE LANDS — In performing work within or adjacent to public use lands, namely National or State Forests, State Gamelands, Wildlife or Waterfowl Refuges, recreation areas, parklands, and historic sites, comply with all applicable rules and regulations of the authority having jurisdiction.

Cooperate with the National or State Forest Officer or Supervisor and authorized subordinates in observing sanitary laws and in exercising every reasonable precaution to prevent and suppress forest fires and vandalism.

Do everything reasonable to prevent and suppress forest fires. Notify a forest supervisor, as soon as possible, of the location and extent of any fire observed. Before starting indicated work affecting stream channels, verify that the Commission has the approval of the DEP and/or the DCNR.
107.09 INDEMNITY — Assume the entire responsibility and liability for any damage or injury of any kind or nature whatever (including death resulting therefrom) to all persons, whether employees of the Contractor or otherwise, and to all property caused by, resulting from, arising out of or occurring in connection with the execution of the work of the Contractor, and if any claims for such damage or injury (including death resulting therefrom) be made or asserted, whether or not such claims are based upon the alleged active or passive negligence of participation in the wrong of the Commission, its Commissioners, agents, servants and/or employees (herein collectively the "Commission") or upon any alleged breach of any statutory duty or obligation on the part of the Commission; the Contractor agrees to indemnify and hold harmless the Commission from and against any and all such claims, loss, costs, expense, liability, damage or injury, including legal fees, interest, penalties and disbursements that the Commission may directly or indirectly sustain, suffer or incur as a result thereof, and the Contractor assumes, on behalf of the Commission, the defense of any action at law or in equity which may be brought against the Commission arising by reason of such claims and will further pay on behalf of the Commission upon demand, the amount of any judgment that may be entered against the Commission, individually, jointly or severally in any such action.

In the event that any such claim, loss, cost, expense, liability, damage or injury arises or is made, asserted or threatened against the Commission, its Commissioners, officers, agents, servants or employees, the Commission only will have the right to withhold from any payments due or to become due to the Contractor an amount sufficient in the Commission's judgment to protect and indemnify it, its Commissioners, officers, agents, servants and employees, from and against any and all such claims, loss, cost, expense, liability, damage or injury, including legal fees and disbursements, or the Commission only in its discretion, may require the Contractor to furnish a surety bond satisfactory to the Commission guaranteeing such protection which bond will be furnished by the Contractor within five (5) days after written demand has been made therefor. In the event performance of the terms of this paragraph by the Contractor requires the retention of legal counsel on behalf of the Commission, the selection of such legal counsel by the Contractor will be subject to the approval of the Commission, such approval not to be unreasonably withheld by the Commission. In the event the Commission is required to take legal action to enforce the terms of this Paragraph, Contractor is responsible for the Commission's cost of collection including attorney's fees.

107.10 CONTRACTOR'S RESPONSIBILITY FOR WORK —

(a) Responsibility for Performed Work. The terms and conditions of the Contract will be in effect until the work is completed and accepted by the Commission. However, the Contractor will be relieved of responsibility for further physical work, maintenance, and third party liability on the date of physical work completion as established during the final inspection. The Commission's acceptance of the project does not relieve the Contractor and surety from continuing liability for latent defects, as specified.

(b) Responsibility for Latent Defects. The Representative will determine if a defect is a latent defect. The Contractor and his surety will continue to be liable for all latent defects. However, the surety is liable only until the performance bond is released. Satisfactorily repair or correct latent defects, at no expense to the Commission. If the defects cannot be satisfactorily repaired or corrected, provide reimbursement for any expenses or damages incurred by the Commission because of the defects.

(c) Responsibility During Temporary Suspension of Work. Should the work be temporarily suspended, wholly or in part, according to the provisions specified in Section 105.01(b), written notification will be given of the suspension and the reason(s) for the suspension.

If the work is temporarily suspended, wholly or in part, due to the fault of the Contractor, the
Required Completion Date and any specified Milestone Date(s) will not be changed, unless otherwise directed by the Chief Engineer.

After a whole or partial suspension, upon receipt of written notice from the Representative, actively resume work according to the detailed schedule of operations.

(d) Specified Suspension of Work. The Commission reserves the right to suspend work, wholly or in part, and on a temporary basis, to accommodate the customers, traffic requirements and maintenance operations. The extent of such specified suspension of work will be included within the Special Provisions for the project. Responsibility for maintenance of the facility and its repair during such periods of specified suspension of work will be the responsibility of the Commission.

The Contractor is not responsible for winter maintenance activities which include snow removal and the application of deicing chemicals or anti-skid materials, during such periods of specified suspension of work.

107.11 CONTRACTOR'S RESPONSIBILITY FOR PUBLIC OR PRIVATE FACILITIES AND STRUCTURES — Cooperate with others in the performance of corrective project work, as specified in Section 105.06.

The Commission will cooperate in the issue of notices and will participate in all essential field conferences relating to the facilities and structures.

107.12 FURNISHING OF RIGHT OF WAY — The Commission will be responsible for securing all necessary rights of way in advance of construction. Any exceptions will be indicated in the proposal and contract.

107.13 PERSONAL LIABILITY OF PUBLIC OFFICIALS — In carrying out any of the provisions of these specifications or in exercising any power or authority granted to them by or within the scope of the contract, no liability may be placed upon the Commissioners, Chief Executive Officer, Engineer, or their authorized representatives, either personally or as officials of the Commission. In such matters, they act solely as Commission agents and representatives.

107.14 NO WAIVER OF LEGAL RIGHTS — The Commission, the Chief Executive Officer, the Engineer, or the Representative will not be prevented by an erroneous

- measurement,
- computation,
- estimate, or
- certificate

made or given by them or any agent or employee of the Commission, under any provision or provisions of the contract at any time, either before or after the completion and acceptance of, and payment for the project, from showing at any time that any

- measurement,
- computation,
- estimate, or
- certificate

is untrue or incorrectly made in any particular or that the work or material or any part does not conform to the specifications and contract.

The Commission will have the right to reject the whole or any part of the work or material, should any
be discovered or be known to be inconsistent with the contract terms or otherwise improperly given. The
Commission will not be prevented, notwithstanding any

- measurement,
- computation,
- estimate,
- certificate, or
- payment

from demanding and recovering from the Contractor or surety, such damages as it may sustain by the
failure to comply with the terms of the specifications and contract or on account of any overpayment(s) made on any estimate or certificate.

Neither the payment on any estimate or certificate signed by the Commission nor any extension or
remission of contract time nor any possession taken by the Commission or its employees, will operate as a
waiver of any portion of the contractor of any power herein reserved by the Commission or any right to
damages herein provided, nor will any waiver of any breach of contract held to be a waiver of other or
subsequent breach.

The terms of this contract will not be waived or modified by any verbal communication between the
Contractor and Commission personnel.

107.15 MINIMUM WAGE SPECIFICATIONS AND RATES —

(a) Requirements. According to the provisions of the Pennsylvania Prevailing Wage Act 43 P.S.
165-1, and the implementing Regulations of the Pennsylvania Department of Labor and Industry, comply
with the prevailing minimum wage predetermination requirements, as specified in the proposal,
specifications, and contract.

(b) Responsibility for Payment of Wages. Accept responsibility for all wages paid or due to any
employees engaged upon the project under contract, as mandated by the Pennsylvania Prevailing Wage
Act, various applicable Federal acts, and the contract. Do not attempt to pass such responsibility
elsewhere. Do not require employees to refund, directly or indirectly, any part of such wage(s). Where
classification, reclassification, or additional classifications of workmen are made in accordance with the
Pennsylvania Prevailing Wage Act and its regulations, make no claim against the Commission for
additional compensation for such classification, reclassification, or additional classification.

If after a contract has been awarded, it is decided, because of unforeseen construction development, to
list an additional classification and wage rate, the Commission, with or without application by the
Contractor, will make written request for a wage determination by the Secretary of Labor and Industry.

No person may be employed on the project under contract, except in accordance with the
classification set forth in the decision of the Secretary of Labor and Industry.

(c) Certification and Payment of Rate of Wage. According to the provisions of the Pennsylvania
Prevailing Wage Act and various applicable Federal acts, including their implementing regulations, file
with the Commission a weekly statement and a final statement at the conclusion of project work under
contract, certifying that all employees have been paid wages in conformity with the provisions of the contract, as prescribed by the regulations of the Pennsylvania Department of Labor and Industry, implementing the Pennsylvania Prevailing Wage Act. If any wages remain unpaid, list on the statement the amount of wages due to each employee. Certify that, directly or indirectly, no refunds are received from any employee of any such minimum wage(s), other than deductions authorized by the Pennsylvania Wage Payment and Collection Law, 43 P.S. 260.1. Use forms furnished by the Commission and submit the forms to the Representative within 7 days after the regular payment date of the payroll period. Payment of the current and final estimates will be withheld if such certification is not submitted, using the proper form, within the prescribed time limit.

(d) Posting. Post a notice(s) in the manner and form prescribed by the current regulations of the State Department of Labor and Industry. This notice is to be clearly legible and to be placed in a prominent and easily accessible place at the project site under contract, as well as at places where employees are paid their wages.

(e) Records and Inspection. Keep accurate records of employment and wage payments, including all the information required by the regulations of the State Department of Labor and Industry implementing the State Prevailing Wage Act, as amended. Keep time cards of employees, as required by the cited regulations and act. In addition, keep the original signed indentures for each apprentice and the approvals of the Pennsylvania Apprenticeship and Training Council. Preserve the records for 2 years from the date of payment and keep open at all reasonable hours, for inspection by the Commission and by the State Secretary of Labor and Industry. Make these records easily accessible within a period of 7 days from the date on which the State Secretary of Labor and Industry requests in writing that such records be made available. For the purpose of such inspection, furnish the authorized inspectors of the Commission every assistance in determining the wages paid in compliance with the regulations.

(f) Penalties. Failure to comply with the Pennsylvania Prevailing Wage Act and its regulations will result in withholding money due or to become due on the project contract. It will also result in termination of the right to proceed with the project work under contract and/or other penalties prescribed by law.

107.16 HAULING RESTRICTIONS —

(a) General. Accept responsibility for all hauling done on the project and on adjacent highways, in connection with the contract. Hauling restrictions on highways will be according to the applicable sections of the Pennsylvania Vehicle Code, Act of 1976, No. 81.

Without written permission, do not move and/or operate heavy-duty construction grading and hauling equipment over existing or new pavements, subbase, base and surface courses, and structures which will remain in service.

No special permits will be required for the transfer of oversize or overweight equipment or vehicles from one work area to another work area within the project limits. However, correct any damage caused by the transfer of equipment or vehicles.

If, in special cases, further restrictions are necessary, such restrictions will be indicated and/or specified in the proposal.

Hauling restrictions on the Turnpike System will also be governed by appropriate Commission rules and regulations.

(b) Weight Limits and Weighing.

1. Do not operate on public highways any vehicles which are in excess of the registered, gross
and/or axle weight limits established in Chapter 49 of the Vehicle Code, 75 PA. C.S. Chapter 49, or as posted by the Department.

2. Submit to weighing by Department weigh teams when requested. If, as a result of such a weighing, it is determined that a vehicle owned or leased by the Contractor or any Subcontractor has been operated on public highways carrying a weight in excess of the above registered, gross or axle weight limits, the sum of $50 for each 500 pounds or part thereof of such excess weight will be deducted as liquidated damages from money due or to become due. These liquidated damages are attributable to inherent damage to the highway which is not readily ascertainable and do not relieve the Contractor of responsibility to pay ascertainable damage as may be required in other sections of these Specifications.

107.17 ACCESSIBILITY OF FIRE HYDRANTS — Make necessary arrangements with the local authorities to provide fire protection at all times. Keep the fire hydrants adjacent to the work readily accessible to fire apparatus and do not place material or other obstructions within 15 feet of any hydrant.

107.18 DISCRIMINATION ON ACCOUNT OF RACE, COLOR, RELIGIOUS CREED, ANCESTRY, SEX, AGE OR NATIONAL ORIGIN PROHIBITED IN CONNECTION WITH EMPLOYMENT—

(a) General. Do not discriminate against any individual, who is qualified and available to perform the work to which the employment relates, by reason of race, color, religious creed, ancestry, sex, age or national origin.

(b) Penalties. Failure to comply with the above provisions, prescribed in greater detail in 15 P.S. 7306, and modified by Pennsylvania Human Relations Act 43 P.S. 951, may result in the deduction of money due or to become due for each violation. A second or subsequent violation will result in cancellation or termination of the contract upon which the violation occurred, and forfeiture of all money due or to become due, and other penalties prescribed by law.

107.19 SELECTION OF LABORERS AND MECHANICS — In employment on public works, Provisions of 51 P.S. 492.1 require a preferential rating, similar to that given to State employees, to any soldier making application for employment and on intended discharge for reduction in force. The word "soldier", as used in the cited act, means a person who served in the armed forces of the United States or in any official women's organization, during any war or armed conflict in which the United States was engaged, and who has an honorable discharge from such service.

107.20 WATERWAY REGULATIONS AND WATER POLLUTION CONTROL —

(a) Waterway Regulations. Conduct indicated work in waterways, flood plains or their hydrologically connected wetlands in accordance with the requirements of permits or approvals issued by the U.S. Army Corps of Engineers, the U.S. Coast Guard, the DEP, the DCNR and/or the Pennsylvania Fish and Boat Commission, whichever is applicable. Do not conduct work, including borrowing or wasting material other than indicated, in waterways, floodplains or their hydrologically connected wetlands before obtaining the required permits or approvals.

(b) Water Pollution Control. Comply with all applicable State and Federal laws and regulations preventing the pollution of surface water and ground water resources.

(c) Act 247. In accordance with Act 247, enacted by the General Assembly of the Commonwealth of Pennsylvania and approved by the Governor on October 26, 1972, ascertain the current statutes, rules,
and regulations concerning anti-pollution measures. Include in the bid price all costs of complying with the terms of the statutes, rules, and regulations. No separate or additional payment will be made for such compliance. In the event that the statutes, rules, and regulations are amended, or if new statutes, rules, or regulations become effective, perform all additional and/or extra work deemed necessary, as ordered in writing and directed by the Representative, in accordance with Section 109.03.

Determine what local ordinances, if any, will affect the project work. Check for any county, city, borough, or township rules or regulations applicable to the area in which the Project is being constructed, and, in addition, for any rules or regulations of other organizations having jurisdiction, such as chambers-of-commerce, planning commissions, industries, or utility companies who have jurisdiction over lands which the project occupies. Include any costs of compliance with local controls in the prices bid, even though documents of such local controlling agencies are not listed herein. No separate or additional payments will be made for complying with existing, amended or new local ordinances, directives, or controls.

107.21 EROSION AND SEDIMENT POLLUTION CONTROL PLANS AND PERMITS — Install and maintain erosion and sediment pollution control devices as indicated or submit an alternate plan for accomplishing equal or better temporary and permanent erosion and water pollution control. When an alternate plan is submitted, do not start work until the plan is approved by the County Conservation District and the Commission. When a National Pollutant Discharge Elimination System Permit (NPDES) is involved, do not start work until the plan is approved by the DEP and/or the DCNR or their designee and the Commission.

The Contractor will become a co-permittee for the NPDES permit and will be responsible for completing and signing the permit and the Notice of Termination.

107.22 THIRD-PARTY LIABILITY - Contracts covered by these specifications are not to be construed for the benefit of any person or political subdivision not a party to this contract, nor will this contract be construed to authorize any person or political subdivision not a party to this contract to maintain a lawsuit on or under this contract.

107.23 CONTRACTOR’S INSURANCE —

(a) General. Do not commence work under the contract until all insurance, and insurers, under this section have been obtained and approved by the Commission.

Before or at the execution of a Contract, provide the Commission with certificates of insurance evidencing the coverage required.

Have all primary and excess liability policies contain the following clause:

"Thirty (30) days written notice of any cancellation, non-renewal, limit or coverage reduction is to be sent to the Commission by Certified Mail."

The preceding is subject to existing Commonwealth of Pennsylvania statutory cancellation provisions relating to non-payment of premium and misrepresentation by the insured.

Maintain the insurance described herein until the work is completed and a Final Certificate of Completion has been issued.

All insurance policies must be written by an Insurance Company licensed and authorized to do business in Pennsylvania and acceptable to the Commission. Have all insurance policies and certificates signed by a resident Pennsylvania Agent of the issuing Company. However, in the case of an eligible surplus lines insurer, have all policies and certificates also signed by a party duly authorized to bind, on behalf of the eligible surplus lines insurer, the certified coverages.
(b) Worker's Compensation and Employer's Liability Insurance. Take out, pay for and maintain during the life of the contract, Worker's Compensation Insurance in statutory required limits for the protection of all employees. Provide, pay for and maintain during the life of the contract, Employer's Liability Insurance in limits of not less than $500,000 bodily injury each accident, $500,000 bodily injury by disease, and $500,000 bodily injury by disease each employee.

(c) Commercial General Liability Insurance. Includes: Products/Completed Operations; Blanket Contractual Liability - All Written & Oral Contracts; premises and operations liability; explosion, collapse and underground; personal injury; independent contractors; broadform property damage; severability of interests provisions; personal injury and advertising liability; premises medical payments; host liquor liability; fire damage legal liability - real property; incidental malpractice (including employees); non-owned watercraft; and automatic coverage for newly acquired entities.

The minimum required limits for the Commercial General Liability policy will be as follows:

- $2,000,000 Each Occurrence
- $2,000,000 Advertising and Personal Injury Limit
- $2,000,000 General Aggregate per Location/Per Site
- $2,000,000 Products and Completed Operations Aggregate
- $50,000 Fire Damage Legal, Any One Fire
- $5,000 Medical Payments

(d) Commercial Automobile Liability Insurance - covering all owned, hired, leased and non-owned vehicles with a minimum limit of liability of $1,000,000 per occurrence.

(e) Commercial Umbrella/Excess Insurance - with the following minimum limits:

- $5,000,000 Per Occurrence
- $5,000,000 General Aggregate
- $5,000,000 Products/Completed Operations Aggregate

(f) The Commercial General Liability and Automobile Liability policies will name the Pennsylvania Turnpike Commission, the Commonwealth of Pennsylvania, Pennsylvania Department of Transportation, Michael Baker, Jr., Inc., the Design Engineer and the Construction Manager, if any, as an Additional Insured.

(g) Special Hazards. Requirements concerning Railroad Protective Insurance, Modification of Blasting Insurance Requirements and Insurance for other special hazards will, if required, be included in the Special Provisions.

(h) Proof of Insurance. Before commencing work, furnish to the Commission a certificate of insurance outlining the coverages detailed above. The certificate will also indicate the Additional Insured status of the Commission and the appropriate cancellation/non-renewal notice wording.

The insurance company certificates will be in standard ACORD form and will contain the address and phone number of the insurance company or insurance agent. If appropriate, the Commission reserves the right to request certified copies of the contractor's insurance coverages.

(i) Payment. Incidental to the project.
107.24 **BLASTING** — Perform no blasting without prior permission of the Representative. At no time will the blasting interfere with the operation of the Commission's radio system.

107.25 **NONDISCRIMINATION CLAUSE** — During the term of this contract, Contractor agrees as follows:

(a) Not to discriminate against any employee, applicant for employment, independent Contractor or any other person because of race, color, religious creed, ancestry, union membership, political affiliation, age, sex, sexual orientation, national origin or non-job-related handicap or disability. Take affirmative action to ensure that applicants are employed and that employees or agents are treated during employment without regard to their race, color, religious creed, ancestry, union membership, political affiliation, age, sex, sexual orientation, national origin or non-job-related handicap or disability. Such affirmative action includes, but is not limited to, the following: Employment; upgrading; demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation and selection for training. Post in conspicuous places, such as the outside of a trailer or an outside bulletin board that are available to employees, agents, applicants for employment and other persons, a notice to be provided by the Pennsylvania Turnpike Commission setting forth the provisions of this non-discrimination clause. Notices posted outside must be weatherproof.

(b) In advertisements or requests for employment placed, state all qualified applicants will receive consideration for employment without regard to race, color, religious creed, ancestry, union membership, political affiliation, age, sex, sexual orientation, national origin or non-job-related handicap or disability.

(c) Send each labor union or workers' representative with which the Contractor has a collective bargaining agreement or other contract or understanding a notice advising the labor union or workers' representative of its commitment to this non-discrimination clause. Similar notice is to be sent to every other source of recruitment regularly used by Contractor.

(d) It is no defense to a finding of noncompliance with this non-discrimination clause that Contractor had delegated some of its employment practices to any union, training program or other source of recruitment which prevents it from meeting its obligations. However, if evidence indicates that the Contractor was not on notice of the third-party discrimination or made a good faith effort to correct it, such factor will be considered in mitigation in determining appropriate sanctions.

(e) Where the practices of a union or of any training program or other source of recruitment will result in the exclusion of minority group persons so that Contractor will be unable to meet its obligations under this non-discrimination clause, employ and fill vacancies through other non-discriminatory employment procedures. **See Attachment I.**

(f) Comply with all state and federal laws prohibiting discrimination in hiring or employment opportunities. In the event of Contractor's noncompliance with the non-discrimination clause of this Contract or with any such laws, this Contract may, after hearing and adjudication, be terminated or suspended, in whole or in part, and Contractor may be declared temporarily ineligible for further Pennsylvania Turnpike Commission contracts, and other sanctions may be imposed and remedies invoked.

(g) Upon written request, furnish all necessary employment documents and records to, and permit access to its books, records and accounts by, the Pennsylvania Turnpike Commission. If Contractor does not possess documents or records reflecting the necessary information requested, furnish such information on reporting forms supplied by the Pennsylvania Turnpike Commission.
(h) Actively recruit minority subcontractors or subcontractors with substantial minority representation among their employees. Minority subcontractor recruitment includes, but is not limited to, the Disadvantaged Business Enterprise Division, Bureau of Equal Opportunity, Pennsylvania Department of Transportation at 717-787-5891, or address correspondence to: Disadvantaged Business Enterprise Division, Bureau of Equal Opportunity, 5th Floor, Commonwealth Keystone Building, 400 North Street, Harrisburg, PA, 17120, or contact the Pennsylvania Department of General Services, Bureau of Minority & Women Business Opportunities at 717-787-7380. Address correspondence to: Pennsylvania, Department of General Services, Bureau of Minority & Women Business Opportunities 502 North Office Building, Harrisburg, PA, 17125. Also, contact the Pennsylvania Turnpike Commission, Contracts Administration Office, at 717-939-9551, Extension 4241. In addition, use the resources listed in Attachment 1.

(i) Include the provisions of this non-discrimination clause in every subcontract so that such provisions will be binding upon each subcontractor.

(j) Contractor obligations under this clause are limited to the Contractor's facilities within Pennsylvania or where the contract is for purchase of goods manufactured outside of Pennsylvania, the facilities at which such goods are actually produced.

Commission will furnish the Contractor with forms to comply with this section at the Pre-Construction Conference.

107.26 MINORITY BUSINESS AND WOMEN BUSINESS ENTERPRISE REQUIREMENTS - The following provisions apply only if indicated in the Special Provisions for the project.

(a) Participation Level

1. The Pennsylvania Turnpike Commission (Commission) has established the Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) minimum levels of participation indicated in the Special Provisions for this project.

These minimum levels of participation serve exclusively as a guide in determining bidder responsibility as specified in Section 107.26(c) below. Attainment of the levels is not a measure of bid responsiveness.

Predetermined amounts shown in the proposal will be excluded from the total bid price for determination of participation levels.

2. MBE/WBE Subcontractors and Manufacturers will be credited at 100%. Regular dealers are credited at 100%. Others providing a BONA FIDE service are credited 100%.

2.a Manufacturers. An MBE/WBE Manufacturer is a firm that operates or maintains a factory or establishment that produces on the premises the materials or supplies obtained by the Contractor.

2.b Regular Dealers. An MBE/WBE Regular Dealer is a firm that owns, operates or maintains a store, warehouse or other establishment in which the materials or supplies required for the performance of the contract are bought, kept in stock and regularly sold to the public in the usual course of business. A regular dealer, is a firm that engages in, as its principal business, and in its own name, the purchase and sale of the products in question. An MBE/WBE regular dealer in such bulk items as steel,
cement, gravel, stone and petroleum products need not keep such products in stock if it owns or operates distribution equipment. MBE/WBE brokers and MBE/WBE packagers are not regarded as MBE/WBE manufacturers or MBE/WBE regular dealers.

2.c Providers of BONA FIDE Services. This includes fees or commissions charged for providing a bona fide service, such as professional, technical, consultant or managerial services and assistance in the procurement of essential personnel, facilities, equipment, materials or supplies required for performance of the contract, fees charged for delivery of materials and supplies required on job site (but not the cost of the materials and supplies themselves) when the MBE/WBE hauler, MBE/WBE trucker or MBE/WBE delivery service is not also the MBE/WBE manufacturer or MBE/WBE regular dealer in the materials and supplies, the fees or commission charged for providing any bonds or insurance specifically required for the performance of the contract, provided that all above such fees or commissions are determined by the Commission to be reasonable and not excessive as compared with fees customarily allowed for similar services.

3. A firm which is both an MBE and a WBE will only receive credit toward the minimum participation level as either an MBE or WBE in any single supply or work area. The firm will not receive credit in each category, MBE and WBE. Bidders will note with the submission which status, MBE or WBE, is submitted for credit.

(b) Responsiveness

1. Bidders are required to submit documentary evidence of MBE and WBE firms who have been contacted and who are to be used. Submit documentation of such solicitations and commitments, concurrently with the bid, on PTC Form 22-94-16 (MBE/WBE Subcontractor and Supplier Solicitation Sheet) and on PTC Form 22-95-32 (MBE/WBE Subcontractor and Supplier Commitment Sheet). Failure to submit the required information on MBE/WBE participation may result in rejection of the bid as being non-responsive. The aforementioned forms are included in the bid documents.

Completed forms 22-94-16 and 22-95-32 and accompanying documents regarding solicitation of and commitments to MBE and WBE firms become part of the contract.

Mailings are to large numbers of MBEs and WBEs which are intended to provide notice of a contractors interest in bidding a Commission contract will not be deemed solicitations, but rather will be treated as informational notifications only.

Only make actual solicitation of MBE and WBE subcontractors, manufacturers, regular dealers and/or providers of bona fide services whose work, material, supplies, equipment and/or services are within the project scope and are related to project line items or portions thereof which the Contractor reasonably believes it will choose to subcontract, purchase or lease.

If the minimum levels of participation are not met, the three (3) low bidders are required to deposit, fax, mail or electronically transmit sufficient evidence, which demonstrates to the Commission that the bidder has not engaged in discriminatory practices in the solicitation and commitment of subcontracts and supply contracts. Sufficient evidence must be documentation of efforts made prior to bid submission and must be received by the Pennsylvania Turnpike Commission’s Contract Management Services Manager by 3:00 PM, Prevailing Local Time, of the second business day following the day of the bid opening by any of the following methods:

- Deposit required documents in or send overnight mail service to Pennsylvania Turnpike Commission’s Construction Department, Attention: Contract Management Services Manager, 700 S. Eisenhower Boulevard, Middletown, PA 17057.
• or send them to Pennsylvania Turnpike Commission’s Contract Management Services Manager by facsimile (FAX) 717-986-9762.

• or e-mail them to ebsadmin@paturnpike.com.

The Commission will only review documentation corresponding to the commitments submitted with the bid on the MBE/WBE Subcontractor and Supplier Commitment Sheet (PTC Form 22-95-32). Any discrepancy between the commitments submitted with the bid and the documentary evidence submitted subsequent to the opening of bids may result in the rejection of the bid.

1.a The evidence submitted by the bidder is required to demonstrate the following:

1.a.1 The bidders whose actions resulted in a limited or no commitment to minority and/or women businesses, was not motivated by considerations of race or gender.

1.a.2 Solicitation and commitment decisions were not based upon policies which disparately affect minority and women businesses. Prime contractors are to have policies that demonstrate their willingness to provide subcontracting opportunities to minority and/or women businesses.

1.a.3 If the minimum participation levels are not met for minority firms, the bidder is to indicate whether minority firms were solicited for each type of work the bidder intends or expects to subcontract or for all materials and services the bidder intends to purchase. If a quotation was provided and not used, explain the non-usage. If the minimum participation levels are not met for women firms, the bidder is to indicate whether women firms were solicited for each type of work the bidder intends or expects to subcontract or for all materials and services the bidder intends to purchase. If a quotation was provided and not used, explain the non-usage.

1.a.4 For each type of work the bidder intends or expects to subcontract or for all materials which the bidder intends or expects to procure, indicate whether minority and women businesses were permitted an opportunity to quote. If a quotation was provided and not utilized, indicate the reason.

1.a.5 In any instance where a minority or women business has not been committed to for a type of subcontract work or materials contract in any area where a quote was received from a minority or women business, the reason is to be expressly indicated.

1.a.6 If no quotations are received from solicitation of minority and women businesses, this information is to be noted with the bid submittal along with detailed information on the solicitation effort. (Form 22-94-16)

1.a.7 If no commitments are made to minority and women firms, this information is to be noted with the bid submittal. (Form 22-95-32)

If the bidder does not submit sufficient evidence by 3:00 PM of the second business day following the day of the bid opening, the bid submissions will be considered non-responsive and the bid rejected.

(c) Responsibility

1. Upon receipt of bids for a construction contract, the submittals of each bidder will be subject to review by the Commission to determine whether the bidder has discriminated in the selection of subcontractors, manufacturers, regular dealers and other providers of a BONA FIDE service. If a bidder
has met the minimum levels for MBE/WBE participation, the bidder will be presumed not to have discriminated in its selections. Where the minimum levels are not met and the bid has not otherwise been rejected for reasons of non-responsiveness, the Commission will determine whether discrimination has occurred. After review of PTC Form 22-94-16 (MBE/WBE Subcontractor and Supplier Solicitation Sheet), PTC Form 22-95-32 (MBE/WBE Subcontractor and Supplier Commitment Sheet), and other relevant information, the Commission will make a determination of whether or not discrimination has occurred. If the Commission determines that discrimination has occurred, the bidder will thereby be deemed to be not responsible and its bid will be rejected.

2. MBE/WBE firms and commitment amount made at the time of bidding are to be maintained throughout the term of the contract. Any change in MBE/WBE firms or commitment amount must be pre-approved by the Commission.

(d) Access to Information. The Commission, its designees or agents have the right to obtain documents and information from any contractor, subcontractor, manufacturer, regular dealer or other provider of a BONA FIDE service that may be required in order to ascertain bidder or contractor responsibility. Except as otherwise provided by law and/or for use by the Commission, its designees or agents for investigations and proceedings following therefrom, the documents submitted with the bid will be confidential.

(e) MBE/WBE Certification

1. Credit will not be given for MBE/WBE Subcontractors, manufacturers, regular dealers or other providers of a BONA FIDE service which are not certified by one of the following agencies: 1) Pennsylvania Unified Certification Program (PA UCP) 2) Pennsylvania Bureau of Minority & Women Business Opportunities, Department of General Services. Credit will only be given for MBE/WBE firms that are certified at the time of the bid. Where, because of the nature or quantity of the work, prequalification by Pennsylvania Department of Transportation (PENNDOT) is necessary for firms certified by PENNDOT, MBE/WBE firms must be prequalified at bid submission.

2. Under Act of December 21, 1984, No. 230, P.L. 210, 18 Pa. C.S.A. Section 4107.2, a person commits a felony of the third degree if, in the course of business, he or she engages in deception relating to MBE/WBE certification.

(f) Resources

1. A listing of certified MBE/WBEs will be maintained by the following certifying authorities and will be made available to bidders upon request. Certification of an entity as an MBE/WBE by any of the following means that the entity is certified as an MBE/WBE for any Commission project incorporating minimum participation levels for MBEs and WBEs.

   Pennsylvania Unified Certification Program (PA UCP)
   Website: http://www.paucp.com

   Pennsylvania Department of General Services
   Bureau of Minority & Women Business Opportunities
   502 North Office Building
   Harrisburg, Pennsylvania 17125
   717-787-7380 or 1-800-822-2903
   http://www.dgsweb.state.pa.us/mbewbe/VendorSearch.aspx
Firms certified and/or prequalified by PENNDOT are available at:

Pennsylvania Department of Transportation (PENNDOT)
http://www.dotdom2.state.pa.us/
(Contractor Services/Contractor Information/ECMS DBE Listing)

2. In addition to the above resources, the Commission’s Contract Administration Office is available for technical assistance to all bidders/contractors seeking to meet the Commission MBE/WBE minimum participation levels. Contact the Pennsylvania Turnpike Commission, Contracts Administration Office at (717) 939-9551.

3. Do not rely solely on these resources to identify MBE/WBEs. Efforts to secure MBE/WBEs are to go beyond these resources.

(g) Records and Reports

1. Keep such project records as are necessary to determine compliance with its MBE/WBE commitments. Design these records to indicate:

1.a The number of MBE/WBE and non-MBE/WBE subcontractors, manufacturers, regular dealers and other providers of BONA FIDE service, and the type of work or materials or services performed on or incorporated in this project.

1.b The progress and efforts made in seeking out MBE/WBE contractor organizations and individual MBE/WBE contractors for work on this project to increase the amount of MBE/WBE participation and/or to maintain the commitments made at the time of the bid to MBEs and WBEs.

1.c Documentation of all correspondence, contacts, telephone calls, etc., to obtain the service of MBE/WBEs on this project.

2. Submit reports as required by the Commission, or at least on a monthly basis, of those contracts and other business executed with MBE/WBEs with respect to the records referred to in subsection G.1. above in such form and manner as prescribed by the Commission. Submit the monthly reports to the Representative by the twentieth day of the following month and have them contain:

2.a Number of contracts awarded to MBE/WBEs noting the type of work and amounts of each contract executed with each firm, including the execution date of each contract.

2.b The amounts paid to each MBE/WBE during the month and the date of payment.

2.c Upon completion of individual MBE/WBE firm's work, submit paid invoices or a certification attesting to the actual amount paid to each firm. In the event the actual amount paid is less than the award amount, a complete explanation of difference is required.

3. Maintain all such records for a period of 3 years following acceptance of final payment. Make these records available for inspection by the Commission, its designees or agents.
(h) **Subcontracts/Purchase Orders**

1. Subcontracts with minority and women business firms will not contain provisions waiving legal rights or remedies provided by laws or regulations of the Federal Government or the Commonwealth of Pennsylvania or the Commission through contract provisions or regulations.

2. Prime contractor will not impose provisions on minority and women subcontracts that are more onerous or restrictive than the terms of the prime's contract with non-MBE/WBEs.

3. Subcontracts are to show evidence that minority and women subcontractors were advised of the availability of mobilization funds and that they were provided an opportunity to refuse said mobilization. Include a signed statement with the subcontract attesting to the aforementioned.

4. Executed copies of subcontracts/purchase orders are to be received by the Commission before the commencement of work by the MBE/WBE.

(i) **Payments**

1. Checks are to be issued for this project only and not commingled with payment for other projects.

2. Dual party checks are to be issued only with the concurrence of both the MBE/WBEs and the prime contractor. If no agreement can be reached, the prime contractor must demonstrate a clear business necessity for same.

3. Payments to MBE/WBEs are to be made within five business days of receipt of payment by the prime contractor.

(j) **Construction**

1. Sufficient notice is to be given to MBE/WBEs concerning the initial and subsequent construction meeting which impact on their area of work. Written notice is to be provided concerning the time, date, and location of the aforementioned meetings. Before the commencement of work by the MBE/WBEs, a meeting will be scheduled by the project superintendent to clarify scheduling, work expectations, and payment schedule. Notice will be provided to the Commission’s Contracts Administration Office that the aforementioned meeting has occurred.

2. MBE/WBEs are not to have more restrictive requirements placed upon them than is placed upon other non-MBE/WBEs subcontractors/suppliers on the project.

**107.27 ENVIRONMENTAL POLLUTION CONTROL** — All equipment and operations are to be conducted in accord with all local, state and federal rules and regulations pertinent to the control of air, water and other environmental pollution.

Ascertain any and all restrictions regarding the work involved in this project, obtain and pay for all required permits not previously obtained by the Commission and furnish the Commission copies of all such permits before the performance of any activity requiring permit.

Provide protection against pollution of streams, watercourses and wetlands during excavation, grading operations, placing or stockpiling embankment, construction of new drainage, extension and cleaning of existing drainage, utilization of staging and storage areas and other similar operations which may effect the
quality of water in existing streams and watercourses, in accord with approved methods and to the satisfaction of the Representative and such agencies legally entrusted with the prevention of pollution.

Equip construction vehicles and equipment with functioning exhaust mufflers to minimize noise levels. Locate access and haul roads as far as practical from sensitive receptors including schools, churches and residences. Construct temporary noise mitigation features including constructed walls between stationary equipment and sensitive receptors as determined and required by the Commission. Where practical, locate construction trailers and/or material stockpiling areas between sensitive receptors and the construction area.

Control fugitive dust created by material hauling and grading operations by means such as wetting down roadways. The use of heavy equipment and unnecessary idling near sensitive receptors must be kept to a minimum whenever possible.

SECTION 108 — PERFORMANCE AND PROGRESS

108.01 NOTICE TO PROCEED — Within thirty (30) days of the award and as soon as practical after approval of the bonds and insurance certificates, the Commission will issue a purchase order or executed contract with a written Notice to Proceed. Issuance of the purchase order will constitute the Notice to Proceed. The date of the purchase order is the Notice to Proceed date. Extension(s) of the 30-day period will be made only by mutual written consent of the parties to the contract provided such written consent is given prior to the expiration of the 30-day period.

108.02 PERFORMANCE AND PROGRESS —

(a) Preconstruction Conference. Before the start of work, a preliminary conference will be held. The purpose of this conference will be to discuss the scope of the project work, to discuss all essential matters pertaining to the satisfactory project completion, and to resolve any questions regarding contract interpretation.

In addition to the Construction Schedule specified in 108.02(b), the following documents must be completed promptly by the Contractor:

1 Reproducible Copy of the Contractor's Estimated Monthly Values of the progressing project and its various categories of work. This schedule of values will indicate those dollars which the Contractor estimates will be due him for each monthly period of work. This schedule will complement the approved construction schedule and the values indicated are to reflect the estimated percentages of completion applicable to the progressing project and its various major categories of work.

The Commission may require a Detailed Estimate or item cost breakdown applicable to "Lump Sum" contracts and to major items of work bid on a "Lump Sum" price. However, the Representative reserves the right to require a detailed estimate for items bid on a unit price basis whenever, in his judgment, the complexity of the work performed under the unit price necessitates the further examination of the methods and costs involved in the determination of the unit price.

Additional information may be required from the Contractor by the Representative, depending upon the specific items of work included in the project.

(b) Construction Project Scheduling. The Contractor is required to submit a fully detailed and complete schedule of operations. Schedule each operation necessary for the performance of all work separately for the Commission's review of the methods and sequences of work.

If the submitted schedule is not acceptable to the Commission, resubmit until an acceptable schedule is provided.
Submit the schedule to the Commission within ten (10) days of notice of award or at the preconstruction conference, whichever occurs first.

108.03 LIMITATION OF OPERATIONS —

(a) Maintenance of Traffic. Conduct the work in a manner and sequence that assures minimal interference to traffic.

(b) Completion of Sections of Project. Complete any designated portion or portions, as indicated or as specified in the proposal, or as directed in writing, when seasonal, local, or other conditions relating to the project or public convenience justify such action.

The Representative may relieve the Contractor of responsibility for further work on any portion of the project which has been completed before the whole if the section has been satisfactorily completed in accordance with specifications.

Release of Contractor responsibility is further contingent on the following:

- such portions have been entirely and satisfactorily completed, in accordance with the contract, and a final inspection of the section has been made as specified in Section 109.05(a).

- the Contractor's obligation under the contract to replace defective work or material is not relieved;

- the Contractor's responsibility for making further repairs to the designated sections of the project made necessary because of construction operations is not relieved; and

- any work done by the Commission on any designated sections of the project that may have been satisfactorily completed, as provided, does not waive the rights of either party to the entire contract.

(c) Maintenance of Existing Vegetation. In order to maintain natural vegetation in all undisturbed areas, do not cross these areas with construction equipment or make any other use of these areas, except at permitted locations.

(d) Working Schedule. Schedule and execute work operations to present the least inference to traffic and complete all operations within the specified contract time.

Ascertain any and all restrictions in regard to working times which may be imposed by local, state and federal agencies.

No work may be performed without the specified traffic control and protection whether working roadway pavement or shoulders.

The Chief Executive Officer may impose restrictions on the Contractor's operations, including complete suspension to eliminate unsafe traffic conditions or congestion of the Turnpike, without liability for any delay.

108.04 CHARACTER OF WORKMEN; METHODS AND EQUIPMENT —

(a) General. Employ at all times sufficient labor and equipment for performing the work.

(b) Competence of Workers. Employ only competent and efficient superintendents, forepersons, clerks, timekeepers, equipment operators, laborers, mechanics, or artisans for every kind of work. Whenever, in the Representative's opinion, any person is unfit to perform the task, does the work contrary to instructions, or exhibits improper conduct, discharge the person immediately and do not employ the person again on the project without written permission of the Representative. Failure to remove such
person, as ordered, or failure to furnish suitable and sufficient personnel for the proper completion of the work, after being ordered to correct the deficiency, may result in suspension of the work, by written notice from the Representative, until such orders are followed.

If the superintendent or representative on the project fails to cooperate with the Commission's authorized representatives in any way, the Representative will give a written order for dismissal and replacement of that superintendent or representative.

(c) Equipment. Furnish the type, condition, and quantity of equipment that meets the qualifications necessary for the proper execution of the work within the specified contract time. Maintain the equipment in good condition, subject to acceptance, before and during use in connection with the project.

If the contract specifies that construction be performed by the use of certain methods and equipment, use such methods or equipment, unless others are authorized. To use a method or type of equipment other than those specified, request authority to do so. Provide the request in writing and include a full description of the methods and equipment proposed to be used, with an explanation of the reasons for desiring to make the change. If acceptance is given, it will be on condition that construction work is performed in conformity with contract requirements. If, after trial use of the substituted methods of equipment, it is determined that the work produced does not meet contract requirements, discontinue the use of the substitute method or equipment. Complete the remaining construction with the specified methods and equipment. Remove the deficient work and replace it with work of specified quality, or take such other corrective action, as directed. No change will be made in the basis of payment for the construction items involved, nor in contract time, as a result of authorizing a change in methods or equipment under these provisions.

All equipment and its use on the project is subject to the approval of the Representative, and the Commission reserves the right of the Representative to require additional controls, modifications and alternate methods of operation to ensure the proper effect from the operating equipment. Equipment not capable of operations necessary to meet the approval of the Representative will be removed from the project or confined to such operations where its capabilities are considered adequate for the approval of the Representative.

108.05 TIME EXTENSIONS AND REDUCTIONS — A time extension or time reduction may be granted by the Commission as a result of the following events or occurrences, provided the required written request is submitted to the Representative within 10 calendar days of the event or occurrence. Include, with the time extension request, a revision to the Schedule.

- Progress on one or more controlling operations is adversely affected by an act or omission of the Commission, which is not the fault of the Contractor, all of which will be determined by the Representative.

- Satisfactory project completion requires work in greater or lesser quantities than those indicated in the contract for one or more controlling operations.

- The Representative, in writing, eliminates an item of work or reduces the quantity of an item of work and the elimination or reduction affects progress on one or more controlling operations.

- The Representative, in writing, authorizes additional or extra work, which affects progress on one or more controlling operations.

- A strike or labor dispute that causes, despite all reasonable efforts by the Contractor to avoid it, a shutdown of the entire project or of one or more controlling operations as specified in Section 108.09.
108.06 LIQUIDATED DAMAGES —

(a) Construction Engineering Liquidated Damages. For each day that any physical work remains uncompleted after the Required Completion Date, the sum per day specified in the following schedule, unless otherwise stated in the proposal, will be deducted from money due or to become due. This deduction will not be as a penalty, but as Construction Engineering Liquidated Damages.

<table>
<thead>
<tr>
<th>Original Contract Amount</th>
<th>Schedule of Daily Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>From More Than $0 $400,000</td>
<td>Per Calendar Day</td>
</tr>
<tr>
<td>$0 $400,000</td>
<td>$870</td>
</tr>
<tr>
<td>400,000 1,000,000</td>
<td>1,630</td>
</tr>
<tr>
<td>1,000,000 5,000,000</td>
<td>2,150</td>
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<tr>
<td>5,000,000 10,000,000</td>
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</tr>
<tr>
<td>10,000,000 15,000,000</td>
<td>4,420</td>
</tr>
<tr>
<td>15,000,000</td>
<td>5,765</td>
</tr>
</tbody>
</table>

In the event the Contractor is declared in default, as specified in Section 108.08, Construction Engineering Liquidated Damages will be charged as provided by this section. If the total amount chargeable as Construction Engineering Liquidated Damages exceeds the amount payable to the Contractor or the surety, the excess is to be paid to the Commission by the Contractor or the surety.

(b) Work Zone Liquidated Damages. A sum of no less than $1000 per day will be charged as liquidated damages for failure to comply with maintenance and protection of traffic specifications and drawings. This deduction will not be as a penalty, but as Work Zone Liquidated Damages.

108.07 DEFAULT AND TERMINATION OF CONTRACT — In the following paragraphs, the word "Contractor" also means the surety, in case of default, and completion of the contract by the surety.

(a) Delay, Neglect, or Default. The Contractor may be declared in default for the following reasons:

- failure to begin work within the time specified in the Notice to Proceed;
- failure to perform the work with sufficient labor, equipment, or material to insure the completion of the specified work in accordance with the contract terms;
- unsatisfactory performance of the work;
- failure or refusal to remove material, or to repair or remove and replace any work, rejected as defective or unsatisfactory;
- discontinuing work without approval;
- failure to resume work, which has been discontinued, within a reasonable time after notice to do so;
• insolvency or bankruptcy;
• commission of any act of bankruptcy or insolvency;
• making assignment for the benefit of creditors;
• failure or refusal within 10 days after written notice by the Representative to make payment or show cause why payment should not be made, of any amounts due for material furnished, labor supplied or performed, for equipment rentals, or for utility services rendered, as covered by the Payment Bond;
• failure to protect, to repair, or to make good any damage or injury to property, as provided in Section 107.07; and
• not performing work in an acceptable manner for any cause.

The Commission, upon written notice from the Representative or upon other proof satisfactory to the Commission, and after having given written notice to the Contractor and the surety of such delay, neglect, or default on the part of the Contractor, will have power and authority, without violating the contract to:

• declare the Contractor in default;
• take the completion of the work out of the hands of the Contractor;
• appropriate or use any or all material and equipment of the Contractor assembled for the project;
• enter into a contract or contracts for the completion of the work, according to the contract; or
• use such other methods that will be expedient for the completion of the contract in a satisfactory manner.

(b) Completion by Surety. The Commission may elect to take the performance of the work from the Contractor and may at that time notify and require the surety to complete the contract according to its terms. Also, require the surety to render within 3 months from acceptance of the project date, but before final payment, a detailed statement of the costs of the completion of the work, including receipts and disbursements of all funds received and paid on account. However, the responsibility of the surety extends only to the limit of the bond amount.

(c) Completion by Commission Forces. The Commission may elect to take the performance of the work from the Contractor and fulfill the contract with Commission forces. At that time and in the Commission's name, the Commission may take all right, title and interest in and to the equipment and material owned by the Contractor and assembled for use in the execution of the contract, and may use them for completion.

(d) Settlement of Contract. If the contract completion by any of the methods specified results in financial loss to the Commission, the Commission may dispose of any of the remaining equipment and material taken over under Section 108.07(a) or (c), without further legal process and in the manner that may be considered in the Commission's best interests. Any equipment or material not required for
completion or recoupment of loss, or for legal charges against the contract, or any balance remaining from the disposition of material and equipment after deducting losses by the Commission, or any legal charges against the contract, will be turned over to the party legally or equitably entitled to them.

In the event the contract is completed by Commission forces, all proper costs and legal charges incurred by the Commission in connection with the contract will be deducted from money due or to become due to the Contractor. The Commission will credit the Contractor with the amount realized from the disposal of equipment or material.

If legal charges against the contract and the expense incurred by the Commission in connection with contract completion by any of the methods specified, less the credits herein provided for, exceed the sum which would have been payable under the contract for the completed work, the Contractor or the surety are liable to the Commission for the excess amount.

If such legal charges and expenses are less than the contract value of the completed work, the difference will be paid to the Contractor or such difference may be paid to the surety, in an amount not exceeding the total amount which has been paid by the surety on its obligations under the Performance Bond and the Payment Bond. In this event, the surety is required to furnish evidence satisfactory to the Commission that such payments have been made and that any balance remaining after payment to the surety will be paid to the Contractor.

(e) Termination Clause. The Commission may, by written notice, terminate the contract or any portion because of any of the following conditions:

- the Contractor is prevented from proceeding with the construction contract as a direct result of a President's Executive Order with respect to the occurrence of war or in the interest of national defense;

- the Commission or the Contractor is prevented from proceeding with the construction contract as a direct result of an Order of a Court of competent jurisdiction;

- funds necessary for the project completion become unavailable;

- for the Commission's convenience, the Commission has determined that such termination will be in the Commission's best interest; or

- all of the work of any controlling operation is delayed for more than 90 consecutive calendar days, for any cause beyond the responsibility of the Contractor. The Commission may enter into an Agreement with the Contractor or may terminate the contract by written notice to the Contractor. If an agreement is entered into, it will be executed by the Contractor and the Commission, approved by the Surety and the Chief Counsel, or their designees.

When the contract, or any portion is terminated before completion of all items of contract work, payment will be made for each unit of work fully completed at the contract unit price and payment for each partially completed unit of work will be as mutually agreed or at the percentage of the contract unit price that the cost of the partially completed unit is of a fully completed unit with a maximum allowable of 100%. No claim for lost profits or damages of any kind will be allowed for the termination.

Acceptable material, obtained by the Contractor for the work, will be purchased from the Contractor at actual cost, as shown by receipted bills and actual cost records, at such points of delivery as may be designated.

Termination of any portion of the contract does not relieve the Contractor of responsibilities for the completed work, nor will it relieve the surety of its obligation for any claim arising out of the performance of the work.
108.08 NONCOMPLIANCE BY THE CONTRACTOR — In addition to the elective measures the Commission may take for violation of the contract, as provided in Section 108.07, the Commission will 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 Sections 105.03, 107.07, 107.10(d) or 109.03(d):

- The Commission may shut down the work until the requirements of the violated section are met. In this event, no remission will be made in contract time for the period for which the work is shut down.
- The Commission may withhold payment of estimates for work completed until the requirements of the violated section are met.
- The Commission may enter upon the project and perform all work necessary to meet the requirements of the section violated, then deduct the cost from money due or to become due to the Contractor or the surety. If the Contractor fails to comply with the requirements of Sections 107.07 and 107.10(d), the Commission will not proceed until 48 hours after written notice to the Contractor and the surety that the Commission will take such action.
- The Commission has the right to enter upon the project and repair or replace public or private property which has been damaged in violation of Section 107.07, to estimate the amount of such damage, and to deduct the amount from money due or to become due to the Contractor or the surety. When money is deducted as provided, the Commission will settle with the property owner and secure a written statement, releasing the Commission and the Contractor from further responsibility for such damage.

108.09 STRIKES OR LABOR DISPUTES — Time extensions will be considered appropriate in the event of a strike or labor dispute which causes, despite all reasonable efforts of the contractor to avoid it, a shutdown of the entire project or of one or more controlling operations, whether the strike or labor dispute involves a union bargaining with the Contractor, a subcontractor, the Commission, or third parties. In no event, however, will the Contractor be entitled to any delay costs for labor, material, equipment, or related expenses such as overhead or administrative costs, profit, etc., resulting from the strike or labor dispute, regardless of whether the strike or labor dispute involves a union bargaining with the Contractor, a subcontractor, the Commission, or third parties affecting a controlling operation.

However, reimbursement for additional costs to maintain required signs and devices for the maintenance and protection of traffic during the temporary suspension of work will be made in accordance with the provisions of Section 109, Payment.

SECTION 109 — PAYMENT

109.01 GENERAL — Payment for items of work performed under this contract will be made at the contract price per unit of measure, complete in place. Unless otherwise specified, the contract unit price will cover all costs for materials, labor, and equipment:

- specified, described, or identified in each section of the specifications (including the special provisions and plans);
- identified in each section of the specifications (including the special provisions and plans) as "as required" or "as directed"; or
- permitted or allowed under the specifications (including the special provisions and plans) and for which payment is not expressly provided.
In addition to the above, the contract price includes all other costs incurred in performing work on the project (e.g., home office overhead) and all profit. The contract price is accepted as payment in full for all risk, loss, damage, or expense of every kind arising out of the nature of the work or the performance thereof, subject to the provisions of Section 107.14.

Work specified as "incidental" in the specification for a contract item is to be considered as an additional obligation to the other work required for the item(s). This incidental work is not payable directly, but is to be considered included in the contract price for the item(s) of work specified.

Removal and replacement of defective work, as specified in Section 105.12, will not be paid by the Commission.

No payment will be made for work in excess of that indicated, shown, or specified, unless otherwise accepted in writing by the Commission.

Work, material, or labor specified for an item will not be measured or paid for again under any other indicated pay items.

109.02 DIFFERING SITE CONDITIONS, SUSPENSIONS OF WORK, AND SIGNIFICANT CHANGES IN THE CHARACTER OF WORK —

(a) General. If differing site conditions, changes in quantities, or alterations of the construction drawings will significantly increase or decrease the cost of performing the work directly affected, perform such work only when authorized in writing, as specified in Section 109.03(a). Payment for such work will be made under Section 109.03.

(b) Differing Site Conditions. During the progress of the work, if subsurface or latent physical conditions are encountered at the site, differing materially from those indicated or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work, are encountered at the site, the party discovering such conditions is responsible for promptly notifying the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.

Upon written notification, the Representative will investigate the conditions, and if it is determined that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding loss of anticipated profits, will be made as specified in Section 109.02(a). The Representative will notify the Contractor of the determination whether or not an adjustment of the contract is warranted.

No contract adjustment which results in a benefit to the Contractor will be allowed unless the contractor has provided the required written notice.

No contract adjustment will be allowed under this section for any effects caused on unchanged work.

(c) Suspensions of Work Ordered by the Representative. If the performance of all or any portion of the work is suspended or delayed by the Representative in writing, in accordance with Section 107.10(c), for an unreasonable period of time (not originally anticipated, customary, or inherent to the construction industry) and the Contractor believes that additional compensation and/or contract time is due as a result of such suspension or delay, submit to the Representative, in writing, a request for adjustment within 7 calendar days of receipt of the notice to resume work. Set forth the reasons, and support for such adjustment, in the request.

Upon receipt, the Representative will evaluate the Contractor's request. If the Representative agrees that the cost and/or time required for the performance of the contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the Contractor, its suppliers, or subcontractors, and not caused by weather, the Representative will make an adjustment,
excluding profit, in accordance with Section 109.03 and Section 108.05, as applicable. The Representative will notify the Contractor of the determination whether or not an adjustment of the contract is warranted.

No contract adjustment will be allowed unless the Contractor has submitted the request for adjustment within the time prescribed. No contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under Section 107.10(c).

(d) Required Changes in the Scope of Work. The Commission reserves the right to make, in writing, at any time during the work, such changes in quantities and such alterations in the work as are necessary to satisfactorily complete the project. Such changes in quantities and alterations will not invalidate the contract nor release the surety, and the Contractor agrees to perform the work as altered.

If alterations in the work or changes in quantities do not significantly change the character of the work to be performed under the contract, the work will be paid for at the original contract unit price.

If alterations in the work or changes in quantities significantly change the character of the work under the contract, whether such alterations or changes are in themselves significant changes to the character of the work or by affecting other work cause such other work to become significantly different in character, an adjustment, excluding loss of anticipated profits, will be made as specified in Section 109.03. The basis for the adjustment will be agreed upon before the performance of the work. If a basis cannot be agreed upon, the work will be paid for as extra work as specified in Section 109.03.

The term "significant change" applies only to the following circumstances:

- If the character of the work as altered differs materially in kind or nature from that involved or included in the original proposed construction, or

- If an item of work is increased in excess of 125% or decreased below 75% of the original contract quantity. Any allowance for an increase in quantity applies only to that portion in excess of 125% of original contract item quantity or, in case of a decrease, below 75% to the actual amount of work performed.

When a contract item experiences a significant change in character as a result of a decrease to below 75% of the original contract quantity, the actual quantity of work performed may be paid at an adjusted price, as agreed upon with the Contractor and approved; however, total compensation will not exceed the contract item’s original value. Item value is defined as the original contract quantity multiplied by the contract unit price.

(e) Adjustment of Lump Sum Items. The original contract price for any lump sum item will be adjusted only if differing site conditions, as specified in Section 109.02(b), or changes directed by the Representative will significantly increase or decrease the cost of performing the work. If the Representative determines that conditions materially differ and cause an increase or decrease in the cost or time for performance of the work, or if increases or decreases in quantities are required due to a change directed by the Representative, adjusted payment will be made as specified in Section 109.03.

109.03 ADDITIONAL WORK, EXTRA WORK, AND EXTRA WORK ON A FORCE ACCOUNT BASIS —

(a) General. Work specified in Sections 104.02 and 104.03 will be paid, if authorized in writing by the Representative, as additional work, extra work, or extra work on a force account basis. Compensation will be limited to the work authorized in writing and actually performed. Work performed before written authorization will be at the Contractor’s risk.
A change order identifying the work to be done and the price to be paid therefore will be processed before or during the performance of the work. To avoid interrupting the project, written authorization to perform work under this section will be in the form of a letter, telegram, mailgram, or other writing from the Representative, or the Inspector-in-Charge, in writing to the Contractor when confirming an oral authorization of the Representative, issued within a reasonable length of time.

If the work is to be paid as additional work, the Representative's writing will refer to the contract price for that work.

If the work is to be paid as extra work and:

- is such that a reasonable price therefore can be negotiated, and
- is such that force account records, if necessary, can be kept by the Commission,

the Representative's writing will authorize commencement of work as extra work. Within 10 calendar days of such authorization, submit a price for the extra work with back-up data to the Representative. Pending approval of the price, force account records will be kept as stated below. If the price is accepted, the work will be paid only at the negotiated price, which will not be renegotiated once submitted for acceptance.

If the work is to be paid as extra work and:

- the Contractor and Representative cannot agree on a tentative price, therefore, and
- the work is such that force account records cannot be kept by the Commission,

the Representative's writing will contain a firm, binding price determined by the Representative to be fair and equitable for the work to be performed.

If the Representative and Contractor cannot agree on a tentative price for the extra work and if the work is such that force account records can be kept by the Commission, the Representative's writing will state that such work is to be paid on a force account basis. Force account records will be kept as stated below.

Payment for additional work, extra work, and extra work on a force account basis is accepted as payment in full for all profit and for all equipment, labor, material, field overhead, home office and general administrative expenses, and every other expense incurred as a result of the additional or extra work. No claims for additional compensation of any kind arising out of or relating to such work can be asserted against the Commission with the Board of Claims.

(b) Additional Work. This includes only the following:

- work of the type already provided by the contract and

Perform all such work only when authorized in writing by the Representative, as stated in Section 109.03(a).

All additional work will be paid at the contract price and in the same manner as if it had been included in the original contract.

(c) Extra Work. This includes only the following:
• work arising from changes described in Section 109.02 which result in a significant increase or decrease in the cost of performing that work, or

• work, having no quantity and/or price included in the contract, which is determined by the Representative to be necessary or desirable to complete the project.

Perform all such work only when authorized in writing by the Representative, as stated in Section 109.03(a). All extra work will be paid only as stated in Section 109.03(a).

(d) Force-Account Work. Perform all extra work on a force account basis only when directed in writing by the Representative, as stated in Section 109.03(a).

The Commission will keep records of extra work done on a force account basis. Compare force account records with those kept by the Commission, at the end of each day or as directed, to ensure accuracy and obtain concurrence. Report any unresolved disagreements with such records to the Representative. Failure to review the Commission’s records or to report disagreements with such records will create a presumption that the Commission’s records are complete and accurate.

Payment for extra work performed on a force account basis will be made, as specified herein, upon completion of the work. Progress payments will be made only when an itemized estimated force account of cost is provided, in writing, within 10 working days after receipt of the Commission’s written authorization to perform the extra work on a force account basis.

1. Labor. Wages of forepersons; equipment operators; and skilled, semiskilled, and common laborers directly assigned to the specific operation will be reimbursed, as direct labor costs, at the actual base pay rate and fringe benefit rate paid, for each hour that such employees are engaged in the performance of authorized work and, if directed, overtime as provided for in existing laws and regulations.

Indirect labor costs will be allowed as a percentage of the total base labor cost. However, if certified payroll records indicate that the Contractor’s method of making payment is such that fringe benefits are paid directly to the worker, indirect labor costs will be allowed as a percentage of the total direct labor cost. Compute indirect labor costs as follows:

• Social Security Tax at the percentage legally required;

• Medicare Tax at the percentage legally required;

• Unemployment Taxes at the estimated effective rate;

• Workers’ Compensation Insurance at the policy percentage rate as adjusted for experience modifiers;

• Contractor’s Public Liability Insurance at the policy percentage rate; and

• Contractor’s Property Damage Liability Insurance at the policy percentage rate, including coverage for damage due to blasting and explosions, when additional coverage is required on projects involving blasting.

Compute estimated effective rates for the current calendar year by dividing the Contractor’s total, company-wide Unemployment Tax payments for the previous calendar year by the total wages and salaries paid to all employees for the same period. Recompute estimated effective rates each year thereafter, for the duration of the project, based on the previous calendar year’s total wages and salaries and total tax payments.
2. **Material.** The cost of material used will be reimbursable, including applicable sales tax and transportation costs charged by the material supplier.

3. **Equipment.** Reasonable rental rates for equipment, including trucks and machinery, mutually considered necessary, will be allowed, computed as follows:

3.a ** Owned Equipment.** For any Contractor-owned equipment, an hourly rental rate will be determined using the monthly rate listed in the applicable edition of the Rental Rate Blue Book for Construction Equipment (Blue Book), Volume 1. The Blue Book edition in effect as of the first day that work is performed on a specific force account is the edition that will remain applicable throughout the performance of such work. The applicable edition of the Blue Book will be authorized for use statewide on a specified date.

   The hourly rental rate for owned equipment will be computed by dividing the monthly rate listed in the Blue Book by 176. Apply to this rate, the area adjustment percentage for the State and the age adjustment percentage for the model year of the piece of equipment, as shown on the Regional Adjustment Maps and in the Rate Adjustment Tables, respectively, located at the beginning of each section of the Blue Book.

   An allowance will be made for operating costs by adding, to the above adjusted hourly rate, the estimated operating cost per hour, as listed in the Blue Book, for each hour that the equipment or machinery is actually in operation on the force account work. If equipment or machinery is required at the work site on a standby basis, but is not operating, compensation will be at 50% of the adjusted hourly rate, exclusive of operating costs.

   Equipment used for maintenance and protection of traffic on a 24-hour basis will be reimbursed at a daily rental rate, which will be determined by dividing the monthly rate listed in the Blue Book by 22.

   Where Contractor-owned equipment or machinery is not listed in the Blue Book, a rental rate will be determined based on the manufacturer’s list price for sale (new) of such equipment. In these cases, the monthly rate will be computed as 6% of the sale price (new), and the total hourly rate determined by dividing the monthly rate by 160, when operating, and by 352, when required at the work site on a standby basis, but not operating, with no adjustment percentages applied. For equipment used for maintenance and protection of traffic on a 24-hour basis, with no listing in the Blue Book, the daily rental rate will be computed as 6% of the manufacturer’s list price for sale (new) of the equipment divided by 22, with no adjustment percentages applied.

   The rates established above include the cost of fuel; oil; lubrication; supplies; necessary attachments; repairs; overhaul and maintenance of any kind; storage; all costs of moving equipment on to and away from the work site, except as specified below; and all incidentals.

   The Commission will not approve any costs in excess of those outlined above unless such costs were incurred for the convenience of the Commission, as directed, and are supported by an acceptable cost breakdown. If a piece of owned equipment, not already on or near the project site, is needed specifically for the force account work, the cost of moving the equipment on to and away from the work site will be reimbursed, provided the equipment will not be used immediately thereafter in the performance of original contract work.

   The term “owned equipment”, as used above applies to equipment (including trucks and machinery) which the Contractor is required to provide for the proper execution of the contract work, as specified in Section 108.04(c), whether the equipment is actually owned directly by the Contractor, is leased, or has been obtained in some other manner.

3.b ** Rented Equipment.** If a piece of equipment needed for the force account work is not of the type required to be provided by the Contractor for the proper execution of the contract work, or if
the piece of equipment needed is “owned” but not currently available, and the equipment can be obtained by rental, discuss the need to rent the equipment with the Representative and obtain approval of the rental rate to be paid before renting the equipment for the force account work.

Additionally, if an item is purchased specifically for the force account work, but does not become a permanent part of the work, the item will be considered rented equipment for cost reimbursement purposes. If the item’s useful life is completely expended in the performance of the work, as determined by the Representative, the full cost of the item will be reimbursed, including applicable sales tax and transportation costs. Otherwise, that portion of the item’s useful life expended in the performance of the force account work will be determined and reimbursement made at a prorated cost.

The Contractor will be reimbursed the actual invoiced cost for rented equipment, plus the cost of transporting the equipment to and from the work site. An allowance will be made for operating costs by adding, to the rental cost, the estimated operating cost per hour, as listed in the Blue Book, for each hour the rented equipment is actually in operation on the force account work. Furnish a copy of the invoice, receipt, or canceled check as support for the rental expense incurred.

Transportation charges for each piece of rented equipment, to and from the site of the force account work, will be paid provided:

- Equipment is obtained from the nearest available source,
- Return charges do not exceed the delivery charges,
- Haul rates do not exceed the established rates of licensed haulers, and
- Charges are restricted to those units of equipment not readily available and not on or near the project.

4. Services by Others. For specialized construction analyses, engineering services, or work not considered subcontract work, the Contractor will be reimbursed the invoice price plus 2% to cover administration and all other costs. Furnish a copy of the invoice, receipt, or cancelled check as support for the expense incurred. The markup on service by others costs will be limited to 2% only, regardless of whether the service was arranged by the Contractor or a subcontractor performing any or all of the force account work. The overhead and profit allowances specified in Section 109.03(d)7 are not applicable to service by others costs.

5. Permits, Bonds, and Insurance. When specifically required for the force account work, as directed, the securing of permits, bonds, or specialized insurance coverage, of a type not already required by the contract, will be considered service by others, as specified in Section 109.03(d)4, and reimbursement of the permit fee, bond price, or insurance premium paid will be allowed plus the specified markup.

6. Subcontracting. Payment for work performed by a subcontractor, will be determined based on a complete statement of applicable material, labor, and equipment costs, computed as specified herein, plus applicable markups for overhead and profit.

7. Overhead and Profit. Except for work considered to be service by others, as specified in Section 109.03(d)4, to cover all administration, general and project superintendence, other overhead, bonds, insurance, anticipated profit, and use of small tools and equipment for which no rental is allowed, 20% will be added to the total material cost, 35% will be added to the total labor cost, and 5% will be added to the total equipment cost. If applicable, in addition to the above markups, 6% will be added to the total cost of any force account work performed as approved subcontract work as specified in Section 109.03(d)6.
8. **Statements.** Final payment will not be made for work performed on a force account basis until the Contractor has furnished the Representative with an itemized statement of the cost of the work, in the form of a properly completed force account record, detailed as follows:

- Name, classification, work dates, daily hours, total hours, base pay rate, fringe benefit rate, total pay rate and extension for each foreperson; equipment operator; and skilled, semi-skilled, and common laborer;

- Description (year, make, model, capacity, etc.), use dates, daily hours, total hours, rental rates (operating and standby) and extension for each piece of rented equipment and/or description, rental cost, transportation costs (if separate), and extension for each piece of rented equipment;

- Description, quantity, unit price and extension for all materials, applicable sales tax, and transportation costs charged by the material supplier;

- Name, description, unit price and extension for all services by others; and

- Rates (legally required, estimated effective, or policy percentage) paid for property damage and public liability insurance, workers’ compensation insurance, unemployment taxes, medicare tax, and social security tax.

Statements of labor costs are to be supported by certified payroll records. Statements of material costs (including sales tax and transportation costs) and service by others costs are to be supported and accompanied by invoices.

If materials used in the force account work are not specifically purchased for the work but are taken from the Contractor’s stock or provided by entities that are divisions, affiliates, subsidiaries or in any other way related to the Contractor or its parent company, furnish an affidavit certifying that the materials were obtained as described above, that the quantity claimed was actually used, and that the price and transportation costs claimed were actually incurred.

(e) **Disputes.** Notwithstanding the provisions of Section 105.01, in the event of a disagreement with the Representative as to whether work is:

- original contract work or additional work,
- original contract work or extra work, or
- additional work or extra work,

notify the Inspector-in-Charge immediately of such disagreement and confirm the disagreement in writing to the Representative within 10 calendar days. Upon notification to the Inspector-in-Charge of such disagreement, records will be kept daily of all labor, equipment and materials used from that day forward in the disputed work. Keep and maintain such daily records in the field. Claim no extra costs of any kind for work performed before notifying the Inspector-in-Charge of disagreements with the Representative's decision. On each Monday, compare records of the previous week's work with those kept by the Commission and review for accuracy. Report to the Representative within 10 calendar days of each review all disagreements with such records or to report disagreements with such records. Refusal or repeated failure to meet to review the Commission's records or to report disagreements with such records will create an irrebuttable presumption in favor of the Commission that its records are accurate.
Disputes concerning all such work will be resolved by the Representative and payment will be made on the basis determined by him.

In the event of a disagreement with the decision of the Representative, comply with provisions of Section 105.01 concerning due notice in writing of an intent to file a claim and send a copy of the written notice to the Representative within the time frame allowed by that section. If written notice is not submitted to the Representative within 10 days of receipt of the Representative's decision, daily records of labor, equipment and materials will no longer be kept by the Commission and no claim for additional compensation of any kind arising from or relating to the disputed work or the decision of the Representative can be filed with the Board of Claims.

If due notice in writing is submitted to the Representative within the 10 calendar-day period, continue to keep and review daily records, as provided above, until completion of the disputed work.

With the exception of those specific daily records or portions thereof on which written disagreements were filed with Representative as provided above, any claim for damages filed with the Board of Claims arising out of or relating to the disputed work or the decision of the Representative can be measured at the hearing solely by the aforementioned daily records kept by the Commission.

109.04 CURRENT ESTIMATE PAYMENTS — No later than 30 calendar days after acceptance of the current estimate, the Commission will make partial payment to the Contractor for work performed during the specified estimate period.

The Commission will retain 5% of the amount due the Contractor for the duration of the contract. All monies retained by the Commission may be withheld from the Contractor until release of final payment.

Unless otherwise noted, the Commission will prepare the final estimates for partial payment and submit them to the Contractor for verification and certification of the performed during the preceding 30 days.

Within 7 calendar days of the receipt of current estimate and final payments from the Commission, pay all subcontractors their earned share of the payments, including any and all retainage, provided the terms and conditions of the applicable subcontract or purchase agreement have been reasonably met.

109.05 FINAL INSPECTION, ACCEPTANCE, AND FINAL PAYMENT

(a) Final Inspection. When the project is substantially complete, make arrangements for a mutual final inspection. Substantial completion is the date when at least 90% of the contract work has been completed and the project can be used, occupied, or operated for its intended use.

At the time of final inspection, the Representative, along with the Contractor, will establish the following:

- The date of final inspection;
- The list of all physical work items, by stations and in detail, requiring completion and/or correction; and
- A list of all certificates or documents requiring submission, completion, and/or correction.

As established during the final inspection, perform work as necessary for required correction or completion of all physical work items, and complete, correct, and submit all outstanding certificates and documents.

The Contractor will be relieved of responsibility for further physical work, maintenance, and third-party liability only for work items which are satisfactorily completed at the time of, or subsequent to, the final inspection. The Contractor’s responsibility for further physical work, maintenance, and third-party liability remains for work items, which are not satisfactorily completed at the time of, or subsequent to,
the final inspection. When all physical work has been satisfactorily completed according to the requirements of the contract, the Representative will establish the Date of Physical Work Completion.

Upon receipt and verification, the Representative will establish the date that all required certificates and/or documents are satisfactorily furnished.

When all physical work has been satisfactorily completed and all contractually required certificates and documents have been properly furnished, the date of project acceptance will be established.

If any substantial project section has been completed in advance of the whole, a final inspection will be made of that section and the Contractor will be relieved of responsibility for further physical work, maintenance, and third-party liability on the section of the project as specified in Section 108.03(b). The final inspection will be conducted as specified for the entire project; except, the date of project acceptance will not be established nor will an acceptance certificate be issued.

(b) Project Acceptance. Upon completion of all work and following the final inspection by the Representative, the Representative will certify that the project is accepted.

(c) Final Payment Computations. The Representative will compute the entire amount of each contract work item performed and its contract value. The Representative will notify the Contractor of the amount for each item, including additions to and deductions from the contract quantity for each item of work, all other legal and equitable additions and deductions to be made, amounts previously paid, and the net amount of the final payment computations. The Representative will request written acceptance of, or exception to, these final payment computations within 10 days of the notification.

109.06 RELEASE OF FINAL PAYMENTS – The Commission may withhold the final payment pending the receipt of release by surety.

Foreign corporations and their sureties will not be discharged from liability on the bond, nor the bond surrendered, until the corporation files the following with the Commission:

- a certificate, from the Department of Revenue, proving the payment in full of all bonus taxes, penalties, and interest; and

- a certificate, from the Bureau of Employment and Unemployment Compensation of the Department of Labor and Industry, as required by the Act of June 10, 1947, P.L. 493 (8 P.S.23).

SECTION 110 — DELAY CLAIMS

110.01 COMPENSABLE DELAYS — The Commission is responsible for delay damages arising only from delays created by its negligent acts or omissions and from Utility Infrastructure and Utility Adjustment delays as specified in Section 105.06. Unless otherwise specified, assume the risk of damages from all other causes of delay.

110.02 GENERAL CONDITIONS CONCERNING DELAY CLAIMS — Because of the nature and extent of damages arising out of work that has been delayed; of the need for the Commission to be made aware of potential delay claims promptly after the cause or causes of delay have arisen so that record-keeping can begin; and of the parties' intent to have all such claims as fully documented as possible, strict adherence to the provisions of this section is an essential condition precedent to filing a delay claim with the Board of Claims. The following items of damage cannot be included in any delay claim against the Commission:

- profit;
• loss of profit;

• labor inefficiencies;

• home office overhead, including but not limited to costs of any kind for home office personnel; and

• consequential damages, including but not limited to loss of bonding capacity, loss of bidding opportunities, and insolvency.

110.03 NOTIFICATION OF DELAY CLAIM — Notwithstanding the provisions of Section 105.01, within 10 calendar days of any negligent act or omission of the Commission or of any Utility Infrastructure or Utility Adjustment delay as specified in Section 105.06, notify the Inspector-in-Charge that operations have been or will be delayed and that a claim for delay damages either is going to or might be filed with the Board of Claims. Confirm such notification in writing to the Representative within 10 days of such notification to the Inspector-in-Charge.

110.04 PROCEDURES — Upon notifying the Inspector-in-Charge as provided above, keep records, on a daily basis of all labor, material, equipment and site overhead expenses for all operations that are affected by the delay. Identify in such daily records each operation and the station or stations thereof affected by the delay. The Commission’s forces will also keep daily records of all labor, equipment, material, and site overhead expenses for all operations affected by the delay. On each Monday, compare the previous week's daily records with those kept by the Commission and review for accuracy. Report to the Representative within 10 calendar days of each such review all disagreements with such records. Refusal or failure to meet to review the Commission's records or to report disagreements with such records will create an irrebuttable presumption in favor of the Commission that its records are accurate. Make no claim for delay costs of any kind allegedly incurred, before notifying the Inspector-in-Charge that operations have been delayed.

On a weekly basis, prepare and submit to the Inspector-in-Charge written reports containing the following information:

(a) The number of days behind schedule.

(b) An identification of all operations that have been delayed, or are to be delayed.

(c) An explanation of how the Commission's negligent act or omission or the Utility Infrastructure or Utility Adjustment as specified in Section 105.06 delayed each operation and an estimation of how much time is required to complete the project.

(d) An itemization of all extra costs being incurred, including:

• An explanation as to how those extra costs, including site overhead costs, relate to the delay and how they are being calculated and measured;

• An identification of all project employees for whom costs are being compiled; and

• An identification of the manufacturer's numbers of all items of equipment for which costs are being compiled.
Upon completion of the project, submit to the Inspector-in-Charge and the Representative copies of a report containing the following information:

- An itemization and explanation of the measurement and basis of all extra costs being sought, including all reports certified by an accountant;
- A description of the operations that were delayed, including all reports by scheduling experts or other consultants, if any; and
- An as-built chart, CPM scheme or other diagram depicting in graphic form how the operations were adversely affected; and
- For delays related to Utility Infrastructure and Utility Adjustments, an explanation of why the delay was unforeseen based on the contract documents and a careful pre-bid examination of the project site, or of any waste or borrow sites designated in the proposal.

The Representative will review the submission and any reports prepared by the Inspector-in-Charge. If, in the opinion of the Representative, the Commission is not responsible for any delay, a written decision will be issued. Comply with the provisions specified in Section 105.01 if the Representative's decision is disputed.

If the Representative determines that the Commission delayed operations, a review of the damages claimed will be made and a written decision will be issued. Comply with the provisions specified in Section 105.01 if the Representative's decision is disputed.

Only expenses for extra labor, material, equipment, and site overhead will be considered by the Commission in the event the Representative determines that operations were delayed by the Commission. Ten percent will be added to these costs to cover allocable home office overhead. Likewise, in the event a delay claim is filed with the Board of Claims, only the foregoing expenses may be claimed.

If computing additional equipment expenses (i.e., ownership expenses) arising as a direct result of a delay caused by the Commission, do not use, in any way, the Rental Rate Blue Book for construction equipment or any other rental rate book. Use actual records kept in the usual course of business, and compute increased ownership expenses pursuant to generally accepted accounting principles.

**SECTION 111 — PROJECT RECORDS**

111.01 SCOPE — This section pertains to all project records that were used to prepare and compute the bid; to prepare all schedules used on the project; to record the progress of work on the project; and to record, compute and/or analyze all costs incurred on the project, including those used in the preparation or presentation of claims to the Commission or the Board of Claims.

111.02 DEFINITION — Charts, graphs, cross-sections, plans, photographs, schedules, reports, accounting statements, accounting ledgers, balance sheets, bid sheets, take-off sheets, cost estimates, cost records, payroll records, financial documents, notes, memoranda, correspondence and all other records, whether typewritten, handwritten, computerized, microfilmed, photographed, or recorded, that were prepared by or received by the Contractor.

111.03 RETENTION PERIOD — Retain the aforementioned project records for a period of 3 years from the date of receipt of final payment with the following exception:

- If any litigation, claim, or audit is started before the expiration of the 3-year period, retain the records until all litigations, claims, or audit findings involving the records have been resolved.
111.04 INSPECTION — Upon written notice by the Representative or an authorized agent acting on behalf of the Commission, make available all requested project records for inspection and copying by Commission personnel or those authorized to act on its behalf. Make such records available at a reasonable time and place.

Refusal or repeated failure to present requested project records for inspection or copying may be considered grounds for declaring the Contractor in default and may be considered against qualification for work on future projects.

Exempt from this section are all project records, which under the Pennsylvania Rules of Civil Procedure, are deemed confidential and, therefore, exempt from discovery.

SECTION 112 — RECIPROCAL LIMITATIONS ACT REQUIREMENTS FOR CONSTRUCTION

112.01 REQUIREMENTS

(a) States Which Apply Preference Favoring In-State Bidders. The Reciprocal Limitations Act; Act 146 of 1986 requires the Commission to give resident bidders a preference against a non-resident bidder from any state that gives or requires a preference to bidders from that state. The amount of the preference will be equal to the amount of the preference applied by the state of the non-resident bidder. The following is a list of the states which have been found by the Department of General Services to have applied a preference for in-state bidders and the amount of the preference:

<table>
<thead>
<tr>
<th>STATE</th>
<th>PREFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Arizona</td>
<td>5% (construction materials from Arizona resident dealers only)</td>
</tr>
<tr>
<td>2. Montana</td>
<td>3%</td>
</tr>
<tr>
<td>3. West Virginia</td>
<td>2.5% (construction, repair, or improvement of any buildings)</td>
</tr>
<tr>
<td>4. Wyoming</td>
<td>5%</td>
</tr>
</tbody>
</table>

(b) States Which Prohibit Use of Out-of-State Goods, Supplies, Equipment, or Materials. The Reciprocal Limitations Act also requires the Commission not to specify, use or purchase any goods, supplies, equipment or materials which are produced, manufactured, mined or grown in any state that prohibits the specification for, use or purchase of such items in or on its public buildings or other works when such items are not produced, manufactured, mined or grown in such state. The following is a list of the states which have been found by the Department of General Services to have prohibited the use of out-of-state goods, supplies, equipment, materials or bidders and the type of prohibition:

<table>
<thead>
<tr>
<th>STATE</th>
<th>PROHIBITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Georgia</td>
<td>Forest Products Only</td>
</tr>
<tr>
<td>2. New Mexico</td>
<td>Construction</td>
</tr>
</tbody>
</table>

If the bid discloses that the bidder is offering to supply one of the above-listed products from the listed state, it will be rejected. Contractors are prohibited from supplying these items from these states.
112.02 **CALCULATION OF PREFERENCE** - In calculating the preference, the amount of a bid submitted by a Pennsylvania bidder will be reduced by the percentage preference which would be given to a non-resident bidder by its state of residency only for the purpose of determining the apparent low bidder.

**SECTION 113 — CONTRACTOR INTEGRITY PROVISIONS**

**113.01 DEFINITIONS**

(a) **Definitions.**

1. Confidential information means information that is not public knowledge, or available to the public on request, disclosure of which would give an unfair, unethical, or illegal advantage to another desiring to contract with the Commission.

2. Consent means written permission signed by a duly authorized officer or employee of the Commission, provided that where the material facts have been disclosed, in writing, by prequalification, bid, proposal, or contractual terms, the Commission will be deemed to have consented by virtue of execution of this agreement.

3. Contractor means the individual or entity that has entered into this agreement with the Commission, including directors, officers, partners, managers, key employees, and owners of more than a 5% interest.

4. Financial Interest means:

   4.a ownership of more than a 5% interest in any business; or

   4.b holding a position as an officer, director, trustee, partner, employee, or the like, or holding any position of management.

5. Gratuity means any payment of more than nominal monetary value in the form of cash, travel, entertainment, gifts, meals, lodging, loans, subscriptions, advances, deposits of money, services, employment, or contracts of any kind.

(b) The Contractor will maintain the highest standards of integrity in the performance of this agreement and will take no action in violation of state or federal laws, regulations, or other requirements that govern contracting with the Commission.

(c) The Contractor will not disclose to others any confidential information gained by virtue of this agreement.

(d) The Contractor will not, in connection with this or any other agreement with the Commission, directly or indirectly, offer, confer, or agree to confer any pecuniary benefit on anyone as consideration for the decision, opinion, recommendation, vote, other exercise of discretion, or violation of a known legal duty by any officer or employee of the Commission.

(e) The Contractor will not, in connection with this or any other agreement with the Commission directly or indirectly, offer, give, or agree or promise to give to anyone any gratuity for the benefit of or at the direction or request of any officer or employee of the Commission.
(f) Except with the consent of the Commission, neither the Contractor nor anyone in privity with him will accept or agree to accept from, or give or agree to give to, any person, any gratuity from any person in connection with the performance of work under this agreement except as provided therein.

(g) Except with the consent of the Commission, the Contractor will not have a financial interest in any other Contractor, subcontractor, or supplier providing services, labor, or material on this project.

(h) The Contractor, upon being informed that any violation of these provisions has occurred or may occur, will immediately notify the Commission in writing.

(i) The Contractor, by execution of this agreement and by the submission of any bills or invoices for payment pursuant thereto, certifies and represents that he has not violated any of these provisions.

(j) The Contractor will, upon the inquiry or request of the Commission's Operations Review office, will provide, or if appropriate, reasonably and promptly make available to that office and its representatives for inspection and copying, any information of any type or form deemed relevant by the Operations Review office to the Contractor's integrity, as that term is defined by Pennsylvania law or management directives. This information may include, but is not limited to, the Contractor's business or financial records, or documents or files of any type or form regarding this agreement. The Contractor will retain this information for three years beyond contract termination unless otherwise provided by law.

(k) For violation of any of the above provisions, the Commission may terminate this and any other agreement with the Contractor, claim liquidated damages in an amount equal to the value of anything received in breach of these provisions, claim damages for all expenses incurred in obtaining another Contractor to complete performance hereunder, and debar and suspend the Contractor from doing business with the Commission. These rights and remedies are cumulative, and the use or nonuse of any one will not preclude the use of all or any other. These rights and remedies are in addition to those the Commission may have under law, statute, regulations, or otherwise.
ATTACHMENT 1

PENNSYLVANIA BLACK WEEKLY NEWSPAPERS

The New Pittsburgh Courier  The Philadelphia Tribune
315 East Carson Street  520 South 16th Street
Pittsburgh, Pa 15219  Philadelphia, PA 19146-0990
Rod Doss, Editor, Publisher  Irv Randolph, Managing Editor
(412) 481-8302  (215) 893-4050

PENNSYLVANIA HISPANIC NEWSPAPER

LA ACTULADID
4953 North Fifth Street
Philadelphia, PA 19120
Mr. Eric Santos, Managing Editor
(215) 425-2201

PENNSYLVANIA BLACK RADIO STATIONS

WAMO  WDAS &
960 Penn Avenue, Suite 200  POWER 99-FM
Pittsburgh, PA 15222  111 Presidential Blvd., Ste. 100
Mr. Ron Davenport, Jr., Gen. Manager  Bala Cynwyd, PA 19004
(412) 456-4064  (610) 617-8500

PENNSYLVANIA HISPANIC RADIO STATIONS

WTEL Radio Station
555 City Line Avenue, Suite 330
Bala Cynwyd, PA 19004
(610) 539-0860

PENNSYLVANIA COMMUNITY-BASED ORGANIZATIONS

PITTSBURGH NAACP  URBAN LEAGUE OF PITTSBURGH
2203 Wylie Avenue  1 Smithfield Street, Third Floor
Pittsburgh, PA 15219  Pittsburgh, PA 15222
Mr. Tim Steven, President  Ms. Ester L. Bush, President & CEO
(412) 471-1024  (412) 227-4802

PHILADELPHIA NAACP  URBAN LEAGUE OF PHILADELPHIA
1619 W. Cecil B. Moore Avenue  1818 market St., 20th Floor
Philadelphia, PA 19121  Philadelphia, PA 19123
Mr. J. Whyatte Mondesire, President  (215) 561-6070
(215) 978-7500

GREATER HARRISBURG NAACP
P.O. Box 2757
Harrisburg, PA 17105
(717)233-2664
OTHER REFERRAL SOURCES:

Contact PennDot’s Supportive Services Center at Cheyney University:  http://penndbe.com/ (This online Center, made possible through an agreement with the Pennsylvania Department of Transportation (PennDOT), will provide online training, technical assistance and technical engineering support to Pennsylvania's Disadvantaged Business Enterprises (women- and minority-owned) wanting greater expertise about the process to secure Federal Highway Administration-aided contracts and subcontracts.)
Email: PENNDBE@CHEYNEY.EDU


COMMONWEALTH OF PENNSYLVANIA OFFICE OF ADMINISTRATION
Education, Training, and Development / Employment Opportunities: http://www.oa.state.pa.us

PA DEPARTMENT OF LABOR AND INDUSTRY
BUREAU OF WORKFORCE DEVELOPMENT PARTNERSHIP
PENNSYLVANIA CAREERLINK: One-Stop On-Line Resource for Job Seeker Services, Employer Services, Social Services, Resources and Training: http://www.pacareerlink.state.pa.us

EASTERN REGIONAL OFFICE – PHILADELPHIA
990 SPRING GARDEN STREET
PHILADELPHIA, PA 19123
Phone: (215) 560-1980

CENTRAL REGIONAL OFFICE – WILLIAMSPORT
208 WEST 3RD STREET, SUITE 303
WILLIAMSPORT, PA 17701
Phone: (570) 327-3647

WESTERN REGIONAL OFFICE – PITTSBURGH
300 LIBERTY STREET, ROOM 1307
PITTSBURGH, PA 15222
Phone: (412) 565-5725

CONSTRUCTION CONSULTANT SERVICES (CCS) INC: An independent contractor that provides On-The-Job Training (OJT) Supportive Services in support of PennDOT’s efforts to stimulate the interest of minorities and females in pursuing a career in highway construction industry.

CCS Provides participants with individualized counseling and monitoring necessary to ensure trainees are afforded the effective and quality training intended by the Department-approved training programs.

CONSTRUCTION CONSULTANT SERVICES, INC
SAINTE CLAIRE PLAZA, SUITE 1200A
1121 BOYCE ROAD, PITTSBURGH PA 15241
Phone: (724) 942-4860
Fax: (724) 942-4863
PENNSYLVANIA TURNPIKE COMMISSION  
HARRISBURG, PENNSYLVANIA 

Specifications 

For 

**Standby Power**

At The 

Somerset Interchange 
Turnpike MP 109.9 EB/WB 

In 

SOMERSET COUNTY, PENNSYLVANIA 

On The 

PENNSYLVANIA TURNPIKE 

CONTRACT NO. EN-00009-03 

SPECIAL PROVISIONS 

TABLE OF CONTENTS 

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>GENERAL</td>
<td>SP-1</td>
</tr>
<tr>
<td>1.02</td>
<td>QUALIFICATION OF BIDDERS</td>
<td>SP-2</td>
</tr>
<tr>
<td>1.03</td>
<td>PROJECT MEETING AND SITE REVIEW</td>
<td>SP-3</td>
</tr>
<tr>
<td>1.04</td>
<td>PREVAILING WAGES</td>
<td>SP-3</td>
</tr>
<tr>
<td>1.05</td>
<td>MATERIAL SUPPLY</td>
<td>SP-3</td>
</tr>
<tr>
<td>1.06</td>
<td>WORKING SCHEDULE</td>
<td>SP-4</td>
</tr>
<tr>
<td>1.07</td>
<td>PROTECTION AND COORDINATION OF UTILITIES</td>
<td>SP-4</td>
</tr>
<tr>
<td>1.08</td>
<td>SUBSURFACE INFOMATION</td>
<td>SP-5</td>
</tr>
<tr>
<td>1.09</td>
<td>EXCAVATION (UNCLASSIFIED)</td>
<td>SP-6</td>
</tr>
<tr>
<td>1.10</td>
<td>MAINTENANCE AND PROTECTION OF TRAFFIC</td>
<td>SP-6</td>
</tr>
<tr>
<td>1.11</td>
<td>ACCESS TO SITE</td>
<td>SP-7</td>
</tr>
<tr>
<td>1.12</td>
<td>PROTECTION OF FIXTURES EQUIPMENT AND PIPING</td>
<td>SP-7</td>
</tr>
<tr>
<td>1.13</td>
<td>EQUIPMENT MANUALS AND OPERATING INSTRUCTIONS</td>
<td>SP-7</td>
</tr>
<tr>
<td>1.14</td>
<td>CONTRACTOR'S GUARANTEE</td>
<td>SP-7</td>
</tr>
<tr>
<td>1.15</td>
<td>APPROVAL OF EQUIPMENT AND MATERIAL</td>
<td>SP-8</td>
</tr>
<tr>
<td>1.16</td>
<td>AS-BUILT DRAWINGS</td>
<td>SP-9</td>
</tr>
<tr>
<td>1.17</td>
<td>EMERGENCY TELEPHONE NUMBERS</td>
<td>SP-9</td>
</tr>
<tr>
<td>1.18</td>
<td>PERMITS, LICENSES AND CERTIFICATES</td>
<td>SP-9</td>
</tr>
<tr>
<td>1.19</td>
<td>HOLIDAY PERIODS</td>
<td>SP-9</td>
</tr>
</tbody>
</table>
1.01 GENERAL

A. The following sections on pages 8-14 of the “General Provisions For Facilities Projects” (GPFP) do not apply to this project:

2. Section 102.05 – Bid Guaranty
3. Section 102.06 – Delivery of Bids
4. Section 102.07 – Withdrawal or Revision of Bids
5. Section 103.04 – Surety Bonds

The contractor shall disregard the above referenced sections of the GPFP for this project. The contractor shall follow the instructions on the bid proposal form for bid submission and bonding requirements.

B. This contract is for the installation of the new stand-by generator system at the PA Turnpike’s Somerset Interchange. All work indicated by the contract drawings and specifications shall be performed by the Contractor.

C. It is the intent of this project that the Contractor shall provide all necessary labor, tools, equipment, materials, transportation, and appliances required in performing all operations in connection with construction work as described in these specifications and as shown, called for or implied by the contract documents. Work shall include any items not specifically listed or shown, but are required for a complete operating system.
D. All work associated with this project shall be performed at the following location on the Pennsylvania Turnpike in Somerset County, Pennsylvania:

1. Somerset Interchange, Turnpike MP 109.9 EB/WB

E. The work to be performed under this project shall include, but shall not be limited to, the following items for the above referenced toll plaza location:

1. Furnish and install one (1) new diesel-fueled 250kW generator, new exhaust system, 100-gallon day tank and connection to existing fuel storage tank. Installation of all required wiring and related appurtenances for the standby power system.

2. Furnish and installation of new prefabricated generator building, including generator exhaust system, heating, lighting, and power systems.

3. Site development and restoration, including cutting, patching, and restoration of disturbed areas.

4. Perform demolition work described on the drawings and as required to prepare work areas for new construction.

5. Sleeve and seal all penetrations through walls and floors to maintain integrity of barrier.

6. Furnish and install all HVAC equipment in accordance with the specifications and drawings.

7. Furnish and install all diffusers, registers, grilles and louvers.

8. Re-connect to existing underground fuel storage tank, piping, insulation and monitoring system.


10. Furnish and install new automatic transfer switch and feeders.

11. Furnish and install new quick-connect double throw switch for portable generator connection.

12. Furnish and install all underground - trenching and underground conduits and wiring.

13. Removal of (1) existing 175-kW generator system, its associated wiring, conduit, day tank, exhaust system, transfer switch and all related parts and appurtenances.

F. This project involves modifications to the existing operating toll plaza. Normal operations of the facility shall be maintained throughout all phases of construction. It shall be the Contractor's responsibility to maintain the buildings in a weather-tight condition at all times during construction. The Contractor shall coordinate with the Commission's Representative to provide all necessary work with a minimum amount of inconvenience. Any conflicts with regard to performance of work shall be brought immediately to the attention of the
1.02 QUALIFICATION OF BIDDERS
A. Prequalification Maximum Capacity rating by the Pennsylvania Prequalification Committee is NOT a prerequisite for bidding on this project.

B. Prospective Bidders are advised that a major portion of the work to be performed under this Contract requires experience in standby power systems and electrical systems installation.

1.03 PROJECT MEETING AND SITE REVIEW
A. Prospective Bidders must thoroughly familiarize themselves with the work to be performed, the project area, and the conditions throughout the project site. Prospective bidders are encouraged to visit the site.

B. A mandatory pre-bid site meeting under the direction of the Representative is scheduled for the time, date, and location shown on the bid proposal.

FAILURE TO BE REPRESENTED AND REGISTERED WITH THE REPRESENTATIVE AT THIS PRE-BID MEETING WILL BE CAUSE FOR REJECTION OF THE BID.

C. Under the direction of the Representative, a review of the site and inspection of the conditions to be encountered will immediately follow the pre-bid meeting.

D. If prospective bidders wish to visit the site further, they are encouraged to do so. However, they must contact Mr. William Poole at telephone number (717)-939-9551, ext. 3710. No unauthorized site visitations will be permitted.

E. During visits to the site, prospective bidders will abide by all rules and regulations pertinent to traffic safety. During such reviews, U-turns are not permitted. Non-revenue privileges are not extended to prospective bidders who visit the site.

F. In compliance with the Americans with Disabilities Act of 1990 (ADA), the Pennsylvania Turnpike Commission has scheduled the pre-bid meeting at a facility which is accessible to persons having disabilities. Any person having special needs or requiring special aids are requested to contact Mr. Bill Poole at (717)-939-9551, Ext 3710, one (1) week prior to the mandatory pre-bid meeting, in order that special needs may be accommodated.

1.04 PREVAILING WAGES
A. The Provisions of the Pennsylvania prevailing Wage Act of August 15, 1961, P.L. 987 as amended, together with the rates and regulations promulgated by the secretary of labor and Industry, are part of these contract documents.
1.05 MATERIAL SUPPLY

A. The quantities indicated on the drawings and in the proposal are estimated quantities and may vary depending upon actual conditions encountered. The Commission assumes no liability for material ordered and supplied in advance of any operation and not used on the project. Payment will be made only for those amounts of materials actually incorporated into the project.

1.06 WORKING SCHEDULE

A. NOTICE TO PROCEED: Within thirty (30) days of the award and after approval of the bonds and insurance certificates, the Commission will issue a purchase order. Issuance of the purchase order will constitute the Notice to Proceed. Therefore, the date of the purchase order is the Notice to Proceed date.

B. TIME OF COMPLETION: Complete all work under this project within 150 calendar days after the Notice to Proceed date. The Contractor shall utilize all available time, including multiple shifts, to complete the project within the specified time limit.

C. NOTICE TO BEGIN MAJOR OPERATIONS: At least ten (10) days before starting any operation give written notice to the Representative of intent to commence operations.

D. Schedule and execute work operations to present the least interference to traffic and complete all operations within specified contract time. There will be no restrictions to the contractor's working time, except for the specified holiday periods as determined by the Commission. Ascertain any and all restrictions in regard to working times, which may be imposed by local, state and federal agencies.

E. No work may be performed without the specified traffic control and protection whether working roadway pavement or shoulders.

F. The Commission's Chief Executive Officer may impose restrictions on the contractor's operations, including complete suspension to eliminate unsafe traffic conditions or congestion of the Turnpike, without liability for any delay.

1.07 PROTECTION AND COORDINATION OF UTILITIES

A. Ascertain and locate any utility lines including Commission owned facilities, in the vicinity of the entire project and take all precautions to fully protect the (utility) facility and service. Prior to performing any work in the vicinity of any underground or overhead line or service, advise the facility owner at least 72 hours in advance of initiating work and provide all measures for protection in accordance with the National Electric Code (safety), the Occupational Safety and Health Administration's Regulations and as deemed necessary by the facility owner with the Representative's concurrence. Coordinate protection and relocation of utilities with the utility.

B. The Contractor shall provide all required equipment, devices and labor necessary to ascertain and locate existing underground facilities and utilities in areas adjacent to
excavations for the installation of underground facilities for this project. The Contractor shall take all precautions necessary to fully protect existing underground facilities and utilities.

C. Attention is directed to the Provisions of Act 287 of 1974 and subsequent amendments which specify the responsibilities in regard to public health and safety during excavation and demolition operations in areas of underground utilities. Contact the One Call System at 1-800-242-1776 for all facilities prior to performing underground work.

D. CONSTRUCTION WATER SUPPLY: To the extent available, the Contractor may arrange to secure water from existing buildings that are owned by the Commission. At no additional cost and without disturbing normal established operations, arrange all necessary connections and extensions from approved sources. The Contractor is responsible for: 1) Making all arrangements to secure water for construction. 2) All costs associated with arrangements required for securing water. At the conclusion of each day, restore the water source to their original condition and repair damage caused to the water system. The Commission assumes no liability for any loss, delay, or damage caused by the inadequacy or interruption of the water supply.

E. CONSTRUCTION POWER SUPPLY: At no additional cost to the Commission, provide power for construction. Without disturbing normal established operations, extend the power supply from approved sources. The Commission assumes no liability for any loss, delay, or damage caused by the inadequacy or interruption of the electrical supply.

F. TEMPORARY POWER: Provide and maintain a diesel generator set as required for temporary electric power supply for lighting, tools, restrooms, and other electrical needs during the entire contract period for the installation of the new generator. Should alternate power become available, during this period, the Contractor shall be responsible for securing power. Temporary power for restrooms shall include electrical power for lighting.

G. Immediately report to the utility company and the Commission any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of the premises and the employees of any emergency created or discovered.

H. Perform all work required for the location, replacement, adjustment or reconstruction of underground utilities in accordance with Publication 408/2003-3.

I. The Commission may have utilities/facilities within the project limits. The Commission's Tradesman Superintendent may be able to provide information about these sites and can be contacted through the Representative.

J. No work is anticipated to be performed by the utility companies with identified facilities within the contract documents. The correctness of the information is not guaranteed and the Commission will not pay costs incurred by the contractor or utilities for work performed for their convenience, unless prior written consent is obtained from the Commission.

K. All work required for protection, reconstruction, repair and relocation of utilities is
incidental to the project, the Commission will not pay any additional cost for this work.

1.08 SUBSURFACE INFORMATION

A. Plans that show the presumed locations of subsurface piping, fixtures, and utilities are included with these specifications. However, subsurface information for this project is not guaranteed. The Contractor assumes full responsibility for determination and protection of all subsurface utilities that remain in place.

B. All underground excavation is unclassified.

1.09 EXCAVATION (UNCLASSIFIED)

A. Excavation is unclassified, and includes the removal and disposal of material encountered when establishing required finish grade elevations. All material encountered regardless of type and hardness shall be removed to the required lines and depths.

B. Blasting shall not be permitted.

C. No additional compensation will be made to the Contractor due to subsurface conditions encountered. Work shall be performed on an "unclassified" basis, that is, the complete removal of all earth and rock formations, the cost for such excavation being included in the contract price at the time of bidding.

1.10 MAINTENANCE AND PROTECTION OF TRAFFIC

A. During construction, utilize approved traffic control devices to maintain and protect traffic. As necessary, locate and relocate devices to: 1) Delineate the necessary traffic pattern. 2) Protect Commission customers and employees from the area of construction.

B. Become fully acquainted with the required activities necessary for proper operation of the facility and cooperate with Commission personnel to assure that satisfactory operation can be maintained. At all times, maintain unobstructed customer access from parking areas to all public facilities.

C. Install signs and other devices as required. Provide signs with Type VIII reflectorized material for background and legend. For this project, only use signs and devices that are in "like-new" condition. Provide the Representative with written certification that verifies all reflectorized materials used on this project comply with these requirements. All signs and devices and their locations are subject to the Representative's review and acceptance.

D. To maintain and protect traffic through the area, use sandbags to properly secure all barricades and warning devices. Do NOT use concrete blocks, stones, or other similar material. Use enough sandbags to prevent the devices from being moved by wind action and/or traffic flow.
E. Utilize traffic cones, barricades with flasher lights, and fluorescent orange snow fence to: 1) Properly identify the work area. 2) Protect both pedestrian and vehicular traffic from construction activities.

F. At night and/or when clarity and sight distances are sharply curtailed, use adequate artificial lighting to indicate the actual location of obstructions.

1.11 ACCESS TO SITE

A. Use of Site: Limit use of Project site to areas within the Contract limits. Do not disturb portions of project site beyond areas in which the work is indicated.

B. Driveways, Walkways and Entrances: Keep driveways, parking lots and entrances serving premises clear and available to PTC employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

C. Schedule deliveries to minimize use of driveways and entrances by construction operations.

D. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

E. The Commission will occupy the site and existing buildings during the entire construction period. Cooperate with Commission personnel during construction operations to minimize conflicts and facilitate PTC usage. Perform the Work so as not to interfere with the PTC day-to-day operations.

1.12 PROTECTION OF FIXTURES, EQUIPMENT AND PIPING

A. Care shall be exercised in the handling and installation of fixtures, equipment and piping to keep them free from dirt and obstructions. Pipe openings shall be protected by caps, plugs or other suitable means during installations. Fixtures and equipment shall be covered and protected against dirt, water, chemicals or mechanical injury. At the completion of the work, the fixtures, equipment and piping shall be thoroughly cleaned and delivered in a condition satisfactory to the Representative.

B. The Contractor is specifically required to maintain completed portions of work until it is reviewed and accepted by the Pennsylvania Turnpike Commission.

1.13 EQUIPMENT MANUALS AND OPERATING INSTRUCTIONS

A. In addition to the working and shop drawings required by the General Provisions for Facilities Projects and the Supplemental Specifications, submit four (4) original copies of the following: manufacturer's detailed drawings, catalog cuts, installation manuals, warranties, replacement instructions and manuals, and operating instructions and manuals.
1.14 CONTRACTOR'S GUARANTEE

A. Before final payment is made, furnish an acceptable maintenance bond in the amount of five percent of the final Contract amount.

B. In addition to any other bonds that are required, this bond provides that the Contractor guarantees his work for a one-year period following the day of final acceptance of the project. During this time, if any defects develop due to defective or inferior materials or workmanship, the Contractor will remedy these defects without cost to the Commission.

C. The Representative will notify the Contractor of any such defects. If the Contractor fails to correct these defects, the Commission will have the defects corrected at the cost of the Contractor or its surety. As to the amount of the expense, the certificates of the Representative are final and conclusive.

1.15 APPROVAL OF EQUIPMENT AND MATERIAL

A. The Contractor, as soon as practicable and before materials, fixtures, equipment, appliances and accessories are purchased shall submit to the Representative for review and acceptance complete lists of all materials, fixtures, equipment, appliances, and accessories to be incorporated in the work, together with the manufacturer's name, address, cuts, catalog numbers, trade names, ratings, capacities and a full description of them. When indicated or directed, submit representative preliminary samples of the material. Submit samples of the kind and quality specified, for examination or test. The Contractor shall also furnish such other detailed information, including as-built drawings, regarding the various items as may be required by the Representative. All lists and accompanying material submitted for review and acceptance shall be submitted in sufficient numbers so that three (3) sets may be retained for Pennsylvania Turnpike Commission's use. Consideration will be given to partial lists submitted from time to time.

B. When practical, component parts of any one system shall be the product of the same manufacturer. Where a manufacturer uses components purchased from others, he must assume full responsibility for and guarantee these components.

C. Material and equipment shall be so designated that they will comply with the applicable standards and regulations of the Underwriter's Laboratories, Inc., National Board of Fire Underwriter's and the Pennsylvania Department of Labor and Industry and PA UCC of 2003, and shall be so labeled and listed.

D. Any materials, fixtures, equipment, appliances and accessories, which are not in accordance with the specific requirements, will be rejected.

E. Inspect material and store only that material meeting specification requirements for project use. Do not unload questionable material, until accepted by the Commission. Do not incorporate with other material previously accepted. When the grading and the quality of the material delivered to the project does not conform to the grading or quality as inspected and tested, the Commission reserves the right to reject the material at the work site. As required, furnish necessary assistance to the inspector in obtaining samples.
F. Allow designated Commission representatives to inspect material being used, or intended to be used, any time before, during or after material preparation, while being used during the progress of the work or after the work has been completed. Furnish or arrange with producers or manufacturers to provide necessary material, labor, tools, and equipment for such inspection.

G. Inspections and tests, if made at any point other than the point of incorporation in the work, will not guarantee acceptance of the material. Inspection and testing performed by the Commission will not relieve the Contractor's responsibility for quality control.

1.16 AS-BUILT DRAWINGS

A. The Contractor will be provided an additional set of Drawings that are to be used exclusively to show the actual installation. The Contractor shall, in a neat and orderly manner, make changes to the contract drawings in "Red Marking"; changes shall be made true to the applicable drawing scale. Upon completion of the project, the As-Built Drawings become the property of the Commission.

B. Payment for preparation of the As-Built Drawings is incidental to the entire project.

1.17 EMERGENCY TELEPHONE NUMBERS

A. At the beginning of the construction project, the Contractor will be required to provide the names and phone numbers of at least three (3) persons who are to be contacted during off hours, weekends and holidays in the event that an emergency situation arises.

B. The phone numbers shall not be that of answering machines or of answering services who have no means of contacting anyone until the next day's business hours.

C. The persons whose names are provided for emergency contact will be those who will have the authority to make immediate corrections to emergency situations.

1.18 PERMITS, LICENSES AND CERTIFICATES

A. The Contractor shall determine, secure and pay for all permits, licenses and certificates required by Federal, State and Local rules and regulations. Copies shall be furnished to the Commission.
1.19 HOLIDAY

2011

EASTER ................................................................. From 3:00 P.M., local time, Thursday, April 21 to 6:00 A.M., local time, Tuesday, April 26, 2011.

MEMORIAL DAY .................................................. From 3:00 P.M., local time, Thursday, May 26 to 6:00 A.M., local time, Wednesday, June 1, 2011.

INDEPENDENCE DAY ........................................... From 3:00 P.M., local time, Friday, July 1 to 6:00 A.M., local time, Monday, July 11, 2011.

LABOR DAY ........................................................ From 3:00 P.M., local time, Thursday, September 1 to 6:00 A.M., Wednesday, September 7, 2011.

COLUMBUS DAY .................................................. From 3:00 P.M., local time, Friday, October 7 to 6:00 A.M., local time, Tuesday, October 11, 2011.

VETERANS DAY .................................................. From 3:00 P.M., local time, Wednesday, November 9 to 6:00 A.M., local time, Monday, November 14, 2011.

THANKSGIVING DAY .......................................... From 3:00 P.M., local time, Tuesday, November 22 to 6:00 A.M., local time, Monday November 28, 2011.

CHRISTMAS AND NEW YEARS .............................. From 3:00 P.M., local time, Thursday, December 22, 2011, to 6:00 A.M., local time, Tuesday, January 3, 2012.
INDEX OF SUPPLEMENTARY SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01731 - CUTTING AND PATCHING ................................................................. 1-4
SECTION 01732 - SELECTIVE DEMOLITION................................................................. 1-7

DIVISION 2 - SITE CONSTRUCTION
SECTION 02081 - REMOVAL OF ASBESTOS CONTAINING MATERIAL ......................... 1-8
SECTION 02230 - SITE CLEARING ............................................................................. 1-5
SECTION 02300 - EARTHWORK .................................................................................. 1-12
SECTION 02742 - HOT-MIX ASPHALT PAVING ......................................................... 1-6
SECTION 02900 - LANDSCAPING ............................................................................. 1-4

DIVISION 3 - CONCRETE
SECTION 03300 - CAST-IN-PLACE CONCRETE ....................................................... 1-16

DIVISION 5 - METALS
SECTION 05500 - METAL FABRICATION .................................................................. 1-3

DIVISION 7 - THERMAL AND MOISTURE PROTECTION
SECTION 07920 - JOINT SEALANTS ........................................................................... 1-8

DIVISION 9 - FINISHES
SECTION 09670 - RESINOUS FLOORING ................................................................... 1-5
SECTION 09900 - PAINTING ..................................................................................... 1-8
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 14 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

1.5 QUALITY ASSURANCE

A. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or results in increased maintenance or decreased operational life or safety. Operating elements include the following:
1. Primary operational systems and equipment.
2. Mechanical systems piping and ducts.
3. Control systems.
4. Communication systems.
5. Conveying systems.
6. Electrical wiring systems.

B. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Piping, ductwork, vessels, and equipment.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

B. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

3. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

4. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

   b. Restore damaged pipe covering to its original condition.
END OF SECTION 01731
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Demolition work required by new construction and as indicated.
2. Demolition and removal of site elements as required by new construction and as indicated.
3. Repair procedures for selective demolition operations.

B. Related Sections include the following:

1. Section 01731 - Cutting and Patching: Cutting and patching procedures for selective demolition operations.
2. Section 02230 - Site Clearing: Site clearing and removal of above- and below-grade improvements.
3. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
4. Division 16 Sections for demolishing, cutting, patching, or relocating electrical items.

1.2 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Commission's property, demolished materials shall be removed from Project site.

B. Salvaged items to be retained by the Commission and not shown to be reused on this project will be "tagged" by the Commission prior to start of demolition. These items shall be removed by the Contractor and placed in a designated area near the project work area. The Commission will be responsible for removal of "tagged" items from the project work area.

1.4 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure the Commission's on-site operations are uninterrupted.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of the Commission's continuing occupancy of portions of existing building and of the Commission's partial occupancy of completed Work.
B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Predemolition Conference: Conduct conference at Project site. Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.6 PROJECT CONDITIONS

A. Provide not less than 10 business days notice to the Commission of activities that will affect the Commission's operations.

B. Hazardous Materials: Hazardous materials have been identified and will be removed by the Contractor.

C. Lead-Based Paint: Some lead-based paint may be present in the existing building(s).

1. Test to determine the total concentration of lead in paint (TCLP) in any waste stream, workmen protection during removal of materials containing lead-based paint, and legal disposal of materials containing lead-based paint during demolition, renovation and construction work.
2. Comply with applicable federal, state, and local rules and regulations governing lead containing materials.

D. Storage or sale of removed items or materials on-site will not be permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.
PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.
   1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
   2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Representative.

D. Engage a professional Surveyor to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by the Commission. Provide temporary services during interruptions to existing utilities, as acceptable to the Commission.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

   . Arrange to shut off indicated utilities with utility companies.
2. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing. Remove abandoned pipe and conduit where indicated.

3.3 PREPARATION

A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, parking areas, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct roads, parking areas, walks or other adjacent occupied or used facilities without permission from the Commission. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by the Commission.

3. Protect existing site improvements, appurtenances, and landscaping to remain.

4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people, vehicles and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of the site and building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.

D. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
E. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

F. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower elevations.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with The Commission’s requirements for using and protecting stairs, walkways, building entries, and other building facilities during selective demolition operations.

C. Removed and Salvaged Items:
   1. Store items in a secure area until delivery to the Commission.
   2. Protect items from damage during transport and storage.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Commission, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

E. Concrete: Demolish in sections. Saw-cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

F. Masonry: Demolish in small sections. Saw-cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

G. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

H. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

I. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel or sand, free of trash and debris, stones over 6 inches diameter, roots, and other organic matter.

3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Section 01731 - Cutting and Patching.

C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off site for proper disposal.

END OF SECTION 01732
SECTION 02081 – REMOVAL OF ASBESTOS CONTAINING MATERIALS

1.1 SCOPE OF WORK

The asbestos abatement work in this contract includes the removal and proper disposal of asbestos containing material.

2.1 PROJECT CONTROL

The Representative will at all times have access to the work during its progress and shall be furnished with every reasonable facility for ascertaining that the work is proceeding in accordance with the requirements and intentions of the Contract Specifications. All work will be subject to the inspection and approval of the Representative. If at any time, the Representative decides that work practices are in violation of pertinent regulations or are endangering workers, immediately cease operations until corrective action is taken and verified by the Representative.

3.1 ASBESTOS REMOVAL – GENERAL

A. Requirements

1. This section covers the furnishing of all labor, materials, facilities, equipment, services, employee training, permits, notifications and insurance necessary to perform the work required for asbestos removal in accordance with these specifications, the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), National Institute of and Occupational Safety and Health (NIOSH) regulations and recommendations, and any other applicable federal, state and local government regulations. Whenever there is a conflict or overlap of the above references the most stringent provisions are applicable.

B. Description of the Work

1. Remove the following asbestos containing materials:

<table>
<thead>
<tr>
<th>Material</th>
<th>Estimated Quantity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Wall</td>
<td>25 square feet</td>
<td>Back-up generator</td>
</tr>
<tr>
<td>Gasket</td>
<td>30 square feet</td>
<td>Exhaust Pipe</td>
</tr>
</tbody>
</table>
2. The above referenced locations and quantities of ACMs and any reference throughout this specification are intended to be used for informational purposes only and may not necessarily indicate all locations and exact quantities of ACMs. It shall be the responsibility of the Asbestos Abatement Contractor to field-verify actual site conditions, the extent to which asbestos-containing materials and asbestos contaminated materials are present and the actual amount of such material to be removed.

C. Perform the work and provide the services as follows:

1. OSHA required trained workers, OSHA required respiratory protection and fit-testing, and medical surveillance program.

2. Work area preparation.

3. Asbestos abatement.

4. Provide access, support and protection to all authorized visitors and inspectors.

D. Work schedule: work may commence as soon as the EPA permit is issued.

E. Qualifications

1. Experience of the asbestos abatement Contractor

   a. Experience: The abatement contractor must be prepared to provide references for at least three asbestos abatement projects with the name and telephone number of purchaser of abatement services and the final decontamination levels achieved for similar projects in scope & size to the satisfaction of the Commission, if required.

   b. Personnel: superintendent, foreman and workers

      i. Training and knowledge of applicable regulations and expertise in safety and environmental protection as evidenced by the participation and successful completion of an EPA accredited course and is certified in the Commonwealth of Pennsylvania.

      ii. Experience with abatement work, as evidenced through participation in at least three asbestos abatement projects of a similar size and scope completed in compliance with Commission requirements. Provide documentation which shall include the names and addresses of the Commission and locations of the work performed.

      iii. Evidence of participation in a respirator program and a medical surveillance program.

   c. Evidence that the Contractor is licensed to perform asbestos abatement within Pennsylvania.
F. Notifications, Permits, Warning Signs, Labels and Posters

1. The Contractor will provide the required notification to EPA, and any other regional, state, and local authority having jurisdiction prior to the start of the project. Secure all permits required for the work, including disposal of asbestos in an approved landfill, as well as the required permit from the OSHA. The Contractor will provide the OSHA with all necessary information for the securing of the permit, and will follow all instructions and requirements of the OSHA in performing the work, including but not limited to asbestos removal and transport and disposal of asbestos containing waste.

2. Provide warning signs in accordance with OSHA and EPA around the workspace and at every point of potential entry from the outside. Provide the OSHA required labels for all plastic bags and all drums utilized to transport contaminated material to the landfill. Post in a prominent and convenient place for the works a copy of the latest applicable regulations and recommendations from OSHA, EPA and NIOSH.

3.2 PROTECTION FOR EMPLOYEES, INSPECTORS, AND OTHER APPROVED BOARD PERSONNEL

A. Protection and Damage

1. Provide all labor, materials and equipment necessary for protection of personnel, furnishings, equipment or building structure from damage.

2. Asbestos containing debris shall be removed from the site daily. Premises shall be left neat and clean after each work shift, so that business may proceed the next regular workday without interruption.

B. Respiratory Systems

1. Provide all workers, foremen, superintendents, authorized visitors and inspectors personally issued and marked respiratory equipment approved by NIOSH and OSHA. When respirators with disposable filters are employed, provide sufficient filters for replacement as necessary by the worker.

2. Respiratory protection shall be in accordance with OSHA Regulation 1926.58 and ANSI Z88.2-1980. Respirators chosen shall also be approved by NIOSH under the provisions of 30 CFR Part 11.

3. The minimum respiratory protection required for this project is as follows:

a. Use Type A, air-purifying respirators for the following:

   i. Preconstruction sealing of walls, floors and openings with plastic sheeting.
   ii. Final clean up and decontamination of work area.
b. Asbestos abatement. The Contractor shall provide historic time-weighted average (TWA) which documents that the respirator used provides sufficient protection for the workers performing specific asbestos abatement operations.

C. Protective Clothing

1. Provide to all workers, foremen, superintendents and authorized visitors and inspectors’ protective disposable clothing consisting of full body coveralls, head covers, gloves and 18 inch high boot covers or reusable footwear, as required by EPA, OSHA, State and Local regulations. Eye protection and hard hats should be available as appropriate.

D. Decontamination-All workers, without exception

1. Must remove street clothes and change to disposable work clothes in equipment room prior to start of work day. Lockers or acceptable substitutes shall be provided by the Contractor for street clothes.

2. Disposable protective clothing must be discarded and disposed of as asbestos waste every time the wearer exits from the workspace to the outside through the decontamination facility.

3. Workers shall shower after leaving containment area. The Contractor shall provide all decontamination and shower facilities.

E. Precautions

1. No smoking, eating, or drinking is to take place once beyond the clean room at the job site. Prior to smoking, eating or drinking, workers shall fully decontaminate by showering. Each worker shall then dress into a new clean disposable coverall to eat, smoke or drink. This new coverall may then be used to re-enter the work area.

2. Work footwear must remain inside the work area until completion of the job.

3. Contractor should take safety measures for painted materials in the building that contain lead. Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1926.62 requires that all employees involved in the construction, alteration, and or repair of lead containing building components, regardless of the exposures, be notified of the presence of lead in any amount. OSHA has determined that any detectable levels of lead paint (even if levels are below HUD standard) will require appropriate exposure measures as outlined in the lead in construction rule, 29 CFR 1926.62. Employees must be trained in conformance with the hazard communication standard (29 CFR 1926.59) and each employer is required to initially determine if any employee may be exposed to lead at or above the action level of 30 microgram/cubic meter (μg/m³).

F. Project Log Book
1. A log book, containing as a minimum the information listed below, shall be kept on the jobsite and be available for inspection by the Commission, the Commission’s representative, or governing agencies inspectors during normal working hours.

   a. **Pre-work Documentation:** This section shall contain any EPA, OSHA, or state notification forms, any necessary federal, state, county, or city licenses or permits (including contractor licenses, building permits, disposal permits, etc.), records regarding insurance, bonds, and size of bonds.

   b. **Personnel Records:** This section shall contain personnel employment records, worker training certificates, certificate of worker’s release, respirator training, fit test verification, and Pennsylvania Certification Cards.

   c. **Notification Data:** This section shall include data which will allow the Commission to notify each worker, the worker’s family, and responsible contractor parties if an emergency should arise.

   d. **Sign-in Sheets:** This section shall contain the daily sign-in sheets. This daily sign-in sheet (log) shall be kept daily by the project superintendent and placed in the project log book at the end of each day’s work. The daily log shall include as a minimum the following:

      i. Name of person entering the work area
      ii. Time the person entered the work area
      iii. Time the person exited the work area
      iv. The person’s affiliation and purpose for entering the work area
      v. Date
      vi. Brief description of day’s work activities
      vii. Brief description of any damage to items in the work area
      viii. If negative air pressure was present in work area, and if not, why, what time and when negative pressure was not present
      ix. Brief description of weather conditions, including approximate outside and inside work area temperatures
      x. Each daily log sheet shall be signed and dated by the project superintendent

   e. **Subcontractors:** This section shall include any information concerning project subcontractors, including work to be performed, names and dates on job site.
f. Air Monitoring: All air sampling performed by the Contractor shall have the results included in this section. Area air sampling and personnel air sampling should be included. A description of the sampling methods, location and test methods shall also be included. The name and location of the laboratory performing the analytical work shall be listed. The Commission’s air monitoring technician will not perform sampling for the Contractor.

g. Waste Disposal: This section shall include the location, date and time of all wastewater disposals, as well as signed and dated trip tickets by the landfill disposal operator stating the number of disposal drums and/or containers accepted. The location of the landfill shall also be provided.

h. Miscellaneous: This section shall include any reported injury/illness of employees, inspection reports by EPA, OSHA or other state and local government agencies, or any other pertinent information.

i. At the completion of the work, the Contractor will provide the Commission with a complete copy of the Project Log Book.

3.3 REMOVAL OF ASBESTOS CONTAINING MATERIALS

A. The asbestos abatement workers will utilize double disposal suits and at least Type A respirators for asbestos removal. The Contractor shall post signs at all entrances to the work area and along the work limits of the site or along the perimeter of the sections of the site where asbestos containing waste material was deposited at intervals of 25 feet or less. The signs shall be posted in such a manner and location that a person may easily read the legend.

1. Gaskets and Fire Wall

   a. The asbestos containing gaskets and fire wall shall be completely removed. These materials should be wetted, even though the material may not be friable, and will not readily absorb liquids. Amended water shall be sprayed on as many times and as often as necessary to ensure that the asbestos material is adequately wetted throughout abatement activities to prevent dust emission as specified in the regulations.

   i. Alternative procedures as proposed by the Contractor will be considered, provided they are submitted in writing to the Representative.

   b. Critical barriers shall be placed over all openings to the regulated area to prevent migration of airborne asbestos from the area. Heating, Ventilating and Air Conditioning (HVAC) systems must be sealed with 2 layers 6 mil plastic or equal. All immovable objects must be sealed with plastic and duct tape or equivalent.

   c. Impermeable Dropcloths required.

2. CFR 61.22(j) prescribes a leak-tight container, the integrity of which is the Contractor’s responsibility until after deposition at a sanitary landfill, which is
operated in accordance with 40 CFR 61.25. Therefore, caution must be used in the choice of container types and consideration given to the method of unloading at the landfill. Fragile containers shall be unloaded by hand to prevent rupture and possible visible emissions.

3. All asbestos materials, wastes, plastics, disposable equipment and supplies shall be disposed of as contaminated waste. In accordance with the EPA, and Pennsylvania Department of Environmental Protection (PADEP) regulations.

4. It is the responsibility of the Contractor to determine current waste handling, transportation, and disposal regulations for the work site and for each waste disposal landfill. The Contractor must comply fully with these regulations and all U.S., PA Department of Transportation, and EPA requirements.

5. The Contractor will document actual disposal of the waste at the designated landfill by completing a Disposal Certificate and forwarding the original to the Commission.

6. The Contractor shall provide, at the completion of the project, a manifest or dump ticket, duly executed by the Contractor, transporter and disposal facility. The manifest shall be all-inclusive describing volume of materials, dates of transportation, and date of disposal.

7. The Contractor shall submit all appropriate EPA, and OSHA notifications upon award of the Contract. The asbestos abatement will commence as soon as permissible and will be completed within 14 working days.

8. The Contractor will provide his/her own electricity, water, shower and sanitary facilities for this project.

3.4 AIR MONITORING AND INSPECTION

A. The Contractor shall furnish an independent third party licensed firm to perform air monitoring throughout the duration of the asbestos abatement work. The monitoring will be inside the work area and the surroundings to ensure full compliance with these specifications and all applicable regulations.

B. Continuous monitoring and inspection will include work area samples and samples outside of the work area to ensure these areas are free from contamination.

C. Clearance Air Monitoring, as prescribed by the EPA will be performed by an independent third party licensed firm furnished by the Contractor.

D. The Commission may employ an independent industrial hygienist consultant to verify contractor’s compliance with the requirements of these specifications and contract documents, to perform continuous inspection monitoring and testing for the safety of his employees and to perform other such services as specified in this section.

3.5 QUALITY ASSURANCE
A. Applicable standards listed in these specifications include, but are not necessarily limited to standards promulgated by the following agencies and organizations:

1. EPA – Environmental Protection Agency, Region III
   Sixth and Walnut Streets
   Philadelphia, Pennsylvania 19106

2. OSHA – Occupational Safety and Health Administration
   2nd and Chestnut Streets
   Philadelphia, Pennsylvania 19106

3. NIOSH – National Institute for Occupational Safety and Health
   Region 3
   P.O. Box 13716
   Philadelphia, Pennsylvania 19101

B. The Contractor has the responsibility of informing itself and all employees fully of the requirements of these agencies and shall satisfy completely these specifications and all referenced regulations.

END OF SECTION
SECTION 02230 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.
1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain PTC's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at the Somerset Interchange.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Representative.
   2. Provide alternate routes around closed or obstructed traffic ways if required by the Representative.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on PTC's premises where indicated.

C. Utility Locator Service: Notify One Call for area where Project is located before site clearing.

D. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

E. Do not direct vehicle or equipment exhaust towards protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 2 Section 02300 "EARTHWORK."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to the Representative.

3.2 TREE AND PLANT PROTECTION

A. Protect, repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Representative.

3.3 EXISTING UTILITIES

A. PTC will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. PTC will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by PTC or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Representative not less than two weeks in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Representative's written permission.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and stockpile in areas approved by the Representative and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off PTC's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 02230
SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Preparing subgrades for slabs-on-grade and walks.
   2. Excavating and backfilling for pre-cast concrete building (Prefabricated concrete generator enclosure).
   3. Drainage course for concrete slabs-on-grade.
   4. Subbase course for slabs-on-grade and walks.
   5. Subsurface drainage backfill for walls and trenches.
   6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:

   1. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Representative. Unauthorized excavation, as well as remedial work directed by Representative, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698/ASTM D 1557.

1.5 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference at the Somerset Interchange.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during Earthwork operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Representative.
2. Provide alternate routes around closed or obstructed traffic ways if required by PTC or authorities having jurisdiction.

B. Utility Locator Service: Notify "One Call" for area where Project is located before beginning Earthwork operations.

C. Do not commence Earthwork operations until plant-protection measures are in place.

D. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncruushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.1 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by Earthwork operations.

B. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

   a. 24 inches outside of concrete forms other than at footings.
   b. 12 inches outside of concrete forms at footings.
   c. 6 inches outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches beneath bottom of concrete slabs-on-grade.
   f. 6 inches beneath pipe in trenches, and the greater of [24 inches wider than pipe or 42 inches wide.
3.4 EXCAVATION FOR STRUCTURES AND SLABS ON GRADE

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit, as indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.

3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.

4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.7 SUBGRADE INSPECTION

A. Notify Representative when excavations have reached required subgrade.

B. If Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Representative, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Representative, without additional compensation.
3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Representative.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Representative.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, Subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
D. Trenches under Roadways: Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material/satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Under pavement and slabs install 6 inches below subgrade.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698/ASTM D 1557:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.
3.16 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698/ASTM D 1557.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.
B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Representative; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off PTC's property.

B. Transport surplus satisfactory soil to designated storage areas on PTC's property. Stockpile or spread soil as directed by Representative.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off PTC's property.

END OF SECTION 02300
SECTION 02742 - HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes the following:
   1. Preparation of subgrade.
      a. Compact subgrade with power roller.
      b. Remove and replace any sub-surface soft spots and unsuitable material.
      c. Geotextile stabilization fabric over the compacted subgrade (earth).
   2. Hot-mix asphalt paving.
B. Related Sections include the following:
   1. Section 01732 - Selective Demolition: Removal of existing paving and aggregate base.
   2. Section 02300 - Earthwork

1.3 SUBMITTALS
A. Product Data: For each product specified. Include technical data and testing physical and performance properties.
B. Shop Drawings: Indicate pavement markings.
C. Samples: Submit minimum 12 x 12 inch sample of each type of geotextile fabric.

1.4 PERFORMANCE REQUIREMENTS
A. Before any asphalt paving work is commenced, all underground utilities, services and equipment shall have been installed, tested, approved and trenches backfilled as specified in related sections.
B. Before installing aggregate base course this contractor shall examine the subgrade for accuracy of elevation, location and compaction required to insure a perfectly stable installation. If the conditions are not satisfactory, this contractor shall notify the Representative in writing specifying the conditions to be remedied.
C. When directed, any soft spots or unsuitable subgrade material shall be removed and replaced with granular or other suitable material and thoroughly compacted.

1. Removal and replacement of unsuitable sub-surface material. Costs for this work will be paid for in accordance with contract conditions relative to changes in work (Change Order).

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

B. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

C. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this project and with a record of successful in-service performance.

1. Firm shall be registered and approved paving mix manufacturer with authorities having jurisdiction or with the PA DOT.

D. Earthwork preparation for paving will be monitored by a qualified soil technician under the direction of the Representative.

1.6 PROJECT/SITE CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 Degrees F and when temperature has not been below 35 Degrees F for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct asphalt concrete surface course when atmospheric temperature is above 40 Degrees and when base is dry. Base course may be placed when air temperature is above 30 Degrees F and rising.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

B. Subbase Material (Porous Fill): Pennsylvania Department of Transportation size and grading numbers 57 or 67, crushed stone or gravel, as per Section 703.

1. Well graded from 1 inch to 1-1/2 inches with sufficient fines to "choke" the porous
fill.
2. Slag is not acceptable.

C. Aggregate Subbase Course: Sound angular crushed stone no slag permitted. Penn DOT No. 2A, Section 703.

D. Asphalt Aggregate Mixture: Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with ASTM D 3515 and as recommended by local paving authorities to suit project conditions.

1. Coarse Aggregate: Sound, angular crushed stone or crushed gravel. Slag is not acceptable.
2. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone, gravel, or combinations. Slag is not acceptable.

E. Asphalt Base Course: Penn Dot ID-2 material.

F. Asphalt Wearing Surface: Penn DOT SRL-H material.

G. Asphalt Cement: ASTM D 3381 for viscosity-graded material; STM D 946 for penetration-graded material.

H. Prime Coat: Cut-back asphalt type, ASTM D 2027; MC-30, MC-70 or MC-250 (only where required by paving subcontractor).

I. Tack Coat: Emulsified Asphalt; ASTM D 977.


1. Manufacturers:
   a. Phillips Fibers Corporation
   b. Exxon Chemical Company
   c. Carthage Mills
   d. Webtec, Inc.

2. Fabric: Non-woven fabric consisting of long chain polymeric filaments or yarns such as polyethylene, polyamide, polyvinylatedene-chloride, polypropylene, or polyester formed into a stable network so that the filaments or yarns retain their relative position to each other.

   a. Soil Stabilization: Minimum 4.5 - 6.0 ounces per square yard.
   b. Filter Fabric: Minimum 4.0 ounces per square yard.

PART 3 - EXECUTION

3.1 PREPARATION

A. Fine grade existing subgrade and compact thoroughly by rolling with power roller weighing not less than 10 tons.
B. Soft spots and unsuitable material shall be removed and replaced with well-graded granular material, and thoroughly compacted with a 10-ton roller.

C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subgrade.

D. Install geotextile fabric, over compacted sub-grade, in compliance with manufacturer's specifications. Overlap shall be minimum 12 inches.

3.2 INSTALLATION

A. Aggregate Sub-Base Course: After subgrade has been established, place sufficient aggregate base material to form a compacted section of the thickness required on the details. Subbase shall be constructed and rolled in strict accordance with Penn DOT Form 408 Specifications, Section 350.3.

1. Choke coarse material with fine material and roll thoroughly to provide a hard unyielding surface that does not creep or wave under the roller.
2. Thickness: Minimum 10 inches.
3. Surface Tolerance: The finished surface shall not vary more than 1/2 inch in 10 feet from required plane when measured in any direction. Slope surface as shown on drawings.

B. Asphalt Base Course: After aggregate base is approved for grade, apply with a mechanical paver a layer of tight bituminous base course mix which, after compaction, will be of the depth required.

2. Rolling: Base course shall be thoroughly compacted by rolling with a 2 or 3-wheeled power-driven roller weighing 10 tons. Rolling shall begin at sides and progress to center. Rolling shall continue until material does not creep or wave ahead of roller wheels. Areas of pavement inaccessible to roller shall be satisfactorily compacted by means of approved tampers.
3. Prior to final surfacing, any irregularities which may be determined by testing with a straightedge shall be brought to proper grade as soon as possible after paving is completed, preferably concurrent with the paving operations. The methods employed to bring the surface to grade shall be subject to approval by the Architect. After base course has received final rolling, no vehicular traffic shall be permitted until the pavement has hardened sufficiently to prevent damage to the surface.
4. Thickness: Minimum 3.5 inches.
5. Surface Tolerance: The finished surface shall not vary more than 1/4 inch in 10 feet from required plane when measured in any direction. Slope surface as shown on drawings.

C. Asphalt Wearing Surface: Prior to installation of wearing course, thoroughly clean bituminous base course of any accumulated dirt. The base course shall be approved by the Architect immediately prior to installing the wearing course.

2. Apply a layer of bituminous wearing course which, after proper compaction, will be of the depth required on the drawings. The application and rolling of wearing course shall be as specified for Bituminous Base Course, above.
3. Any irregularities in wearing course shall be corrected to a tolerance of 3/8 inch when tested in any direction with a 12 foot straightedge to the satisfaction of the Representative.
4. Remove all bituminous materials from adjacent surfaces and dispose of off the site.
5. When finished, the paving shall present a smooth, even surface with positive drainage to inlets or dispersal points.
6. Thickness: Minimum 1.5 inches.
7. Surface Tolerance: The finished surface shall not vary more than 3/16 inch in 10 feet from the reduced plane when measured in any direction. Slope surface as shown on drawings.

D. Joints: Make joints between old and new pavements, or between successive days work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: The Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency shall conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

1. This test method covers determination of the thickness (or height) of compacted bituminous paving mixture specimens.
2. Test specimens shall be taken with a core drill or diamond or carborundum saw.
3. One test specimen shall be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken. Locations of test specimens shall be determined by the Representative.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.

b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.4 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose.

1. Do not allow excavated materials to accumulate on-site.

3.5 CLEANING AND REPAIR

A. After all asphalt paving has been installed, all oil stains, loose dusting materials, debris and mud shall be removed from the surface.

B. All areas of asphalt paving that have cracked, settled or become damaged shall be restored to the satisfaction of the Representative using the materials and following the construction methods specified herein.

3.6 TRAFFIC CONTROL

A. Contractor shall provide flagman for traffic control where equipment crosses existing roads or works adjacent to existing roads.

B. Contractor shall provide flashing warning lights, signs, barricades, and other protective devices as required when working on or near existing roads and traffic areas.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Topsoil
   a. Replacing stockpiled topsoil.
   b. New topsoil (off-site borrow) if required.

2. Lawns

B. Related Sections include the following:

   1. Section 02230 - Site Clearing.
   2. Section 02300 - Earthwork.

1.3 QUALITY ASSURANCE

A. Qualifications: Landscape Work shall be performed by a single firm specializing in Landscaping Work.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery.

1.5 PROJECT/SITE CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the Representative before planting.

D. Planting Time: Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

1.5 WARRANTY

A. Warranty lawns through specified lawn maintenance period, and until final acceptance.

PART 2 – PRODUCTS

2.1 TOPSOIL

A. Topsoil has been stockpiled for reuse in Landscape Work. If quantity of stockpiled topsoil is insufficient, provide additional topsoil at no additional cost to complete Landscape Work.

B. Provide new topsoil (off-site borrow) that is fertile, friable, natural loams, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth.

1. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 12 inches for planting areas. Do not obtain from bogs or marshes.

2.2 SEEDING AND SOIL SUPPLEMENTS

A. Section 804 - Seeding and Soil Supplements.

PART 3 – EXECUTION

3.1 PLANTING LAWNS

A. Loosen sub-grade of lawn areas to a minimum depth of 4 inches. Remove stones over 1-1/2 inches in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.

B. Minimum 4 inches of topsoil required below lawn areas.
C. Place approximately 1/2 of total amount of topsoil required. Work into top of loosened sub-grade to create a transition layer and then place remainder of planting soil. Add specified soil amendments and mix thoroughly into upper 4 inches of topsoil.

D. Apply specified commercial fertilizer at rates specified and thoroughly mix into upper 2 inches of topsoil. Delay application of fertilizer if lawn planting will not follow within a few days.

E. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.

F. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

G. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

H. Seeding New Lawns: Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.

   1. Seed shall be applied at rate specified in Section 804 - Seeding and Soil Supplements.
   2. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with a fine spray.
   3. Protect seeded areas against erosion by spreading specified lawn mulch after completion of seeding operations. Spread uniformly to form a continuous blanket not less than 1-1/2 inches loose measurement over seeded areas.

3.2 RECONDITIONING EXISTING LAWNS

A. Recondition existing lawn areas damaged by project operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where re-grading is required.

B. Provide fertilizer, seed, or sod, and soil amendments as specified for new lawns, and as required to provide a satisfactorily reconditioned lawn.

C. Provide new topsoil, as required, to fill low spots and meet new finish grades.

D. Cultivate bare and compacted areas thoroughly to provide a satisfactory planting bed.

E. Remove diseased and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, stone, gravel, and other loose building materials.

F. Where substantial lawn remains, but is thin, mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before
seeding, or if extensive, apply selective chemical weed killers as required. Apply seedbed mulch, if required, to maintain moist condition.

G. Water newly planted lawn areas and keep moist until new grass is established.

3.3 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain lawns until final acceptance, but in no case, less than 90 days after substantial completion of lawn.

   1. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, re-grading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

C. Furnish all necessary hoses for watering.

3.4 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

C. Upon completion of work of this Section, remove from the site excess materials and debris which has not been cleaned up previously.

3.5 INSPECTION AND ACCEPTANCE

A. When landscape work is completed, including maintenance, the Representative will inspect to determine acceptability.

B. Landscape work may be inspected for acceptance in parts agreeable to the Representative, provided work offered for inspection is complete, including maintenance.

C. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by the Representative and found to be acceptable.

END OF SECTION 02900
SECTON 03300 - CAST-IN-PLACE CONCRETE

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Concrete toppings.
5. Building walls.

B. Related Sections:

1. Division 2 Section 02300 "EARTHWORK" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. General: Submittal requirements in ACI 301.

B. Product Data: For each type of product indicated.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2- PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.


2.4 ADMIXTURES

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M Type E.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2.5 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

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

   a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
   b. Fortifiber Building Systems Group; Moistop Ultra 15.
   d. Insulation Solutions, Inc.; Viper VaporCheck 16.
   e. Meadows, W. R., Inc.; Perminator 15 mil.
   f. Raven Industries Inc.; Vapor Block 15.
   g. Reef Industries, Inc.; Griffolyn Type-105.
   h. Stego Industries, LLC; Stego Wrap 15 mil Class A.

B. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

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

   a. Reef Industries Inc.; Griffolyn Type-85.

C. Sheet Vapor Retarder: ASTM E 1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

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

   c. Stego Industries, LLC; Stego Wrap, 10 mil Class C.

D. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

2.6 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 4 sieve.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
b. Dayton Superior Corporation; Emery Tuff Non-Slip.
c. Lambert Corporation; EMAG-20.
d. L&M Construction Chemicals, Inc.; Grip It.
e. Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

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

   b. BASF Construction Chemicals - Building Systems; Frictex NS.
   c. L&M Construction Chemicals, Inc.; Grip It AO.

C. Emery Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.

1. Color: As selected by Representative from manufacturer's full range.

D. Metallic Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.

1. Color: As selected by Representative from manufacturer's full range.

E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

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

   a. BASF Construction Chemicals - Building Systems; Maximent.
   b. ChemMasters; ConColor.
   c. Conspec by Dayton Superior; Conshake 500.
   d. Dayton Superior Corporation; Quartz Tuff.
   e. Edoco by Dayton Superior; Burke Non Metallic Floor Hardener 250.
   f. Euclid Chemical Company (The), an RPM company; Surflex.
   g. Kaufman Products, Inc.; Tycron.
   h. Lambert Corporation; Colorhard.
   i. L&M Construction Chemicals, Inc.; Quartzplate FF.
   j. Metalcrete Industries; Floor Quartz.
   k. Scofield, L. M. Company; Lithochrome Color Hardener.
   l. Symons by Dayton Superior; Hard Top.

F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture.
Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Construction Chemicals - Building Systems; Mastercron.
   b. ChemMasters; ConColor.
   c. Conspec by Dayton Superior; Conshake 600 Colortone.
   d. Dayton Superior Corporation; Quartz Tuff.
   e. Edoco by Dayton Superior; Burke Non Metallic Floor Hardener 200 - 205.
   f. Euclid Chemical Company (The), an RPM company; Surfllex.
   g. Kaufman Products, Inc.; Tycron.
   h. Lambert Corporation; Colorhard.
   i. L&M Construction Chemicals, Inc.; Quartz Plate FF.
   j. Metalcrete Industries; Floor Quartz.
   k. Scofield, L. M. Company; Lithochrome Color Hardener.
   l. Symons by Dayton Superior; Color Hardener.

2. Color: As selected by Representative from manufacturer's full range.

2.7 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Silica Fume: 10 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

   1. Use water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.50.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
   5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

   1. Minimum Compressive Strength: 4,000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.50.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
   5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

   1. Minimum Compressive Strength: 4,000 psi at 28 days.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
   5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. **Air Content:** Do not allow air content of trowel-finished floors to exceed 3 percent.
7. **Steel-Fiber Reinforcement:** Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd.
8. **Synthetic Micro-Fiber:** Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
9. **Synthetic Macro-Fiber:** Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 4.0 lb/cu. yd.

D. **Concrete Toppings:** Proportion normal-weight concrete mixture as follows:

1. **Minimum Compressive Strength:** 4,000 psi at 28 days.
2. **Minimum Cementitious Materials Content:** 520 lb/cu. yd.
3. **Slump Limit:** 5 inches, plus or minus 1 inch.
4. **Air Content:** 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. **Air Content:** 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. **Air Content:** Do not allow air content of trowel-finished toppings to exceed 3 percent.
7. **Steel-Fiber Reinforcement:** Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd.
8. **Synthetic Micro-Fiber:** Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
9. **Synthetic Macro-Fiber:** Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 4.0 lb/cu. yd.

E. **Building Walls:** Proportion normal-weight concrete mixture as follows:

1. **Minimum Compressive Strength:** 4,000 psi at 28 days.
2. **Maximum Water-Cementitious Materials Ratio:** 0.50.
3. **Slump Limit:** 5 inches, plus or minus 1 inch.
4. **Air Content:** 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. **Air Content:** 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.10 **CONCRETE MIXING**

A. **Ready-Mixed Concrete:** Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. **Project-Site Mixing:** Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3- EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

1. Place and compact a 1/2-inch-thick layer of fine-graded granular material over granular fill.
3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Representative.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section 07920 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Representative.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.


3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, and to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to floor and slab surfaces to be covered with pre-cast concrete floor slab.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and slab surfaces exposed to view.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Representative before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3.11 LIQUID FLOOR/SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 14 days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.
3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.
   3. Headed bolts and studs.
   4. Verification of use of required design mixture.
   5. Concrete placement, including conveying and depositing.
   6. Curing procedures and maintenance of curing temperature.
   7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   6. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
      b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
   7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

10. Test results shall be reported in writing to Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Representative but will not be used as sole basis for approval or rejection of concrete.

12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Representative. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Representative.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

3.13 REPAIRS

Remove and replace concrete that does not comply with requirement in this Section.

END OF SECTION 03300
SECTION 05500 - METAL FABRICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   2. Miscellaneous steel trim including steel angle corner guards and steel edgings.
   3. Pipe Bollards.

B. Products furnished, but not installed, under this Section:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:
   1. Division 03 Section 03300 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.

1.3 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.4 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

C. Galvanizing: Refer to Steel and Iron Finishes.

2.3 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Remove burrs.

C. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

2.4 PIPE BOLLARDS

A. Fabricate pipe bollards from approximately 8 inch o.d., ASTM A53 Schedule 40 steel pipe.
   1. Cap bollards with ¼-inch-minimum steel plate welded to top of pipe bollard.
   2. Fill bollards with concrete, where indicated.

B. Hot-dip galvanized pipe bollards to comply with ASTM A123.

C. Finish: Exposed galvanized pipe bollards shall receive field applied paint primer and finish coats; refer to Section 09900 – Painting.

2.5 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.


PART 3 - EXECUTION

3.1 INSTALLING PIPE BOLLARDS

A. Anchor pipe bollards in concrete footings, as indicated.

3.2 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500
SECTION 07920 - JOINT SEALANTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Shown on drawings as joint sealant or caulking

B. This Section includes sealants for the following applications:

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces.
2. Exterior joints in horizontal traffic surfaces.
3. Interior joints in vertical surfaces and horizontal non-traffic surfaces
4. Interior joints in horizontal traffic surfaces

1.3 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

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

B. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer with a minimum of 5 years of experience specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
1. Rejection of Installed Caulking: Indication of lack of skill on the part of the caulking installers shall be sufficient grounds for the Representative to reject installed caulking and to require its immediate removal and replacement at no additional cost to the Commission.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to joint substrates as follows:

1. Locate test joints where indicated or, if not indicated, as directed by the Commission.

2. Conduct field tests for each application indicated below:
   a. Each type of sealant and joint substrate indicated.

3. Notify the Commission 7 days in advance of dates and times when test joints will be erected.

4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

5. Test Method: Test joint sealants by hand pull method described below:
   a. Install joint sealants in 60-inch-long joints using same materials and methods for joint preparation and joint-sealant installation required for the completed Work. Allow sealants to cure fully before testing.
   b. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
   c. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
   d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

6. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by joint sealant manufacturer agreeing to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Special warranties specified in this Article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS
2.1 MANUFACTURERS

A. Basis-of-Design Product(s): The standard of quality and performance is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Tremco, Inc.
2. Sika Corporation.
3. Pecora Corp.
4. Bostic Inc.
5. Dow Corning
6. GE Silicones; General Electric Company.
7. Approved Equal.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant-manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by the Commission from manufacturer's full range of manufacturer's available colors for the characteristic sealant.

1. If colors are not furnished, provide sealant color to match color of one of the adjacent surfaces to the joint sealant.

2.3 JOINT SEALANTS

A. Joint sealants for vertical surfaces and non-traffic horizontal surfaces.

1. Exterior joint sealant for general use for perimeter joints and expansion joints, unless otherwise indicated.

   a. Description: Medium-modulus, single-component, non-sag pre-pigmented material, silicone joint sealant.

   b. Applicable Standards: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A and O.

   c. Primer: As recommended by joint sealant manufacturer to obtain optimum adhesion and to prevent staining of substrates.

   d. Basis-of-Design Products:

      1) Dow Corning "795 Silicone Building Sealant".

2. Exterior joint sealant for pre-cast concrete.
a. Description: Low-modulus, single-component, pre-pigmented material, silicone joint sealant.

b. Applicable Standards: ASTM C920, Type S, Grade NS, Class 100/50, Use NT, M, G, A and O.

c. Primer: As recommended by joint sealant manufacturer to obtain optimum adhesion and to prevent staining of substrates.

d. Basis-of-Design Products:

   1) Dow Corning, "790 Silicone Building Sealant."

3. Interior joint sealant for general interior walls and ceilings; general use interior sealant.


   c. Primers as required by joint sealant manufacturer to obtain optimum adhesion and to prevent staining of adjacent surfaces.

   d. Basis-of-Design Products:

       1) Tremco "Tremflex 834"
       2) Pecora AC-20.

B. Joint Sealant for Horizontal Traffic Surfaces:

1. General use for exterior/interior expansion and control joints.

   a. Description: Multi-component, self-leveling polyurethane joint sealant or one part silicone joint sealant.

   b. Applicable Standards: ASTM C-920, Type M, Grade P, Class 25, Use T, M, A and O. TTS-00227E, Type 1, Class A.

   c. Primers as recommended by joint sealant manufacturer to obtain optimum adhesion and to prevent staining of adjacent surfaces.

   d. Basis-of-Design Products:

       1) Tremco "THC-9001901"; polyurethane joint sealant.
       2) Dow Corning "SUNS/PC"; silicone joint sealant.

2.4 JOINT-SEALANT BACKING
A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   1. Type C: Closed-cell material with a surface skin, unless otherwise indicated.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Joint Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
   1. Joint primer material recommended by joint sealant manufacturer to prevent joint sealant from staining adjacent surfaces and finishes.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration and width, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

1. Joint primer material recommended by joint sealant manufacturer to prevent joint sealant from staining adjacent finishes.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application, and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration in ASTM C 1193, unless otherwise indicated.

4. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 07920
SECTION 09670 - RESINOUS FLOORING

PART 1- GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY
   A. This Section includes the following:
      1. Chemical resistant epoxy, monolithic, resinous floor; slip-resistant finish.
   B. Related Sections include the following:
      1. Section 03300 - Cast-in-Place Concrete.

1.3 SUBMITTALS
   A. Manufacturer's Literature: Descriptive data and specific recommendations for surface preparation, mixing and application of materials.
      1. Submit details showing termination of resinous flooring at the following areas:
         a. Building walls.
         b. Floor drains.
   B. Manufacturer's Material Safety Data Sheets (MSDS) for each respective product to be used.
   C. Samples for Initial Selection: Color plates showing the full range of colors available for each special coating.
   D. Samples for Verification (Acceptance Sample):
      1. A minimum 8 inch square representative sample of the specified coating system shall be prepared by the Manufacturer's representative and submitted.
      2. The installed coating system shall be similar to the acceptance sample in thickness of respective film layers, color, texture, overall appearance and finish.
   E. Maintenance Data: Each type of special coating to be included in the maintenance manuals. Submit manufacturers written instructions for recommended maintenance practices.
1.4 QUALITY ASSURANCE

A. Installer qualifications: Engage an experienced installer or applicator that specializes in installing resinous flooring types similar to that required for this project and who is acceptable to manufacturer of primary materials.

B. Single Source Responsibility: Obtain waterproofing flooring materials, including primers, resins, and finish coats from a single manufacturer.

C. Bond Testing.
   1. Surface preparation efforts shall be evaluated by conducting Bond Tests at the site prior to application of the coating system(s).
   2. See Paragraph 3.3-B or consult with Material Manufacturer for specific procedure.

1.5 SYSTEM DESCRIPTION OF RESINOUS FLOORING

A. The finished floor coating system shall be uniform in color, texture, and appearance. Alleges that terminate at walls, floor discontinuities, and other embedded items shall be sharp, uniform, and cosmetically acceptable with no thick or ragged edge.

1.6 PROJECT CONDITIONS

A. All material shall be delivered in original Manufacturer's sealed containers with all pertinent labels intact and legible.

B. Store materials in dry protected area between 25 degrees and 90 degrees Fahrenheit. Keep out of direct sunlight. Protect from open flame; keep all containers grounded.

C. Follow manufacturer's specific label instructions and prudent safety practices for storage and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Chemical resistant epoxy, monolithic, resinous flooring.
      a. Crossfield Products Corp: Dex-O-Tex "Cheminert Flooring".
      b. Tamms Industries: DualTex Flooring.
      d. Approved Equal.
2.2 CHEMICAL RESISTANT EPOXY, MONOLITHIC, RESINOUS FLOORING

A. Colors as indicated or if not otherwise indicated, as selected from manufacturer's full range of available colors.

B. Epoxy Flooring: Manufacturer's standard industrial type floor surfacing system consisting of primer, topping including epoxy resin, hardener, coloring agent and selected fine aggregates; and finish coat or coats.

   1. 100% solids, epoxy flooring.

C. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

   1. Compressive Strength (ASTM C579): 7,500 psi
   2. Tensile Strength (ASTM C307): 1,600 psi
   3. Flexural Strength (ASTM D790): 3,000 psi
   4. Bond Strength: 200 psi
   5. Chemical resistance of cured resin (as indicated below when immersed 7 days in reagents listed (FS 405, Method 7011).

      a. No effect from the following: Acetic acid (5%), anionium hydroxide (10%), citric acid (50%), cola syrup, fatty acid, motor oil (20W), and hydrochloric acid (10%), salt water, sodium hydroxide (10%), sulfuric acid (10%), trisodium phosphate (5%), and water (distilled).

      b. Slight softening from the following: Ethyl alcohol (95%), jet fuel JP-4C, and mineral spirits.

      c. No effect but slight stain from nitric acid (10%).


D. Waterproof Membrane: None required for slabs on grade.

2.3 JOINT SEALANT

A. Traffic type joint sealant as recommended by Building manufacturer. Refer to Section 07920 - Joint Sealant.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where resinous flooring is to be installed and notify the Representative of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
B. Do not proceed with application until the surface is acceptable or authorization to proceed is given by the Representative.

3.2 GENERAL

A. If existing ventilation is inadequate, Applicator shall provide sufficient ventilation to allow complete air exchange every five (5) minutes.

B. Provide means for disposal of construction waste.

C. Protect adjacent surfaces not to be coated with masking and/or covers. Equipment shall be protected from dust, cleaning solutions, and flooring materials.

3.3 PREPARATION

A. Surface Preparation:

1. Concrete substrate must be clean and dry. Dislodge dirt, mortar spatter, paint overspray, and other dry surface accumulations and contamination by scraping, brushing, sweeping, vacuuming, and/or compressed air blow down.

B. Bond Testing:

1. Evaluate all surface preparation by conducting bond tests at strategic locations while surface preparation is in progress. Maximum moisture content of concrete based on flooring manufacturer's specifications may not be exceeded immediately prior to installation of flooring.

C. Mechanical Surface Preparation and Cleaning:

1. All accessible concrete floor surfaces shall be mechanically blast cleaned using a mobile steelshot, dust recycling machine. All surface and embedded accumulations of paint, toppings, hardened concrete layers, laitance, power trowel finishes, and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a profile similar to 40 grit sandpaper.

2. Floor areas inaccessible to the mobile blast cleaning machines shall be mechanically abraded to the same degree of cleanliness, soundness, and profile using vertical disc scarifiers, starwheel scarifiers, need guns, scabblers, or other suitably effective equipment.

3. After blasting, traces or accumulations of spent abrasive, laitance, removed toppings, and other debris shall be removed with brush or vacuum.

5. Application of the respective specified material system(s) must be completed before any water or other contamination of the surface occurs.

3.4 CHEMICAL RESISTANT EPOXY, MONOLITHIC, RESINOUS FLOOR

A. Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

1. Application shall be free of any trowel marks.

B. Prime Coat: Apply primer and waterproof membrane over prepared substrate at manufacturer's recommended spreading rate with timing of application coordinated with subsequent application of topping mix to insure optimum adhesion between resinous flooring materials and substrate.

C. Finished Floor Thickness: Minimum 1/4 inch thick. Finished floor surface shall not vary more than 118 inch in 10 feet.

D. Cove Base: None required; terminate resinous flooring at walls.

E. Joints: Where substrate is interrupted by expansion or control joints, provide joint in resinous flooring to comply with details indicated, or, if not otherwise indicated, as recommended by resinous flooring manufacturer.

1. Apply joint sealant materials to comply with resinous flooring manufacturer's recommendations.

F. Application Limitations: Apply material only within manufacturer's allowable temperature range.

3.5 CURING, PROTECTION, AND CLEANING

A. Cure resinous flooring materials in accordance with manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours, unless a longer time is designated by the Manufacturer.

END OF SECTION 09670
SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. This section includes surface preparation and field painting of the following:

1. Exposed exterior items and surfaces.
   a. Exposed ferrous metal, including galvanized metal.
   b. Hollow metal doors and frames.
   c. Pipe bollards.
   d. Other surfaces indicated.

2. Exposed interior items and surfaces.
   a. Hollow metal doors and frames.
   b. Exposed ferrous metal, including galvanized metal.
   c. Masonry walls.
   d. Metal liner panels.
   e. Other surfaces indicated.

3. Painting Related to Mechanical and Electrical Items.
   a. Paint all exposed pipe, pipe insulation, sheet metal, ductwork, conduits, hangers, angles, beams and other metal clad equipment. Factory finished equipment shall not be painted.

B. Related Sections include the following:

1. Division 15 – Mechanical: Painting mechanical patchwork; equipment labeling.
2. Division 16 – Electrical: Painting electrical patchwork.

1.3 ITEMS SHOP PRIMED UNDER OTHER SECTIONS OF THE SPECIFICATION

A. Hollow metal doors and frames.

B. Panelboard covers.
1.4 ITEMS NOT TO BE PAINTED OR FINISHED

A. Do not paint pre-finished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

B. Door hardware and other factory products as identified.

C. Pre-cast concrete building (Emergency Generator Enclosure).

1.5 PERFORMANCE REQUIREMENTS

A. “Paint” as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate of finish coats.

B. Paint exposed surfaces whether or not colors are designated in “schedules,” except where as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not designated, the Commission will select these from standard colors available for materials systems specified.

C. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for shop-fabricate or factory built mechanical and electrical equipment.

D. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory finishing or installer finishing is specified.

E. Concealed Surfaces: Unless otherwise indicated, painting is not required on concealed areas and generally inaccessible areas, foundation spaces, furred areas, pipe spaces, duct and plumbing shafts.

F. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not required finish painting, unless otherwise indicated.

G. Operating Parts and Labels: Moving parts of operation units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated.

H. Do not paint over any code-required label such as Underwriters’ Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.6 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
1. **Material List**: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturers’ catalog number and general classification.

2. **Manufacturer’s Information**: Provide manufacturer’s technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

3. **Submit Material Safety Data Sheets (MSDS’s)** for paints, coatings, sealers and other products which are odorous or potentially irritating.

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

1.7 **QUALITY ASSURANCE**

A. **Applicator Qualifications**: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this project with a record of successful in-service performance.

B. **Source Limitations**: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.8 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver materials to the project site in manufacturer’s original unopened packages and containers bearing manufacturer’s name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at minimum ambient temperatures of 45 deg F.

1.9 **JOB/SITE CONDITIONS**

A. Apply paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50° F and 95° F, unless otherwise permitted by paint manufacturer’s printed instructions.

B. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces.

C. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

1.10 **ENVIRONMENTAL REQUIREMENTS**

A. Volatile Organic Compounds (VOCs)
1. Intent: Reduce the quantity of indoor air contaminants that are odorous or potentially irritating to provide installer and occupant health and comfort.
2. Requirement: Meet or exceed VOC limits to comply with United States EPA laws concerning limits on volatile organic compounds (VOC) for the Architectural and Industrial Maintenance (AIM) industry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Paint:
   a. PPG Industries, Pittsburgh Paints
   b. Pratt and Lambert, Inc.
   c. Sherwin-Williams Co.
   d. Benjamin Moore and Co.
   e. ICI Paint Stores, Inc.
   f. Duron Paints and Wall Coverings.
   g. Sikkens, Azko Nobel Coatings, Inc.
   h. Rust Oleum

2.2 COLORS

A. Paint colors will be selected after award of the Contract.

B. Color pigments: Pure, non-fading, applicable types to suite the substrates and service indicated.

2.3 MATERIALS

A. General: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer’s identification as a standard, best-grade product will not be acceptable. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Previously painted surfaces shall be “scuff-sanded” and shall receive a minimum paint system of two (2) finish coats. Spot prime paint repaired areas.

1. Prime paint previously painted surfaces where recommended by paint manufacturer; apply one coat of tinted primer and one finish coat instead of two finish coats.
C. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove a re-prime as required.

PART 3 - EXECUTION

3.1 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify the Representative in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator’s acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 SURFACE PREPARATION

A. Perform preparation and cleaning procedures in accordance with paint manufacturer’s instructions and as herein specified, for each particular substrate condition.

1. Sand previously painted surfaces to remove pockets or recesses where peeling or blistering paint has been removed.
2. Wash existing previously painted surfaces prior to applying paint or surface treatment. After washing rinse the area thoroughly with clean water and allow to completely dry before painting.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer’s direction.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before applications to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3.4 APPLICATION

A. General: Apply paint in accordance with manufacturer’s directions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

C. Finish doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

D. Sand lightly between each succeeding enamel coat.

E. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

F. Minimum Coating Thickness: Apply prime coat of material which is required to be painted or finished, and which has not been primed-coated by others.

   1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

G. Smooth Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. Transparent (Clear) Finishes: None Required.

3.5 CLEAN-UP AND PROTECTION

A. Clean-up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting as acceptable to the Representative.
B. Provide “Wet Paint” signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.7 EXTERIOR PAINTING SCHEDULE

A. Exterior Ferrous Metal: Gloss alkyd enamel; 2 finish coats over primer.
   1. One (1) coat of PPG Speedhide Inhibitive Primer 6-208.
   2. Two (2) coats of PPG Speedhide Int./Ext. Gloss Alkyd Enamel 6-282 Series.

   NOTE:
   a. First coat not required if factory primed or previously painted with alkyd enamel; spot prime abraded areas only with Inhibitive Primer 6-208.
   b. The Representative’s option to use semi-gloss sheen instead of gloss sheen.

B. Exterior Galvanized Metal: Gloss alkyd enamel; 2 finish coats over primer.
   1. One (1) coat of PPG Speedhide White Galvanized Primer 6-209.
   2. Two (2) coats of PPG Speedhide Int./Ext. Gloss Alkyd Enamel 6-282 Series.

   NOTE:
   a. First coat not required if factory primed or previously painted with alkyd enamel; spot prime abraded areas only with White Galvanized Primer 6-209.
   b. The Representative’s option to use semi-gloss sheen instead of gloss sheen.

3.8 INTERIOR PAINTING SCHEDULE

A. Interior Metal (Ferrous): Lo-Sheen alkyd enamel; 2 finish coats over primer.
   1. One (1) coat of PPG Speedhide Inhibitive Primer 6-208/212.
   2. Two (2) coats of PPG Speedhide Alkyd Lo-Sheen Enamel 6-90.

   NOTE:
   a. First coat not required if factory primed or previously painted with alkyd enamel; spot prime abraded areas only with specified primer.

B. Interior Concrete Masonry Unit (CMU) Walls: Low-sheen alkyd enamel; 2 finish coats over filler.
   1. One (1) coat of PPG Speedhide Block Filler 6-7 (CMU Walls).
   2. Two (2) coats of PPG Speedhide Lo-Sheen Enamel 6-90.
NOTE:

a. Filler not required for existing walls previously painted.

3.9 PAINTING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Factory finished equipment shall be touched up where necessary with same type, texture, and color of paint as equipment was originally finished. Touch-up shall be done as directed after all work has been completed and equipment is in final location.

B. All painting shall be a prime coat of rust inhibiting paint and two coats of best grade machinery enamel of color as listed in the color code.

C. Painting of piping systems shall match the scheme presently used in the facility.

D. Insulation coverings (pipe and exposed rigid insulation): Flat latex emulsion; 2 coats of PPG 6-70 Speedhide Latex Flat Wall Paint.

END OF SECTION 09900
SECTION 13125 - PRECAST CONCRETE BUILDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Division 01 Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. This section includes specifications for off-site fabrication and job site erection of prefabricated, pre-assembled, transportable, pre-cast concrete, building (emergency generator enclosure).

1. Provide appurtenances and accessories indicated including, but not limited to, the following:
   a. Door and door frame.
   b. Door hardware.
   c. Louvers.
   d. Housekeeping pad for emergency generator.

2. Furnish all labor, materials, transportation and equipment for the fabrication and erection of the pre-cast concrete building.

B. Related Sections include the following:

1. Section 03300 - CAST-IN-PLACE CONCRETE: Concrete foundation slab to receive pre-cast concrete building; shop applied floor sealer.
2. Section 09900 – Painting.
3. Division 15 - HVAC; Emergency generator.
4. Division 15 - Plumbing
5. Division 16 - Electrical

1.3 REFERENCE STANDARDS

A. American Concrete Institute (ACI):

1. AC1301 - Structural Concrete for Buildings.
2. AC1304 - Measuring, Mixing, Transporting and Placing of Concrete.
3. AC1318 - Building Code Requirements for Reinforced Concrete.

B. Pre-cast Concrete Institute (PCI):

1. PCI MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
2. PCI MNL-120 - Design Handbook - Pre-cast and Pre-stressed Concrete.
3. PCI MNL-123 - Manual on Design of Connections for Precast Prestressed Concrete.

1.4 DESIGN REQUIREMENTS

A. Design of the precast concrete building shall be performed by or under the direct personal supervision of a Professional Structural Representative experienced in the design of precast concrete buildings and registered in the Commonwealth of Pennsylvania.

B. Dimensions: Refer to drawings for dimensions.

C. Provide pre-cast concrete building capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Floor Load: 200 psi, concentrated up to 800 psf.
   2. Roof Load: 150 psf.

D. Seismic Requirements: None required.

E. Thermal Movements: Design shall provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   1. Temperature Change (Range): 120 deg F, ambient; 80 deg F, material surfaces.

F. Provide floor openings to accommodate utilities projecting through the concrete foundation slab that must project through the floor of the pre-cast concrete building.

G. Pre-cast concrete building shall have a 2 hour fire rating, in accordance with PCI MNL-124.

1.5 SUBMITTALS

A. Product Data: Submit product data for all materials not indicated on shop drawings, including, but not limited to, doors, door frames, door hardware, louvers and finishes.

B. Prepare Shop Drawings under the seal of a Professional Structural Representative experienced in design of this work and registered in the Commonwealth of Pennsylvania.

C. Shop Drawings: Prior to fabrication and delivery, submit shop drawings clearly indicating:
   1. Drawings shall be complete and coordinate the interfacing work with other trades.
2. Member dimensions and cross-sections, fabrication tolerances, locations, size and types of all reinforcement, lifting devices, finishes, details of cast-in and separate items and their relationship to the structure, welded connections and AWS symbols.

3. Locations of doors and door frames, door hardware, louvers and accessory items; locations of caulked and/or grouted joints; locations and details of anchoring devices; locations of plumbing, HVAC and electrical penetrations; location of emergency generator and housekeeping pad.

D. Samples: Submit two (2) samples 24 inches x 24 inches in size illustrating exterior surface finish.

E. Concrete Design Mixture: Submit concrete mixture, aggregate, sand, admixtures, and back-up test data to Representative for review.

F. Indicated design loads, deflections, cambers, bearing requirements, and special conditions.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with the applicable requirements of ACI 301, ACI 318, and PCI MNL-116.

1.7 QUALIFICATIONS

A. Manufacturer: The pre-cast concrete manufacturing plant shall be certified by the Precast/Prestressed Concrete Institute, plant certification program, prior to the start of production.

B. Fabricator: Company specializing in manufacturing the work of this Section with a minimum of 3 years documented experience. Fabricator shall have a minimum of 2 completed projects of equal size and magnitude as this project.

C. Erector: Company specializing in erecting the work of this Section with 3 years documented experience.

D. Registered Professional: Design pre-cast concrete members under direct supervision of a licensed Professional Structural Engineer licensed in the Commonwealth of Pennsylvania and experienced in design of this type.

1.8 REGULATORY REQUIREMENTS

A. Comply with the applicable provision of all codes and standards acceptable to local, state, and federal jurisdictions.

B. Comply with the applicable requirements of ACI 301 and ACI 318 for design load and construction requirements pertinent to the work of this Section.

C. Conform to PCI MNL-124 to achieve required fire ratings specified.
1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle precast units in position consistent with their shape and design. Lift and support only from support points.

B. Lifting and Handling Devices: Capable of supporting units in positions anticipated during manufacturer, storage, transportation, and erection.

C. Protect units from staining, chipping, or spalling of concrete.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Mobile Modular Express, LLC. (Basis of Design – Type 1 Building)

2.2 MATERIALS

A. Portland Cement Concrete: Minimum 5,000 psi at 28 Days; 1 to 3 inch slump prior to addition of plasticizers and not more than 8 inch slump after adding plasticizer; with the following additional requirements.

1. Portland cement: ASTM C150, (Type recommended by manufacturer) for application indicated and as approved by the Representative.
3. Coarse aggregate: ASTM C33, with maximum size limited to the requirements of ACI 31.8.
5. Cement content: Minimum 564 pounds of portland cement per cubic yard.
6. Water/cement ratio: Maximum 0.45 by weight.

B. Concrete Admixtures:

2. Air entraining: For concrete exposed to freeze-thaw cycling, conforming to ASTM C 260, 4-1/2% air entrained plus-or-minus 1- 1/2% when tested in accordance with ASTM C 94.

C. Reinforcement:

1. Strands: All strands for prestressed concrete shall meet the requirements of ASTM A416 grade 250K or 270K, stress relieved.
2. Reinforcing Steel: All reinforcing bars and/or welded steel wire fabric for concrete reinforcement shall meet the standards of ASTM A615 grade 60 bars and ASTM A185 for mesh.
3. Provide minimum #4 reinforcing bars.

D. Cast-In Anchors:
1. Connection and Supporting Devices: ASTM A36 carbon steel- or ASTM A666 stainless steel plates, angles, items cast into concrete, and inserts, conforming to PCI MNL-123; carbon steel shall be hot-dip galvanized (in accordance with ASTM A153).
2. All bolts shall conform to the requirements of ASTM A307 or A325.

E. Non-Shrink Grout Non-shrink, non-metallic minimum compressive strength of 7,000 psi at 28 days.

F. Joint Sealant: Refer to Section 07920 “JOINT SEALANT”

G. Swing Door and Door Frame: Door and frame shall comply with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames".
   1. Exterior Swing Door: Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush). Galvanized steel sheets. Minimum steel face thickness indicated below is uncoated steel.
      a. Minimum 0.053-inch- thick cold-rolled steel sheet faces. (16 gage).
      b. Door Size: 1-3/16 inches thick x 36 inches wide x 80 inches, unless otherwise indicated.
   2. Exterior Door Frame: Fabricate exterior frame from 0.067-inch- (14 gage) thick steel sheet; galvanized both sides. Minimum steel thickness indicated is uncoated steel. 2 inch face for frame, unless otherwise indicated.
   3. Doors and frames shall be factory prime painted with alkyd, rust-inhibiting primer.

H. Door Hardware: Subject to specified requirements, door hardware manufacturers and products to be pre-cast manufacturer's option.
   1. Lock Set: Stainless steel, heavy-duty lockset, mortised, with lever handle and removable cylinder capable of being master keyed to the Commission's requirement.
   2. Hinges: 4-1/2 x 4-1/2 stainless steel hinges with non-removable hinge pins; 3 per door.
   3. Door Holder: Stainless steel overhead slide type, surface mounted door holder.
   4. Drip Cap: Stainless steel.
   6. Threshold: Raised interior, extruded aluminum threshold with neoprene seal.
   7. Door Stop: Furnish stop for each door opening against a wall.

I. Louvers: Stationary metal wall louvers; 4 inches deep. Subject to specified requirements, louver manufacturers and products to be pre-cast manufacturer's option.
1. Drainable blade louver type. 4 inches deep with 37.5 degree stationary drainage blades. Blades and frame shall be 0.081 inch thick extruded aluminum alloy 6063-T5. Minimum 50 percent free air for 48 x 48 inches test size.
2. Bird Screening: Louvers shall be furnished with aluminum, 1/2 inch square mesh, minimum 0.63 inch wire, in re-wireable extruded aluminum frames. Secure screens to louver frames with stainless steel machine screws.
3. Louvers shall be furnished with extended frame at sill. Extend front leg of frame at sill one inch.
4. Finish: Class 1, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

J. Sealer for Exterior Walls: Pre-cast manufacturer's standard product; refer to Article 2.4 Finishes.

K. Elastomeric Roof Coating: Pre-cast manufacturer's standard product; refer to Article 2.4 Finishes.
   1. Provide ultraviolet resistant, reflective elastomeric coating which will not crack, peel or flake and will prevent water intrusion.

2.3 PREFABRICATED EMERGENCY GENERATOR ENCLOSURE

A. Fabrication procedure to conform to PC1 MNL-116.

B. Maintain plant records and quality control program during production of pre-cast members. Make records available upon request.

C. Pre-cast, reinforced concrete enclosure with 2 hour fire rating.

D. Floor: Minimum 6-3/4 inch thick solid concrete.
   1. Floor panels to have 1/2 inch step-down around the entire perimeter, to prevent water migration along the bottom of the wall panels.

E. Walls: Minimum 4 inch thick solid concrete.

F. Roof: Minimum 4 inches thick solid concrete at eave and 5 inches thick solid concrete at ridge. Step joint design.
   1. Provide 2 inch overhang with built-in drip edge or design which extends 1/2 inch below the top edge of the wall panels to prevent water migration into the building along top of wall panels.

G. Joint Sealant: All joints between panels to receive joint sealant on the exterior and interior surface of the joints.
2.4 FINISHES

A. Galvanized Steel Sheets (Steel Doors and Frames): The steel shall be hot-dip galvanized so as to provide a ductile coating, tightly adherent to the base steel. The zinc coating shall be an MO coating in accordance with ASTM A924/A 924M. The zinc coating shall be minimum spangle and shall be treated for paint adhesion.

1. Zinc coating shall be not less the 0.6 oz. per square foot of steel, total coverage.
2. Coating shall be applied to both sides of steel.

B. Interior Finishes:

1. Smooth Finish: Provide smooth surface finish free of form marks, pockets, sand streaks, and honeycomb, with uniform color and texture. Interior finish shall be 0.030” textured, FRP; provided by Nudo Products, Inc.
   a. Interior face of units shall have a form finish as obtained with a well designed mix and proper vibration. Small air pockets and pits will be acceptable. Chips and spalls which occur during transmit and erection shall be patched satisfactorily as far as conformity to original shape and texture.

2. Concrete Floor Treatment: Provide a non-film forming concrete sealer/hardener which increases the abrasion resistance and compressive strength of concrete. Refer to Section 03300 “CAST-IN-PLACE CONCRETE”.

C. Exterior Finishes:

1. Aggregate Finish: Sealed, washed brown river-stone aggregate finish on all exterior wall surfaces. Aggregate to be seeded into top of panel while in form, chemically retarded, and high-pressure washed to expose the aggregate to a depth of approximately 1/8 inch.
   a. Clear or stain sealer to be applied to the exterior walls.

2. Roof Coating: 3-part elastomeric roof coating to be shop applied to top of concrete roof slab to waterproof concrete roof slab.
   a. Provide a 10-year Warranty on Roofing System.

3. Painting: Field painting doors and frames; refer to Section 09900 PAINTING.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site conditions (including foundation slab) are ready to receive pre-cast concrete building and comply with requirements as shown on shop drawings and Contract Documents.

B. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Erect pre-cast concrete building without damage to structural capacity, shape, or finish. Replace or repair damaged units.

B. Set pre-cast concrete building as approved on shop drawings; grout joint at intersection of unit with foundation slab.

C. Secure pre-cast concrete building in place as approved on shop drawings. Perform any welding in accordance with AWS D1.1.

3.3 PROTECTION

A. Protect pre-cast concrete building from damage caused by field welding or erection operations.

B. Provide non-combustible shields during welding operations.

3.4 CLEANING

A. Clean weld marks, dirt and blemishes from exterior and interior exposed surfaces.

END OF SECTION 13125
SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. These Specifications and accompanying Drawings are intended to cover the furnishing of all labor, materials and installation of all mechanical systems and related items. Small items of material, equipment and appurtenances not mentioned in detail or shown on the Drawings but necessary for a complete and operable system, shall be furnished and installed by this Contractor without additional charge to the Commission and shall be under this Contract. Provide all necessary labor, equipment, materials, transportation, accessories and services required for the complete modification and installation of all systems. The work shall basically include but is not limited to:

1. General:
   a. Furnish and install all mechanical system identification.
   b. Furnish and install all sleeves, concrete housekeeping pads, vibration isolation isolators, and supports required for system installation.
   c. Sleeve and seal all pipe penetrations through walls and floors to maintain integrity of fire, smoke, or waterproof barrier. Refer to Section 15140.
   d. Furnish starters and disconnect switches for all motorized equipment.
   e. Test, adjust, balance, and clean the entire mechanical system to provide performance criteria as indicated on the drawings. Provide drive changes and system adjustments required (belts, shelves, etc.) to accomplish design criteria. Refer to Section 15990.
   f. See paragraph below regarding electrical requirements for mechanical equipment.

2. Air Distribution Systems:
   a. Furnish and install all exhaust fans, and all air terminal equipment shown on the drawings.
   b. Furnish and install all HVAC supply, return, and exhaust ductwork.
   c. Furnish and install all Generator Exhaust systems indicated on the drawings.
   d. Furnish and install all diffusers, registers, and grilles.
   e. Furnish and install all required volume control dampers and back-draft dampers as required to balance the system.
   f. Furnish and install all required duct insulation.
3. Miscellaneous Mechanical Systems:
   a. Furnish and install fuel oil system including pumps, storage tanks, piping, valves, and other items shown on the drawings.

4. Control Systems:
   a. Furnish and install a complete automatic temperature control system as specified in Division 15.
   b. Furnish and install electric/electronic control system complete with control panels, controllers, control devices, and other items shown on the drawings.

1.3 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Provide mechanical equipment with voltages and other electrical characteristics as indicated on the drawings and specifications.

B. All starters and disconnect switches, except factory mounted starters and disconnect switches, for equipment provided under Division 15 shall be furnished under Division 15 and installed under Division 16.

C. All power wiring for mechanical equipment provided under Division 15 shall be furnished and installed under Division 16 (from source to starter, disconnect switch, or combination starter/disconnect switch, and to equipment, motor, or other connection point). Except where specifically indicated otherwise, all power wiring to the point of final connection, for equipment provided under Division 15, shall be accomplished under Division 16. In general, the point of final connection shall be the terminal housing on the equipment, motor or an integral junction box on the equipment item. If no junction box is furnished, a junction box shall be furnished and installed under Division 16. Wire leads of adequate length to ensure a proper connection at the final location shall be furnished and installed under Division 16.

D. All control wiring (line voltage and/or low voltage) for mechanical equipment provided under Division 15 shall be furnished and installed under Division 15. Wiring from power source to all control panels, controllers, and other control equipment required for a complete and operable control system serving mechanical equipment provided under Division 15 shall be furnished and installed under Division 15. All wiring from control panels to control devices for mechanical equipment provided under Division 15 shall be furnished and installed under Division 15. All control wire and conduit shall comply with the National Electric Code and Division 16 of the specification. All control wiring shall be in conduit.

E. Wiring, over-current protection devices, voltage, phase, rotation and final location of all equipment provided under Division 15 shall be coordinated with all similar devices and power wiring furnished and installed under Division 16. Coordination shall be accomplished prior to the running of any conduit or wiring.

F. Final electrical power connections to all equipment shall be furnished and installed under Division 16.
G. Electrical control wiring for connection of temperature controllers, push buttons, interlocks in motor controllers, pneumatic switches and like items is specified in the control section(s) in Division 15.

H. All motors, mounts, remote mounted push-button controls and all speed control switches for multi-speed motors for all mechanical equipment provided under Division 15 shall be furnished and installed under Division 15.

I. Division 15 shall fully cooperate with the other Divisions and trades on the job and their manufacturers in promptly providing the information required for proper coordination of motor protection and control equipment and wiring and the characteristics of the equipment.

J. It shall be the responsibility of the contractor to check for adequacy of supply wiring, over-current protection, proper voltage, phase rotation and final location of equipment provided prior to the running of any conduit or wiring. Coordinate with Division 16 to assure proper electrical service is provided to equipment provided under Division 15.

K. Equipment connections shall be made through conduit or raceways in accordance with Division 16, except that connections to motors shall be made through liquid tight flexible metal conduit with equipment grounding conductor.

1.4 CODES, ORDINANCES, REGULATIONS, PERMITS AND FEES

A. Obtain and pay for all permits, inspections and connection fees required by authorities having jurisdiction in connection with the Work. Deliver certificates of inspection to the Representative.

B. All Work shall comply with all Federal, State and Local codes, ordinances and regulations for the following having jurisdiction:

2. Commonwealth of Pennsylvania
4. UL Standards
5. Commonwealth of Pennsylvania Department of Labor and Industry
6. NFPA Standards
7. Commonwealth of Pennsylvania Board of Health
8. Commonwealth of Pennsylvania Department of Environmental Protection
9. United States Environmental Protection Agency
10. United States Occupational Safety and Health Administration

C. Refer to applicable Contract Drawings and specifications pertaining to other Divisions for conditions affecting Work.

1.5 SUBMITTALS

A. Submit shop drawings and product data as specified in individual specification sections
to the Representative for review before purchasing equipment.

1.6 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Submit for Representative's review before proceeding.

1.7 COORDINATION

A. Coordinate work with all other trades.

B. Contractor shall not install systems without prior coordination with other trades. Any work that is found to be in conflict with other trades, building structure, or the intent of the design as a result of a lack of coordination, shall be removed and properly reinstalled. Any and all costs of such instances shall be borne by the installing contractor without additional compensation.

1.8 FIELD MEASUREMENTS

A. Drawings are diagrammatic in nature, except where special instances warrant dimensioned locations. Verify that field measurements are correct prior to installing work.

B. No measurement of a drawing by scale shall be used as a working dimension. Working measurements shall be taken from figured dimensions and through physical field inspections. The Contractor shall bear sole responsibility for physical measurements and working dimensions.

1.9 DEFINITIONS

A. Furnish - Except as otherwise defined in greater detail, the term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations" as applicable to each instance.

B. Install - Except as otherwise defined in greater detail, the term "install" is used to describe operations at the project site including actual "unloading, unpacking, assembly, erection, placing, anchoring, connecting, applying, working to dimension, finishing, curing, protecting, testing to demonstrate satisfactory operation, cleaning and similar operations" as applicable in each instance.

C. Provide - Except as otherwise defined in greater detail, the term "provide" means to furnish and install, complete and ready for intended use and successfully tested to demonstrate satisfactory operation" as applicable in each instance.
D. Remove - Except as otherwise defined in greater detail, the term "remove" means to disassemble, dismantle, and/or cut into pieces in order to remove the equipment from the site and to properly dispose of the removed equipment and pay for all associated costs incurred.

E. Replace - Except as otherwise defined in greater detail, the term "replace" means to remove the existing equipment and to provide new equipment of the same size, capacity, electrical characteristics, function etc. as the existing equipment.

F. Shall - The word "Shall" indicates action which is mandatory on the part of the Contractor.

G. Indicated - The term "indicated" is a cross-reference to graphic representations, details, notes or schedules on the drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in the Contract Documents. Where terms such as "shown", "noted", "scheduled" and "specified" are used in lieu of "indicated" it is for the purpose of helping the reader locate the cross-reference, and no limitation is intended except as specifically noted.

H. Shown - The term "shown" is a cross-reference to graphic representations, details, notes or schedules on the Contract Drawings and to similar means of recording requirements in the Contract Documents.

I. Specified - The term "specified" is a cross-reference to paragraphs or schedules in the specifications and to similar means of recording requirements in the Contract Documents. The specifications include the General Provisions, Special Provisions and the Technical Specifications for the project.

J. No Exception Taken - Where used in conjunction with the Representative's response to submittals, requests, applications, inquiries, reports and claims by the contractor the meaning of the term "no exception taken" shall be held to the limitations of the Representative's responsibilities to fulfill requirements of the Contract Documents. The term "no exception taken" shall also mean to permit the use of material, equipment or methods conditional upon compliance with the Contract Documents.

K. Similar - The term "similar" shall mean generally the same but not necessarily identical; details shall be worked out in relation to other parts of the work.

L. Submit - The term "submit" shall mean, unless otherwise defined in greater detail, transmit to the Representative for approval, information and record.

M. Make Corrections Noted - "Make corrections noted" shall mean the submittal essentially complies with the contract documents except for a few minor discrepancies that have been annotated directly on the submittal that will have to be corrected on the submittal and the work correctly installed in the field by the Contractor.

N. Revise and Resubmit - The term "revise and resubmit" shall mean the Contractor shall revise the submittal to conform with the Contract Documents by correcting moderate errors, omissions and/or deviations from the Contract Documents and resubmit it for review prior to approval and before any material and/or equipment can be fabricated, purchased or installed by the Contractor.
O. Rejected - The terms "disapproved" or "rejected" shall mean the Contractor shall discard and replace the submittal because the submittal did not comply with the Contract Documents in a major way.

P. Submit Specified Item - The term "submit specified item" shall mean the Contractor shall discard and replace the submittal with a submittal containing the specified items because the submittal contained improper manufacturer, model number, material etc.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in the manufacturer's original undamaged packages or acceptable containers.

B. Store and protect all materials, apparatus and equipment from physical damage, the elements, moisture, dirt, debris and Work of other trades. Use of paper, cardboard or other flimsy material for protection shall not be permitted. Replace damaged protective materials immediately. Do not install damaged materials, apparatus or equipment. Remove damaged materials from the site immediately.

C. Handle all materials as recommended by the manufacturer and to prevent physical damage with seals and labels intact and legible.

D. Deliver, store and handle materials in accordance with requirements of Division 1 and manufacturer's instructions.

E. Cap or plug openings in equipment, piping, ducts and other systems to exclude dirt and other foreign material. Pipe, cleanouts, floor drains and similar openings shall be temporarily plugged with oakum or test plugs until final connections are made. Rags, cotton, paper, waste or similar materials shall not be used for plugging.

F. Protect all mechanical equipment and material as soon as delivered to the site. Also, protect fixtures as soon as they are set. Board over water closets and other fixtures and post notices prohibiting their use.

1.11 PROTECTION

A. The Contractor shall provide approved protection for all Work included in this Contract and be responsible for damage of any kind to fixtures, ductwork, piping, equipment or other Work. At the completion of the project the Contractor shall remove all protection and replace or repair all damaged Work to the satisfaction of the Representative without expense to the Commission.

B. In addition to the normal precautions for protection of Work, the Contractor shall provide various types of protection as follows:

1. Protect finished floors from chips and cutting oil by the use of metal chip receiving pan and an oil-proof floor cover.
2. Protect equipment and finished surfaces from welding and cutting spatters with baffles and spatter blankets.
3. Protect equipment and finished surfaces from paint droppings, insulation adhesive, etc. by the use of drop cloths.

C. All pumps, motors, fans and other rotating equipment shall be stored at the site with openings, bearings, etc. covered to exclude dust, moisture and other debris. All stockpiled pipe shall be placed on dunnage and protected from the weather and from entry of foreign material.

D. During construction, open ends of ducts, pipes, equipment, etc. shall be capped, plugged, or covered with plywood or sheet metal to reduce dirt accumulation inside.

1.12 GUARANTEES / WARRANTIES

A. Where extended guarantees/warranties are called for herein, furnish enough copies to be inserted in each of the operation and maintenance manuals.

B. All preventive maintenance and normal service will be performed by the Commission's maintenance personnel after final acceptance of the Work. This shall in no way alter the Contractor's guarantee/warranty of the Work.

C. In addition to the requirements stated in the specifications, the Contractor shall guarantee all equipment, materials, and appurtenances installed by him to be free from all defects. Upon written notice from the authorized Representative, the Contractor shall promptly correct all defects without additional cost to the Commission. This Contractor shall adjust each part of the entire installation for proper working order. Reports shall be submitted to the Representative and adjustments repeated until the entire system is satisfactory. This Contractor shall make good, at his own expense, any defects in materials or workmanship that may appear.

1.13 MATERIAL AND EQUIPMENT LIST AND REQUIREMENTS

A. Within 30 days after award of the Contract, submit for Representative's review a list of Subcontractors' and manufacturer's names for items proposed for the Work.

B. Failure to submit the list or name manufacturer's acceptable to the Representative within the time limit will result in Representative selecting a list of manufacturers, and selection shall be binding upon the Contractor.

C. Where two or more items of the same, type of equipment are required, the product of one manufacturer shall be used. Materials and equipment shall have a record of three years successful field use. For certain items of equipment the specification is based upon the manufacturer's product.

D. Only the manufacturer's equipment upon which the specification has been based has been checked for this project. The Contractor must check the allocated space and structure for suitability of equipment of alternate manufacturer including parts replacement and servicing.

E. The Contractor shall be responsible for all additional costs incurred due to equipment
they install that is other than the basis of design equipment. These costs include, but are not limited to, electrical services, gas services, structural supporting members, roofing, wall, floor and roof penetrations, concrete housekeeping pads, fire protection systems and other building systems. The Contractor shall be responsible for coordinating all changes and requirements due to substitutions and alternative manufacturer selections made by the Contractor.

1.14 CONTRACT DOCUMENTS

A. The Drawings, Specifications and other Contract Documents, including all modifications to the same, are cooperative and complimentary. All items, materials and work shown or specified in one and not the other shall be provided by the Contractor as though fully covered by both.

B. It is the intent of the Contract Drawings, Contract Specifications and other Contract Documents to include all labor, services, supplies, tools, equipment, utilities, materials and accessories required for and incidental thereto, for the complete execution of all work and for complete and operable systems as indicated on the Drawings and/or Specifications; to outline and indicate Work which cannot be readily shown on the Drawings; and further to indicate types and quantities of materials required.

C. The Contractor shall make no changes in, nor deviate from, the requirements of the Drawings, Specifications and other Contract Documents except by written permission from the Representative.

D. The Contractor shall immediately report any errors, discrepancies and/or omissions discovered in the Drawings, Specifications and/or other Contract Documents to the Representative. Any adjustments made by the Contractor without prior approval shall be made at his own risk and settlement of any complications, disapprovals or rejections arising from such adjustments shall be made by the Contractor with no additional cost to the Commission.

E. Any additional work that may be incorporated by future modifications to this Contract shall be fully subject to all terms, conditions and requirements of this basic Contract.


G. Throughout the Specification, the omission of words or phrases such as "the Contractor shall", "in conformity therewith", "shall be", "according to the Drawings" etc. shall not alter the Contractor's responsibility. The specifications are instructions to the Contractor and such omitted words or phrases shall not alter the Contractor's responsibility. It should also be noted that where the term "equal" is used, it shall be understood that this is an "approved equal" as solely determined by the Representative.

1.15 MANUFACTURER'S RECOMMENDATIONS

A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these installation instructions shall be furnished with submittals. Installation
of these items will not be allowed to proceed until the recommendations are approved. Failure to furnish these recommendations can be cause for rejection of the material.

1.16 SAFETY PROCEDURES

A. Refer to the General Provisions, Special Provisions and applicable technical specification sections for requirements.

B. The Contractor shall be responsible for safety on the construction site and for developing the safety program.

C. The Representative shall not be responsible for safety on the construction site.

1.17 SCAFFOLDING

A. This Contractor shall furnish and install scaffolding, ladders, runways, lifts, and similar items required in connection with his work.

B. The Contractor shall be responsible for their safe use and proper installation.

1.18 RECORD DRAWINGS

A. The Contractor shall be required to maintain a complete set of blue or black line white prints of Contract Drawings and Shop Drawings for record markup purposes throughout the contract period. Mark up drawings during the course of work to show changes and actual installation conditions sufficient to form a complete record for the Representative's purposes. Give particular attention to work, which will be concealed and difficult to measure and record at a later date, particularly work which may require servicing or replacement during the life of the building. Include precise locations and elevations of all utility lines installed under this Contract, buried or concealed within or outside the building, including valves or connections, cleanouts, changes in direction, and any other pertinent information. Refer to GPFP, Section 105.02 (d).

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment shall be new unless otherwise indicated. Systems shall be provided complete, and each system as a whole, and in all its parts, shall function correctly up to the specified capacity. Should a system, or any part thereof fail to meet performance requirements, necessary replacements, alterations or repairs as required by the Representative, shall be made to bring the performance up to the specified requirements and all building construction or finishes or equipment damaged or marred by such replacements, alterations or repairs shall be restored to prior condition, at no additional cost to the Commission.

B. Where multiple items of equipment or materials are required they shall be the product
of a single manufacturer.

C. Before ordering any equipment, the Contractor shall check the size of all equipment to verify that the equipment selected fits in the allotted space on the drawing.

D. Inserts, pipe sleeves, hangers, supports, fixtures, trim, drains and anchorage of mechanical equipment shall be provided as specified herein. Where such items are to be set or embedded in concrete, masonry or similar work, the items shall be furnished and layout made at the proper time for setting or embedment thereof so as to cause no delay in the work. If this Contractor fails to see that proper provisions are being made for his work, this Contractor shall be responsible for paying to provide alterations, revisions and/or cutting and patching as required to properly install his work.

E. Piping assemblies of equipment shown on the Drawings are diagrammatic. All piping and appurtenances required for the proper operation of all equipment shall be provided.

2.2 MANUFACTURERS

A. Manufacturer's Names, Model Numbers and Catalog numbers

1. Specific references have been made to one or more manufacturer's name and model or catalog numbers.
2. This does not indicate that the material and equipment specified is necessarily an “off the shelf” item: requirements for specific finishes, materials or other modifications may introduce variances from manufacturer's standards. The Contractor shall ascertain that such modifications are fully considered.

B. Where one or more manufacturers are listed by name without the phrase “substitutions permitted” or “approved equal”, provide only the product of the manufacturer(s) listed.

C. Where one or more manufacturers are listed by name along with the phrase “substitutions permitted” or “approved equal”, provide the products of the manufacturer(s) listed. or an approved equal product of another manufacturer.

D. The Representative shall make the final decision with regard to whether or not a substituted product meets the intent of the specification.

2.3 DIAGRAMS, NAME PLATES AND LABELS

A. Each major component of equipment shall have the manufacturer's name, address, catalog number, model and serial numbers, capacity at design operating conditions, and other essential information as required to identify the equipment on a plate securely affixed in a conspicuous place. The name plate of a distributing agent will not be accepted.

B. In all areas having equipment, valves and control devices, provide single line diagrams framed under glass and mounted on equipment room wall. Diagrams shall be black lines on white vellum. The diagrams shall give name, number designation and location of each piece of equipment, valve and control device.
C. All pieces of equipment, valves, starters, disconnects and all pneumatic and electrical control instruments and appurtenances shall be identified in accordance with specification Section 15190 - MECHANICAL IDENTIFICATION. Equipment shall be designated with a numerical suffix as indicated on the Contract Drawings or control Drawings (for example: Chiller, CH-1; Boiler, BLR-1; Thermostat, T-1).

D. Provide a label for the mechanical system or equipment stating:

"INSTALLATION BY:"

(Name, Address and Phone Number of Contractor and Date Installed)

E. Letters shall be 1/4 inch high and located in a conspicuous place on the equipment.

F. All labels shall be securely affixed. Attach nameplates to valves with non-corrosive chain or wire.

2.4 SPARE PART

A. Provide spare parts as required in the technical specification sections.

2.5 LUBRICATING DEVICES

A. Provide oil level gauges, grease cups, grease gun fittings for machinery bearings, as recommended by machinery manufacturer. Where lubricating means are not easily accessible, extend to accessible locations. Furnish all grease gun fittings of uniform type.

2.6 SUBSTITUTIONS

A. Where manufacturers or suppliers name, style and catalog numbers are mentioned in the description of material and equipment in the Specifications or on the Drawings, it is understood that they are for the purpose of setting a standard. Material and/or equipment of other makes may be supplied providing it is an "Approved Equal" or an "Approved Equivalent" by the Representative to be of similar design and equal in construction, performance, workmanship and finish to that specified. It shall be the Contractor's responsibility to prove and guarantee that the substitution meets or exceeds the Specifications.

B. Design drawings have been prepared utilizing the dimensions, configuration, capacity, weights, electrical characteristics, etc of the equipment scheduled as the basis of design. The acceptance of substitute or alternate manufacturer listed equipment by the Representative does not relieve the Contractor of the responsibility of coordinating the impact of substituted equipment on other trades. All costs associated with the installation of substituted equipment, including design, analysis and construction costs shall be borne by the Contractor.
PART 3 - EXECUTION

3.1 GENERAL

A. Contract Document Drawings for mechanical work are diagrammatic and are intended to convey scope and general arrangement only. All ductwork, piping, equipment and appurtenances required for a complete and operable system shall be provided.

B. Install all mechanical equipment and appurtenances in accordance with manufacturers' recommendations, Contract Documents and applicable codes and regulations.

C. Coordinate construction of all mechanical work with architectural, structural, civil, electrical, work etc. shown on other Contract Drawings. Coordinate and cooperate with other trades to facilitate execution of the work.

D. The location of underground utilities is approximate. Verify the exact location of all existing utilities before commencing work. The Contractor shall pay for and repair all damages to any and all underground utilities unless otherwise noted.

E. Maintain a minimum of 7'-0" clearance to underside of pipes, ducts, conduits, suspended equipment, etc., throughout access routes in mechanical equipment rooms and generator buildings.

F. Where two or more of the same type of equipment are required, the product of one manufacturer shall be used.

G. Verify all equipment connections with manufacturer's certified Drawings. Verify and provide all duct and piping transitions to furnished equipment. Field verify and coordinate all dimensions before fabrication.

H. Concrete housekeeping pads to suit mechanical equipment shall be sized, and located by the Mechanical Contractor. Minimum concrete pad thickness shall be 4 inches. The pad shall extend beyond the equipment a minimum of 4 inches on each side. Reinforcement, detailing and placement of concrete shall conform to ASTM 315 and ACI 318. Concrete shall conform to ASTM C94. Concrete work shall conform to ACI 318, part entitled "Construction Requirements".

I. The locations of all items shown on the Drawings or called for in the specifications that are not definitely fixed by dimensions are approximate only. The exact locations necessary to secure the best conditions and results must be determined by the project site conditions and shall have the approval of the Representative before being installed. Do not scale the Drawings.

J. When work is subcontracted, it shall be the Contractors responsibility for coordinating Subcontractors.

K. Refer questions involving Contract Document interpretation or discrepancies to the Representative for review and direction. Correct faulty work due to resolving discrepancies without proper approval without additional cost to the Commission.
3.2 INSTALLATION AND WORKMANSHIP

A. The work shall be performed by qualified mechanics and all materials, apparatus and equipment shall be installed in a neat, workmanlike manner; align, level and adjust for satisfactory operation; install so that disconnecting ductwork, piping and accessories can be made readily and so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from the indicated arrangements may be made, but only after obtaining approval from the Representative.

B. All work shall be installed in accordance with the Contract Documents, industry and trade standard practices and manufacturer's written instructions or recommendations. All material, apparatus or equipment that, in the opinion of the Representative, is improperly installed shall be removed and reinstalled in the approved manner at no additional cost to the Commission.

C. The work shall be coordinated with the work of other trades. Where the work is dependant upon work of other trades or work already in place, such other work and work in place shall be examined and shall be in proper condition and state of completion before continuing the installation.

D. The installation of the system shall, in general, be in accordance with the Drawings and specifications with regards to location of equipment, ducts, pipes and the like. Piping and ductwork indicated shall be followed as accurately as actual construction will permit and any deviations from the Contact Documents shall be called to the attention of the Representative. Where necessary, as determined by the Representative, the Contractor shall furnish Drawings showing proposed changes.

E. Materials, apparatus and equipment and their associated installation procedures shall be in accordance with industry standard practice and all applicable codes and regulations.

F. The location of ductwork and piping shall be coordinated to determine that it clears openings and structural members; that ductwork and piping indicated as concealed can be properly concealed in walls or partitions and that it does not interfere with lights or other equipment having fixed locations. Make necessary horizontal and vertical offsets with ductwork and pipe fittings to install the systems in the available space. Conceal all ductwork and piping except where otherwise indicated. Ductwork and piping shall be exposed in finished areas only where indicated or with written approval of the Representative.

G. Where drain and water connections necessary to the operation of fixtures or equipment are not specifically indicated, extend necessary branches to the closest indicated branch or main.

3.3 TESTING, ADJUSTING AND BALANCING

A. Test, adjust and balance all devices, equipment, and systems in accordance with Section 15990: Testing, Adjusting, and Balancing.
3.4 EARTHWORK AND DEWATERING
   A. Perform in accordance with Division 2.

3.5 WATERPROOFING
   A. Do not cut or penetrate waterproof surfaces, or waterproofing membranes, without first making arrangements for repair by a method approved by the Representative.

3.6 PAINTING
   A. Painting of piping, ductwork and equipment exposed to view shall be provided by the Mechanical Contractor in accordance with Division 9 of the Specifications unless otherwise indicated.

3.7 TEMPORARY HEAT
   A. Provide temporary heat as required for the completion of the work.
   B. At the completion of the project, remove all temporary heating facilities in their entirety.

3.8 DEBRIS REMOVAL
   A. Remove from the jobsite all debris generated by the unloading, uncrating, unpacking, unwrapping, etc. of all equipment and devices. Remove from the jobsite all debris generated by the installation of work.

END OF SECTION 15010
SECTION 15121 - PIPING EXPANSION COMPENSATION

PART 1- GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY
   A. Section includes:
      1. Flexible pipe connectors.
      2. Pipe loops, offsets, and swing joints.

1.3 REFERENCES
   A. MLLE-17814E - Expansion Joints, Pipe, Slip-Type, Packed.

1.4 PERFORMANCE REQUIREMENTS
   A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

1.5 SUBMITTALS
   A. Submit under General and Special Provisions.
   B. Product Data:
      1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
      2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
   C. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.6 PROJECT RECORD DOCUMENTS
   A. Submit under General and Special Provisions.
B. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.7 OPERATION AND MAINTENANCE DATA
A. Submit under General and Special Provisions.
B. Maintenance Data: Include adjustment instructions.

1.8 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.9 DELIVERY, STORAGE AND HANDLING
A. Deliver, store, protect and handle products to site in accordance with Section 15010.
B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY
A. Provide five (5) year warranty on flexible pipe connectors.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS
A. Steel Piping:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Metraflex.
      b. Vibration Mountings and Controls, Inc.
      c. Mason Industries.
      d. Approved Equal.
   2. Inner Hose: Stainless Steel.
   4. Pressure Rating: As required for system pressures and temperatures.
   5. Joint: As specified for pipe joints.
   6. Size: As per drawings.
   7. Maximum offset: 3/4 inch on each side of installed center line.
2.2 ACCESSORIES

A. Swivel Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advanced Thermal Products.
   b. Hyspan.
   c. Flexonics.

   2. Fabricated steel body, double ball bearing race, field lubricated, with rubber o-ring seals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Construct spool pieces to exact size of flexible connection for future insertion.

C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Rigidly anchor pipe to building structure where necessary. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where indicated.

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide inspection services by flexible pipe manufacturer's representative for final installing and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION 15121
SECTION 15140 – SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section includes:
   1. Pipe and equipment hangers and supports.
   2. Equipment bases and supports.
   3. Sleeves and seals.
   4. Flashing and sealing equipment and pipe stacks.

1.3 REFERENCES

A. ASME B31.9 – Building Services Piping.
B. ASTM F708 – Design and Installation of Rigid Pipe Hangers.
C. MSS SP58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
D. MSS SP69 – Pipe Hangers and Supports – Selection and Application.
E. MSS SP89 – Pipe Hangers and Supports – Fabrication and Installation Practices.

1.4 SUBMITTALS

A. Submit under General and Special Provisions.
B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
C. Product Data: Provide manufacturers catalog data including load capacity.
D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
E. Manufacturer’s Installation Instructions: Indicate special procedures and assembly of components.
1.5 REGULATORY REQUIREMENTS

A. Conform to all applicable codes for support of fuel oil piping.

PART 2 – PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS MANUFACTURERS

A. Manufacturers – Pipe Hangers and Supports; Subject to compliance with requirements, provide products by one of the following:

1. Grinnell.
2. Elcen.
3. Fee and Mason
4. Basic Representativeing, Inc.
5. Carpenter and Patterson, Inc.
6. Bergen Pre-Insulated Pipe Supports, Inc.

B. Manufacturers – Metal Framing Systems:

1. Unistrut.
2. Superstrut.
4. Kin-Line
5. Carpenter and Patterson, Inc.

C. General

1. Double nut or lock nut all hanger rods to attachments, hangers, and supports.
2. All hangers, bolts, nuts, anchors, rods, attachments, inserts, and support structures shall be heavy duty and designed for required load.
3. Materials, design, fabrication and manufacture of pipe hangers and supports shall conform to the MSS Standards SP58, SP69, and SP89, and ASTM F708.
4. Application, selection and installation of pipe hangers and supports shall conform to the MSS Standards SP58, SP69, and SP89, and ASTM F708.
5. Installation of pipe hangers and supports shall conform to ASME B31.9.
6. Hangers supporting un-insulated pipe or insulated pipe where the hanger and pipe has metal to metal contact shall be coated as follows:
   7. Copper plated for copper tubing or brass pipe
   8. Galvanized for galvanized steel pipe
   9. Plastic coated for plastic pipe
   10. Stainless steel for stainless steel piping
   11. Black steel for all other metallic piping

D. Adjustable Steel Clevis Hangers: Hanger shall be MSS Hanger Type 1 – Adjustable
Steel Clevis Hanger.

E. Adjustable Steel Yoke Roll Hangers: Hanger shall be MSS Hanger Type 41 – Single Pipe Roll, Type 43 – Adjustable Roller Hanger with or without Swivel, Type 44 – Pipe Roll, Complete, or Type – 46 Adjustable Pipe Roll and Base.

F. Trapeze Hangers: Steel channels with welded spacers and hanger rods. Hanger shall be MSS Hanger Type 44 – Pipe Roll, Complete or Type – 46 Adjustable Pipe Roll and Base.

G. Wall Supports: Wall supports shall be MSS Type 31 – Light Welded Steel Bracket, Type 32 – Medium Welded Steel Bracket, or Type 33 Heavy Welded Steel Bracket.

H. Riser Supports: Riser supports shall be MSS Type 8 – Extension Pipe or Riser Clamp or Type 42 – Carbon or Alloy Steel Riser Clamp.

I. Base of Riser Supports: Provide a base elbow fitting set on either a concrete or brick pier or a pipe stand. In lieu of using a base fitting, a hanger at the bottom horizontal connection may be used. Locate hanger as close to riser as possible, but permitting sufficient free offset where allowance for expansion and contraction is necessary.

2.2 METAL FRAME SUPPORTS

J. Provide where indicated or required vertical and horizontal galvanized steel channels and fittings bolted together to form a multiple pipe rack secured to the building structure with post bases and brackets.

K. Frames shall be spaced in accordance with the smallest pipe requirements and designed for a maximum deflection of 1/360 of the span.

2.3 PIPE ANCHORS

A. Pipe anchors shall be installed where shown on the drawings or where required for proper installation and to force the pipe expansion in the proper direction. Anchors shall be suitable for installation location and shall be designed to withstand not less than five (5) times the anchor load.

B. Vertical pipes shall be anchored by means of clamps welded around pipes and secured to wall or floor construction.

C. Anchors shall be steel collars, clamps or similar devices welded to pipe, unless otherwise indicated. Secure anchors directly to structural framing. Before making installation, obtain Representative’s approval of anchor detail, location and method of securing to building.
2.4 PIPE GUIDES

A. Pipe guides shall be factory fabricated of cast steel, cast iron or other heavy fabricated steel, consisting of a segmented cylinder and segmented guiding spider bolted or welded tight to the pipe. Guide and spider shall be of sufficient size to clear pipe insulation of uniform thickness, to allow free movement axially and long enough to prevent over-travel of spider and cylinder. Guides shall be Grinnell Figure 256, Elen Figure 411, Fee and Mason Figure 120 or approved equal.

B. Pipe supports shall not be considered guides. Provide pipe guides wherever expansion loops or expansion joints are installed, except those installed within fin tube heating units. Provide guides where required to permit line movement without buckling and misalignment and where shown on the Drawings.

C. Secure guides to structural framing of floors or roof or to their supporting members. Obtain Representative approval of guide details, location and method of securing to building before proceeding with these items.

D. Use of pipe guides with expansion joints shall be controlled by recommendations of expansion joint manufacturer as indicated in his printed literature and shall be installed in strict accordance therewith. Locate and install pipe guides in accordance with the Standards of the Expansion Joint Manufacturer’s Association.

2.5 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded. All hanger rods shall be double nutted or lock nutted. Hanger rods shall not be rusty, bent or damaged.

B. Beam Clamps: MSS Hanger Type 21 – Center Beam, Type 25 – Top Beam Clamp, Type 27 – Side Beam Clamp, Type 28 – Steel Beam Clamp w/Eye Nut and Type 29 – Linked Steel Clamp w/Eye Nut.

C. Concrete Inserts: Double plated expander type anchors. Phillips, Hilti or approved equal. Loads shall not exceed ¼ of tested pullout or shear strength. The Contractor shall verify that anchor is clear of conduit, reinforcing or other item located in the concrete for drilled depth.

D. Brick or Block Walls: Light duty – brackets with self drilling anchors or toggle bolts; Heavy Duty – bolts through wall with back plate.

2.6 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
2.7 FLAShING

A. Metal Flashing: 24 gauge galvanized steel.

B. Metal Counterflashing: 22 gauge galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 lb/sq ft sheet lead.
   2. Soundproofing: 1 lb/sq ft sheet lead.

D. Flexible Flashing: 47 mil thick steel, compatible with roofing.

E. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.8 SLEEVES

A. Sleeves for Pipes Through Non-Fire Rated Floors: 18 gauge thick galvanized steel.

B. Sleeves for Pipes Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gauge thick galvanized steel.

C. Sleeves for Pipes Through Fire Rated Resistive Floors and Walls, and Fire Proofing: Provide products with a flame spread index of less than 25 and a smoke developed index of less than 450 as determined per ASTM E84.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel.

F. Fire Stopping Insulation: UL listed fire stop elastomeric sealant, movement and vibration resistant.

G. Sealant: Refer to Section 07920.

PART 3 - EXECUTION

3.1 PIPE SUPPORT AND PIPE STRESS

A. The Contractor shall provide pipe support and pipe stress calculation in accordance with ASME B31.9 procedures.

B. The installation of pipe supports and expansion compensation shall be in accordance with the recommendations of the analysis or as shown on the drawings, whichever is more stringent.
3.2 PIPE HANGERS AND SUPPORTS INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Piping and equipment shall be supported from structural members and shall not be supported from metal deck and slab assemblies. Provide intermediate support members to provide support spacing required.

C. Support all piping not shown as buried. Support horizontal and vertical piping as scheduled. Support riser piping independently of connected horizontal piping.

D. Chain, wire, wood, straps or other makeshift devices shall not be used as hangers or supports.

E. Pipe hangers or supports shall be spaced not over five (5) feet from elbows, fittings or valves.

F. Provide supports to maintain required slope and alignment.

G. Secure all hangers to rods with double nuts.

H. Make allowance for expansion and contraction.

I. Pipe shall not be supported from ducts or other pipes.

J. Trapeze hangers may be used where pipes are run parallel and at the same slope and elevation. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

K. Provide bracing to prevent lateral motion of horizontal or vertical piping.

L. Provide supports at or near all changes in direction. One hanger shall be installed not more than one (1) foot from each change in direction as a minimum.

M. Hanger rods may not pierce ducts.

N. Strength and rigidity of all hangers and supports shall be suitable for imposed loads.

O. Support piping so there is no strain on the connection to boilers, chillers, pumps, air handling units, and other equipment.

P. Provide hangers and supports complete, including rods, bolts, turnbuckles and bases.

Q. Supports for horizontal piping shall have vertical adjustment after installation. Use hangers with 1.5 inch minimum vertical adjustment.

R. Install hanger to provide minimum 1/2 inch space between finished covering and adjacent Work.

S. Hanger shall be fabricated to permit adjustment after erection while still supporting the load.
T. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion and movement and to prevent buckling, swaying and undue strain. Design hangers for pipe movement without disengagement of supported pipe.

U. Provide structural and miscellaneous steel not shown on the Drawings but required to properly support piping, headers, and equipment. Materials for support shall conform to the requirements specified in Division 5.

V. Piping in trenches or on the roof shall be supported as detailed on the Drawings.

W. Select and install structural attachments for hangers supporting pipes for stresses to which they may be subject and for proper distribution of load to the building structural members.

X. Prime coat exposed steel hangers and supports. Refer to Division 9, Section 09900. Hangers and supports located in crawls spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 INSERTS

A. Provide inserts for placement in concrete formwork.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

B. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

C. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FUEL OIL AND ENGINE EXHAUST PIPING INSTALLATION

A. Hangers:

1. Pipe Sizes 2 inches and smaller: Adjustable, Steel Clevis Hanger.
2. Pipe Sizes 2.5 inches and larger: Adjustable steel Yoke Roll Hangers Type 41 or Type 43.

B. Trapeze Hangers:
   1. Pipe Sizes 2 inches and smaller: Steel Pipe Clamp and Pipe Saddle.
   2. Pipe Sizes 2.5 inches and larger: Adjustable Steel Yoke Roll Hangers Type 44 or 46.

C. Wall Supports:
   2. Pipe sizes 2 inches and smaller: Steel Pipe Clamp and Pipe Saddle.
   3. Pipe sizes 2.5 inches and larger: Adjustable Steel Yoke Roll hangers Type 44 or 46.

D. Riser Supports:
      a. Pipe Sizes 2.5 inches and smaller: Steel Pipe Riser Clamp Type 8.
      b. Pipe Sizes 3 inches and larger: Steel Pipe Riser Clamp Type 42.
   2. Base of Riser Supports: Base elbow fitting on concrete or brick pier.
   3. Provide MSS Hanger Type 53 – Variable Spring Trapeze Hanger on all piping subject to vertical movement.

E. Floor Supports:
   1. For Pipe Sizes 2 inches and smaller; Cast iron adjustable pipe saddle, lock nut, nipple, floor flange and steel support.
   2. For Pipe Sizes 2.5 inches and larger: Adjustable cast iron roll and stand Type 46, steel screws and steel support.

3.6 FLASHING
A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or water proofed walls, floors, and roofs.

3.7 SLEEVES
A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
C. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk at rated assemblies; with material and finish to match surrounding construction at non-rated assemblies. At
finished surface, provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.8 SCHEDULES

A. Horizontal Piping:

<table>
<thead>
<tr>
<th>PIPE SIZE (INCHES)</th>
<th>MAXIMUM HORIZONTAL SUPPORT SPACING (FEET)</th>
<th>MINIMUM ROD SIZE (INCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STEEL PIPE</td>
<td>COPPER PIPE</td>
</tr>
<tr>
<td>¾&quot; and Smaller</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>1&quot; thru 1.5&quot;</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2&quot; thru 3&quot;</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>4&quot; thru 5&quot;</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

B. Vertical Piping:

<table>
<thead>
<tr>
<th>PIPE SIZE (INCHES)</th>
<th>MAXIMUM VERTICAL SUPPORT SPACING (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STEEL PIPE</td>
</tr>
<tr>
<td>2.5&quot; and Smaller</td>
<td>Every Floor Base of Tall Pipe Risers</td>
</tr>
<tr>
<td>3&quot; thru 6&quot;</td>
<td>Every Other Floor Base of Tall Pipe Risers</td>
</tr>
</tbody>
</table>

END OF SECTION 15140
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Common requirements for electric motors furnished on equipment specified in other Sections, including single phase and three phase electric motors.

B. Starters.

1.2 REFERENCES

A. NEMA MG1 - Motors and Generators.

B. NFPA 70 - National Electrical Code.

C. UL 674 - UL Standard for Safety Electric Motors and Generators for Use in Division 1 Hazardous locations.

D. UL 1836 - UL Standard for Safety for Electric Motors for Use in Class I, Division 2 and Class II, Division 2 Hazardous Locations.

E. EPACT - Energy Policy Act

1.3 DELIVERY, STORAGE AND PROTECTION

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.4 WARRANTY

A. Provide a one-year warranty for all motors, starters, and disconnects switches.

PART 2 - PRODUCTS

2.1 MOTORS

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

1. Baldor
2. Dayton
3. General Electric D  
4. Toshiba  
5. Lincoln  
6. Reliance  
7. TECO - Westinghouse

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer’s standard and need not conform to these specifications.

B. Single Phase Motors: Permanent-Split Capacitor where available.

C. See drawing schedules and specifications for electrical characteristics.

D. Open drip-proof type except where specifically noted otherwise.

E. Design for continuous operation in 40 degrees C environment.

F. Design for temperature rise in accordance with NEMA MG1 limits for insulation class, service factor, and motor enclosure type. Motors selected for use with variable frequency drives shall be in compliance with NEMA NG1, Part 31.

G. Explosion-Proof Motors: UL approved for hazard classification.

H. Visible Nameplate: Indicating manufacturer’s name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency.

I. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sizes to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

J. 1 to 200 HP, 3600, 1800, and 1200 RPM, AC, drip proof and totally enclosed fan cooled, general purpose, T-frame, single speed, foot mounted, 3-phase, 208/230/460 Volt, 60 Hertz, Nema design A and B squirrel cage induction motors shall be manufactured to meet efficiency standards as established by the Energy Policy Act.

K. Service Factor: A minimum motor service factor of 1.15 shall be provided unless otherwise indicated.
2.3 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS
A. Starting Torque: Exceeding one fourth of full load torque.
B. Starting Current: Up to six times full load current.
C. Multiple Speed: Through tapped windings.
D. Open Drip-proof of Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.4 MANUFACTURERS – STARTERS AND DISCONNECT SWITCHES
A. Manufacturers; Subject to compliance with requirements, provide products by one of the following:
   1. Allen-Bradley
   2. Square D
   3. TECO - Westinghouse
   4. General Electric
   5. Cutler Hammer

2.5 MANUAL STARTERS
A. Fractional Horsepower Manual Controller: NEMA ICS 2, AC general purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
B. Starters specified in a circuit with an automatic device (i.e. thermostat) shall have a hand-off-auto selector switch independent of the overload trip. The automatic control device shall be connected to control the motor when the selector switch is in the automatic position only.
C. Enclosure: NEMA ICS 6: Type 1.

2.6 MAGNETIC STARTERS
A. Magnetic Motor Controllers: NEMA ICS 2, AC general purpose Class A magnetic controller for induction motors rated in horsepower. Controllers shall be equipped with renewable silver to silver contacts for each of 3 phases and have hinged, tilting arc chutes with center coil blowout magnets.
B. Coil operating voltage: Voltage as indicated on drawings, 60 hertz.
C. Overload Relay: NEMA ICS 6, bimetal overload relays shall be provided for all 3 phases. All starters shall have mounted in cover a manual reset button, an HOA switch, a
red running light, and a green load off light. Lights shall be semi-flush mounted, push to test type.

D. Control Power Transformer: Each starter shall have a control power transformer, rated at 100 volt amps minimum, with 120 volt secondary and fuses in all ungrounded legs.

E. Contacts: Provide two (2) normally open interlock contacts and solid-state time delay relay for all starters.

F. Enclosure: NEMA ICS 6, Type 1. Minimum starter size shall be NEMA Size 1 with terminations for #10 AWG or smaller utilizing mechanical lugs and #8 AWG or larger using compression lugs. Provide permanent type wiring and control diagram attached to visible location within starter.

G. All starters over 50 hp shall be closed transition, auto-transformer type magnetic motor starter with 2 leg auto transformer, 3 contactors (start, run, wye), automatic over temperature device, and voltage taps of 50%, 65%, and 80%.

2.7 COMBINATION MAGNETIC STARTER/DISCONNECT SWITCH

A. Magnetic Motor Controllers: NEMA ICS 2, AC general purpose Class A magnetic controller for induction motors rated in horsepower. Controllers shall be equipped with renewable silver to silver contacts for each of 3 phases and have hinged, tilting arc chutes with center coil blowout magnets.

B. Coil operating voltage: Voltage as indicated on drawings, 60 hertz.

C. Overload Relay: NEMA ICS 6, bimetal overload relays shall be provided for all 3 phases. All starters shall have mounted in cover a manual reset button, an HOA switch, a red running light, and a green load off light. Lights shall be semi-flush mounted, push to test type.

D. Control Power Transformer: Each starter shall have a control power transformer, rated at 100 volt amps minimum, with 120 volt secondary and fuses in all ungrounded legs.

E. Contacts: Provide two (2) normally open interlock contacts and solid-state time delay relay for all starters.

F. Enclosure: NEMA ICS 6, Type 1. Minimum starter size shall be NEMA Size 1 with terminations for #10 AWG or smaller utilizing mechanical lugs and #8 AWG or larger using compression lugs. Provide permanent type wiring and control diagram attached to visible location within starter.

G. All starters over 50 hp shall be closed transition, auto-transformer type combination magnetic motor starter with 2 leg auto transformer, 3 contactors (start, run, wye), automatic over temperature device, and voltage taps of 50%, 65%, and 80%.

H. All combination magnetic motor starters shall have a motor protector circuit breaker type disconnect as specified below.
2.8 DISCONNECT SWITCHES

A. All switches shall be heavy-duty type, externally operated, quick-make, quick-break, rated for 600 volts with the number of poles and ampacity as noted. All switches for motors shall be horsepower rated.

B. Switches shall have NEMA 1 enclosures for indoor installation and NEMA 3R enclosures for outdoor installations unless otherwise noted.

C. Switches generally shall be non-fused except where noted to be fused on the Drawings.

D. Switches where indicated shall have electrical interlock to break the control circuit before the switch blades open.

E. Short circuit rating with fuses shall be not less than 200,000 AIC. Silver or cadmium plate all contact surfaces including fuse clips.

F. Interlocking: Equip switches with an external operating handle and interlock the operating handle with the cover door such that the cover door cannot be opened unless the switch is in the OFF position. Provide means for padlocking the operating handle in the OFF position such that when the operating handle is padlocked in the OFF position, the cover door cannot be opened and the switch cannot be closed. Equip switches with auxiliary contacts when required.

G. Fuse Clips: Standard rejection type for dual element cartridge type fuses as specified unless otherwise require.

H. Fractional Motor Starters: Single speed starters for 115 volt motors shall be per NEMA Industrial Control and Systems (ICS) Standard and consisting of a toggle-operated, single pole, quick-make, quick-break type starter, 1 thermal overload element, pilot light in cover, all mounted in a NEMA 1 surface mounting enclosure, or with a stainless steel plate for flush mounting in an outlet box for installation in finished spaces. Provide means for padlocking the toggle operator in the OFF position. Provide a total of 4 keys for key-operated starters.

2.9 PRODUCT FEATURES

A. Auxiliary Contacts: NEMA ICS 2, provide required number of auxiliary contacts to meet application.

B. Cover mounted pilot devices: NEMA ICS 2, standard duty type.

C. Pilot Device Contacts: NEMA ICS 2, Form Z, rated A 150.

D. Pushbuttons: Recessed type.

E. Indicating Lights: Incandescent type, provide on all devices.
F. Control power transformers: 208 volt primary/120 volt secondary or 480 volt primary/120 volt secondary, as applicable in each motor starter. Provide fused secondary, and bond unfused leg of secondary to enclosure.

G. Provide hand-off-auto front panel control.

PART 3 - EXECUTION

3.1 APPLICATION

A. Motors shall be open drip-proof type, except where specifically noted otherwise.

3.2 INSTALLATION - MOTORS

A. Install in accordance with manufacturer’s instructions.
B. Check line voltage end phase and ensure agreement with nameplate.

3.3 INSTALLATION – STARTERS AND DISCONNECT SWITCHES

A. Install enclosed controllers in accordance with manufacturer’s instructions.
B. Tighten all bolted connections to manufacturer’s specifications with torque wrench before activating.
C. Install enclosed controllers plumb.
D. Check the nameplate current rating of each motor and provide properly sized overload elements in each motor starter. Replace all improperly sized or blown overload elements.
E. Heights: Install starters and disconnect switches 5 feet to operating handle.
F. Install fuses in fusible switches.
G. Select and install overload heater elements in motor starters to match installed motor characteristics.
H. Provide engraved plastic listing equipment served by starter.

END OF SECTION 15170
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

   A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section

1.2 SUMMARY

   A. Section includes:

   1. Identification of HVAC products installed under Division 15.
   2. Nameplates
   3. Tags
   4. Stencils
   5. Duct and Pipe Markers
   6. Lockout Devices

1.3 REFERENCES

   B. ANSI 253.1- Safety Color Code for Marking Physical Hazards

1.4 SUBMITTALS

   A. Submit under General and Special Provisions.
   B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
   C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
   D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 - PRODUCT

2.1 NAMEPLATES

   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Seton Name Plate Company
2. Brady USA, Inc.
3. MSI
4. Emed Co., Inc.
5. Carlton Industries, Inc.

B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Seton Name Plate Company
   b. Brady USA, Inc.
   c. MSI
   d. Emed Co., Inc.
   e. Carlton Industries, Inc.

2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1 ½ inches diameter.

B. Metal Tags

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Seton Name Plate Company
   b. Brady USA, Inc.
   c. MSI
   d. Emed Co., Inc.
   e. Carlton Industries, Inc.

2. Brass with stamped letters; tag size minimum 1 ½ inches diameter with smooth edges.

C. Information Tags

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Seton Name Plate Company
   b. Brady USA, Inc.
   c. MSI
   d. Erred Co., Inc.
   e. Carlton Industries, Inc.

2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3 1/4 X 5
5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart:

1. Typewritten letter size list in anodized aluminum frame with plastic laminated lens.

2.3 STENCILS

A. Stencils shall be with clean cut symbols and letters and colored to contrast with background of the following size:

<table>
<thead>
<tr>
<th>Outside Diameter of Duct, Pipe or Covering</th>
<th>Length of Color Field</th>
<th>Size of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/4” &amp; Smaller</td>
<td>8”</td>
<td>1/2”</td>
</tr>
<tr>
<td>1-1/2” – 2”</td>
<td>8”</td>
<td>3/4”</td>
</tr>
<tr>
<td>2-1/2” – 6”</td>
<td>12”</td>
<td>1-1/4”</td>
</tr>
</tbody>
</table>

B. Stencil paint shall be semi-gloss enamel.

2.4 DUCT AND PIPE MARKERS

A. Color and Lettering:


B. Plastic Markers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Seton Name Plate Company
   b. Brady USA, Inc.
   c. MSI
   d. Emed Co., Inc.
   e. Carlton Industries, Inc.

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around duct, pipe, or covering. Larger sizes may have maximum sheet size with spring fastener.

B. Plastic Tape Markers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Seton Name Plate Company
   b. Brady USA, Inc.
   c. MSI
   d. Emed Co., Inc.
   e. Carlton Industries, Inc.
2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Underground Markers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Seton Name Plate Company
   b. Brady USA, Inc.
   c. MSI
   d. Emed Co., Inc.
   e. Carlton Industries, Inc.

2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

D. Markers shall conform to the following color field length and letter size:

<table>
<thead>
<tr>
<th>Outside Diameter of Duct, Pipe or Covering</th>
<th>Length of Color Field</th>
<th>Size of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/4” &amp; Smaller</td>
<td>8”</td>
<td>1/2”</td>
</tr>
<tr>
<td>1-1/2” – 2”</td>
<td>8”</td>
<td>3/4”</td>
</tr>
<tr>
<td>2-1/2” – 6”</td>
<td>12”</td>
<td>1-1/4”</td>
</tr>
</tbody>
</table>

2.5 LOCKOUT DEVICES

A. Lockout Hasps

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Brady USA, Inc.

2. Anodized aluminum hasp with erasable label surface; size minimum 7 ¼” X 3”.

B. Valve Lockout Devices

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Brady USA, Inc.

2. Steel device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION
A. Degrease and clean surfaces to receive adhesive for identification materials prior to applying identification.

B. Ductwork and piping systems shall be complete including testing, insulating, and painting when specified before applying identification.

C. Place identification so that markings are visible and readable from the floor.

D. Protect identification to ensure markings are clear and legible when project is turned over to the Commission.

3.2 INSTALLATION

A. Plastic Name Plates:
   1. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

B. Metal Tags:
   1. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

C. Controls:
   1. Identify control panels and major control components outside panels with plastic nameplates.

D. Valves:
   1. Identify all valves in main and branch piping with tags. Each tag shall be stamped showing valve identification number, function and service.

E. Piping:
   1. Identify piping, concealed or exposed, with stencils or markers.
   2. Identify pipe size, service, and flow direction.
   3. Install in clear view and align with axis or piping.
   4. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure, wall, floor, roof or enclosure, and at each obstruction. See ductwork and piping identification diagram.

F. Ductwork:
   1. Identify ductwork with plastic nameplates, stencils, or markers.
   2. Identify duct size, service, and flow direction with equipment identification number and area served.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each damper, or fan and at each side of penetration of structure, wall, floor,
roof or enclosure, and at each obstruction. See ductwork and piping identification diagrams.

G. Equipment:

1. Identify all HVAC equipment with plastic nameplates or stencils.

H. Install identifying devices after completion of coverings and painting.

I. Install tags using corrosion resistant chain. Number tags consecutively by location.

J. Install underground plastic pipe markers 12 inches below finished grade, directly above buried pipe.

K. Tag automatic controls, instruments, and relays. Tags shall be coordinated and clearly indicated on control schematic.

3.3 VALVE CHART

A. Provide a typed or printed valve list segregated by systems, and showing valve number, equipment served or system function and location in the building by room and nearest column. The list shall be on an 8-1/2 x 11 inch paper bound in plastic binder.

3.4 DUCTWORK AND PIPING IDENTIFICATION

A. Identify specific contents of line and provide directional flow arrows using identification as specified above at the following locations:

1. Where duct and pipe pass through walls, floor, roof, sheeting or other obstructions (identify both sides).
2. Where duct and pipe exit or enter ground or trench.
3. At valves (identify both sides if line continues) or at valve stations.
4. At all outlets, including vents and drains.
5. At 20-foot intervals on straight ductwork and piping runs.
6. At dampers, fans, and other duct mounted equipment.
7. At all equipment connections.

3.5 SCHEDULES

<table>
<thead>
<tr>
<th>PIPE IDENTIFICATION</th>
<th>COLOR BACKGROUND</th>
<th>COLOR ARROW &amp; LETTERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Oil Supply</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Fuel Oil Return</td>
<td>Yellow</td>
<td>Black</td>
</tr>
</tbody>
</table>

END OF SECTION 15190
SECTION 15245 - VIBRATION ISOLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section

1.2 SUMMARY

A. Section includes:

1. These Specification and accompanying Drawings are intended to cover the furnishing of all labor, materials and installation of vibration isolations and related items.
2. Vibration isolation.

1.3 REFERENCES


1.4 SUBMITTALS

A. Submit under General and Special Provisions.

B. Shop Drawings: Shop drawings shall indicate vibration isolator locations, with static and dynamic load on each and include installation instructions. Data for all isolation equipment shall be submitted at the same time in one submittal. Piecemeal submittals will be returned without action. Shop drawings shall clearly indicate individual selections and shall include for each isolator:

1. Equipment served and isolator schedule
2. Isolator type
3. Isolator size including spring diameter
4. Isolator load
5. Isolator deflection including compressed spring height
6. Isolator solid spring height
7. Isolator location including placement sketch
8. Installation instructions for each type of isolator

C. Product Data: Provide schedule of vibration isolator type with location and load on each.

D. Manufacturer’s Installation Instructions: Indicate special procedures and setting dimensions.
E. Manufacturer’s Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under General and Special Provisions.
B. Record actual locations of hangers including attachment points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Amber/Booth
B. Korfund Dynamics Corp.
C. Mason Industries
D. Peabody Noise Control, Inc.
E. Vibration Eliminator
F. Vibration Mountings and Controls

2.2 GENERAL

A. Provide vibration isolation for all mechanical equipment to prevent the transmission of vibration and mechanically transmitted sound to the building structure.
B. Isolation equipment shall be the products of a single manufacturer.
C. Isolation equipment shall be selected for uniform static deflection according to distribution of weight and to meet the requirements specified herein.
D. Isolator shall not be selected for less than the deflections indicated on the schedule contained herein.
E. Vibration isolation shall be stable during starting and stopping of equipment without excessive movement of equipment.
F. Vibration isolation is specified on the basis that the equipment is structurally built or supported on rigid frame suitable for the type of isolation specified. Provide and mount equipment on
structural steel base of adequate rigidity if equipment or frame is not suitable for specified isolation.

G. Where necessary, provide lateral snubber type isolation, which will not interfere with main isolator performance, to prevent excessive movement due to dynamic horizontal forces as may occur on fans with horizontal air flow.

H. Mountings shall utilize laterally stable steel springs having a horizontal stiffness equal to or greater than the rated vertical spring stiffness. Spring diameters shall not be less than 80 percent (eight tenths) of the compressed spring height at rated load.

I. Springs shall provide additional travel equal to 50% of rated deflection before reaching a solid state as a minimum.

J. Color code spring mounts and hangers. All isolator springs and all mountings used indoors shall be finished in polyvinyl chloride and color coded for easy identification of spring.

2.3 MOUNTINGS

A. General: Mounting shall have leveling bolts that can be rigidly bolted to the equipment.

B. Type M3: Type M3 mountings shall be Mason Industries Type SLR spring mounts with free standing, laterally stable springs, with housing and vertical travel limit stops to prevent upward movement due to weight change or wind loading, two layers of neoprene pads between base plate and supports and leveling bolts. Housing shall serve as blocking during erection. Spring installed and operating heights shall be the same. One-half (1/2”) inch clearance around restraining bolts and between housing and spring shall be maintained so as not to degrade the vibration isolation characteristics. Limit stops shall be out of contact during normal operation. Spring diameters shall not be less than eight tenths (0.8) of the compressed spring height at rated load. Springs shall provide additional travel equal to fifty percent (50%) of rated deflection before reaching a solid state as a minimum. Springs shall be so designed that the horizontal stiffness is equal to or greater than the vertical spring stiffness.

2.4 HANGERS

A. Type H1: Type H1 hangers shall be Mason Industries Type 30N combination spring and double deflection rubber or neoprene in series hangers with 0.30” minimum deflection for neoprene element. Spring diameter shall not be less than eight tenths (0.8) of the compressed spring height at rated load. Springs shall provide additional travel equal to fifty percent (50%) of rated deflection before reaching a solid state as a minimum.

B. Type H3: Type H3 hangers shall be Mason Industries Type WHS combination spring and double deflection rubber on neoprene grommet hangers. Spring diameter shall not be less than eight tenths (0.8) of the compressed spring height at rated load. Springs shall provide additional travel equal to fifty percent (50%) of rated deflection before reaching a solid state as a minimum.
3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.

B. Install vibration isolation for motor driven equipment.

C. Install vibration isolators in locations to permit inspection and adjustment and to provide proper operation. Install spring hangers without binding.

D. Adjust leveling bolts and hanger rod bolts so that isolated equipment is level and in proper alignment with connecting ducts and pipes.

E. Protect isolators from damage during construction. Keep isolators clean and free of dirt and debris. Clean each vibration isolator and verify that each is working freely and that there is no dirt or debris in the immediate vicinity of the isolator that could disrupt that proper operation of the isolator.

F. Adjust all isolator deflections to the specified values while maintaining the equipment level. Deflections called for in this specification are certifiable minimums – not nominal deflections.

G. Adjust vibration isolation to ensure that units have equal deflection, do not bottom out under loading, and are not short-circuited by other contacts or bearing points. No metal-to-metal contact shall be permitted between fixed and floating parts. Grommets as required on some isolators to prevent metal-to-metal contact shall not be in contact with the moving metal part under normal equipment operating conditions.

H. Remove support blocks and similar devices intended for temporary support during installation.

I. Adjust leveling devices as required to distribute loading uniformly onto isolators. Locate isolation hangers as near overhead support structure as possible.

J. Electrical, drain and other connections and items made to isolated equipment shall be isolated from the building structure. Allow for deflections equal to or greater than equipment deflections.

K. Vibration analysis of equipment, that in the opinion of the Representative does not meet the specification requirements, shall be conducted by the Contractor at no additional cost to the Commission.

L. Where equipment vibration exceeds levels specified or standard anticipated levels, the Contractor shall make corrections to reduce vibration frequencies and amplitude to within specified limits. If this cannot be accomplished, the equipment shall be replaced at no additional cost to the Commission.

M. Sound pressure level measurements in rooms or sound power levels of equipment shall be made in areas that in the opinion of the Representative do not meet the specification requirements. All measurements shall be conducted by the Contractor with no additional cost to the Commission. Sound pressure level measurements shall be made in accordance with ASHRAE Sound Testing Procedures. Tests shall be conducted with all equipment operating and space
unoccupied.

N. When equipment or space sound pressure levels exceed the specified criteria, the Contractor shall determine the source of the noise and make necessary corrections to reduce it to acceptable levels at no additional cost to the Commission.

O. Test instruments shall be tested for accuracy by an approved testing laboratory or by the manufacturer and certificates showing degree of accuracy shall be furnished in the operation and maintenance manuals. All labor, instruments and appliances required for tests shall be furnished by the Contractor.

P. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

Q. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

R. Connect wiring to isolated equipment with flexible hanging loop.

3.2 DUCTWORK ISOLATOR SCHEDULE

A. Provide vibration isolation for all ductwork supports connected to and within fifty (50) feet of isolated equipment and throughout mechanical equipment rooms. Provide Type H1 isolators for suspended ductwork and Type M3 isolator for floor supported ductwork for the first six support points consistent with mounting of nearest isolated equipment.

B. Isolator deflection shall have one-half (1/2) the static deflection capabilities of the isolation system of the equipment to which it is connected.

3.3 PIPING ISOLATOR SCHEDULE

A. Provide vibration isolation for all piping supports connected to and within fifty (50) feet of isolated equipment and throughout mechanical equipment rooms, except at base elbow supports and anchor points for main risers.

B. Isolator deflection shall have one-half (1/2) the static deflection capabilities of the isolation system of the equipment to which it is connected.

C. Suspended Piping: Type H1.

3.4 EQUIPMENT ISOLATOR SCHEDULE

A. Install isolators of the type and deflection specified herein.

B. Equipment Isolator Schedule

<table>
<thead>
<tr>
<th>Equipment Type and Floor Construction</th>
<th>Isolator and</th>
<th>Minimum Static</th>
</tr>
</thead>
</table>

Generator Installation
EN-00009-03 – Somerset Interchange
VIBRATION ISOLATION
15245 - 5
### Generator Installation

#### VIBRATION ISOLATION

#### 15245 - 6

<table>
<thead>
<tr>
<th>Base Type</th>
<th>Deflection Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Fans, Fan Powered Air Terminal Units, Cabinet Unit heaters, Unit Heaters – Small Terminal Equipment Suspended</td>
<td></td>
</tr>
<tr>
<td>600 CFM and less</td>
<td></td>
</tr>
<tr>
<td>Floor Span &lt;= 20 ft.</td>
<td>H1</td>
</tr>
<tr>
<td>20 &lt; Floor Span &lt;=30 ft.</td>
<td>H1</td>
</tr>
<tr>
<td>30 &lt; Floor Span &lt;=40 ft.</td>
<td>H1</td>
</tr>
<tr>
<td>40 &lt; Floor Span &lt;=50 ft.</td>
<td>H1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment Type and Floor Construction</th>
<th>Isolator and Base Type</th>
<th>Minimum Static Deflection Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Fans, Fan Powered Air Terminal Units, Cabinet Unit heaters, Unit Heaters – Small Terminal Equipment Suspended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 600 CFM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Span &lt;= 20 ft.</td>
<td>H1</td>
<td>0.75</td>
</tr>
<tr>
<td>20 &lt; Floor Span &lt;=30 ft.</td>
<td>H1</td>
<td>0.75</td>
</tr>
<tr>
<td>30 &lt; Floor Span &lt;=40 ft.</td>
<td>H1</td>
<td>0.75</td>
</tr>
<tr>
<td>40 &lt; Floor Span &lt;=50 ft.</td>
<td>H1</td>
<td>0.75</td>
</tr>
<tr>
<td>Engine Exhaust Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Span &lt;= 20 ft.</td>
<td>H3</td>
<td>0.75</td>
</tr>
<tr>
<td>20 &lt; Floor Span &lt;= 30 ft.</td>
<td>H3</td>
<td>1.5</td>
</tr>
</tbody>
</table>

#### 3.5 MANUFACTURER’S FIELD SERVICES

A. Examine systems under General and Special Provisions.

B. Inspect isolated equipment after installation and submit report. Refer to Paragraph 1.3E of this section. Include static deflections.

**END OF SECTION 15245**
SECTION 15265 - PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section

1.2 SUMMARY

A. Section includes:

1. Engine exhaust piping insulation.
2. Jackets and accessories.

1.3 REFERENCES


1.4 SUBMITTALS

A. Submit under General and Special Provisions.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience. Manufacturing facilities must be certified and registered with an approved registrar for conformance with ISO 9000 quality standard.
B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.
1.6 REGULATORY REQUIREMENTS
   A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, UL 723.

1.7 DELIVERY, STORAGE, AND PROTECTION
   A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

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

PART 2 - PRODUCTS

2.1 HYDROUS CALCIUM SILICATE
   A. Manufacturer; Subject to compliance with requirements, provide products by one of the following:

      1. Johns-Manville Thermo-12 Gold.
      2. Owens Corning.
      5. PABCO.

   B. Insulation: ASTM C533; rigid molded, asbestos free.

      1. 'K' value: 0.40 at 300 degrees F.
      2. Maximum service temperature: 1200 degrees F.

   C. Connection: band or filament wound tape.

2.2 PERLITE
   A. Manufacturer; Subject to compliance with requirements, provide products by one of the following:

      1. Knauf Temperlite 1200°
      2. Calsilite
      3. Johns-Manville
B. Insulation: ASTM C610, Type II; rigid molded, asbestos free.
   1. ‘K’ value: 0.50 at 300 degrees F.
   2. Maximum service temperature: 1200 degrees F.
   3. Density: 13 lb/cu ft

C. Connection: Band or filament wound tape.

2.3 JACKETS

A. Aluminum Jacket: ASTM B209.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Embossed.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/4 inch wide; 0.015 inch thick aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate insulation and cover seams in least visible locations.

C. Insulate entire system including fittings, valves, unions and flanges.

D. Inserts and Shields (MSS) Standards SP-58 & SP-69. See Section 15140 -Supports and Anchors for additional information.
   1. Application: Insulation inserts shall not be less than the following lengths:
      
      Pipe Sizes 4" through 6": 16 Gauge x 18" Long

   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

E. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at
supports, protrusions, and interruptions. At fire separations, refer to Section 15140.

3.3 INSULATION SCHEDULE

A. Other Systems

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>INSULATION THICKNESS</th>
<th>JACKET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Exhaust (Calcium Silicate or Perlite)</td>
<td>All</td>
<td>4”</td>
</tr>
</tbody>
</table>

END OF SECTION 15265
SECTION 15537 - FUEL OIL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Fuel oil storage tank accessories.
2. Fuel oil leak detection and overfill monitoring system.
3. Fuel oil and vent piping.
5. Fuel oil for testing and tank fill.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. All materials shall be UL listed and bear the listing mark.
6. Pennsylvania Department of Environmental Protection.

1.4 SUBMITTALS

A. Contractor shall submit shop drawings in accordance with General and Special Provisions. Drawings shall include, but are not limited to, all critical dimensions, locations of fittings and accessories, i.e., manholes, hold-down straps, etc. Materials of construction shall be in accordance with Part 1.2 of this Section.

B. Contractors shall submit manufacturer's literature, installation instructions, operation and maintenance manuals, calibration charts, etc. in accordance with General and Special Provisions.
1.5 WARRANTY

A. Provide the Manufacturer's standard warranties for the following:

1. 1-year Warranty for tank accessories and monitoring equipment.

PART 2 - PRODUCTS

2.1 TANK ACCESSORIES

A. Tank Fill Assembly:

1. Pipe Fill Cap: Die-cast aluminum body, die-cast zinc handle, epoxy coated; toggle type latch operating mechanism, stainless steel linkage, Buna-N gasket; provisions for locking, (2"), OPW 634-TT or Emco Wheaton A0097. Label fill cap for use with #2 diesel fuel.
2. Fill Pipe Adapter: Bronze, female threaded end, Buna-N gasket, (4x4"), OPW 633-T or Emco Wheaton A0030.
3. Drop Tube: Aluminum, length as required to reach within 6" of tank bottom, end cut at 45 degree angle (4"), OPW 61-SO or Emco Wheaton A0020. Provide check valve in drop tube for overfilling.
4. Tank fill assembly shall be provided with a 6" secondary containment pipe and a spill container manhole with drain and lid.

B. Vent Caps:

1. For venting tank and interstitial space between primary and secondary tank shell walls. Aluminum body and cover, open type 40 mesh brass screen. Fitting designed to direct vapors upward, OPW 23; or Emco Wheaton A4103.

C. Secondary Containment Pipe Coupling

1. Provided by the turbine enclosure manufacturer, the secondary containment pipe coupling shall interface with the secondary containment piping. This shall consist of a flexible entry boot.
2. The two-piece coupling shall be constructed of fiberglass reinforced plastic and shall be field installed.
3. Contractor shall provide the necessary saw-cut holes within the FRP turbine enclosure prior to installing the FRP coupling. Seal watertight with manufacturer supplied adhesive kit.

D. Electrical Conduit Coupling

1. Provided by the turbine enclosure manufacturer, the electrical conduit coupling shall interface with 1" steel conduit.
2. The two-piece coupling shall be constructed of steel and shall be field installed.
Seal watertight.
3. Contractor shall provide the necessary saw-cut holes within the FRP turbine enclosure prior to installing the coupling.

2.2 LEAK DETECTION AND OVERFILL MONITOR SYSTEM

A. Type: Continuous operation leak detection and overfill monitor system for double wall underground storage tank. Systems shall have system test capability, and shall be UL listed and/or FM approved. Alternately, ETL Testing Laboratories, Inc., Product Safety Testing Listing is acceptable if the listed product has been tested to the applicable UL standard.

B. Acceptable Manufacturers:

1. Veeder-Root
2. Containment Solutions, Inc.
3. D-Tech Corp.
4. EMCO Wheaton Inc.

C. Tank Alarm/Inventory Control Panel (located inside the Maintenance Building):

1. Panel shall visually indicate status of tank interstitial leak monitoring system; and shall sound a panel mounted audible alarm when high or low brine is detected.
2. Panel shall visually indicate status (normal or overfill condition) of each tank; and shall sound a weatherproof alarm horn mounted outside the building when an overfill condition is detected.
3. Panel shall visually indicate status (dry or liquid) of the secondary containment collar; and shall sound a panel-mounted alarm when fluid is detected.
4. Panel shall alarm on low fuel level in tank.
5. All control panels shall include:
   a. Alarm lights for each circuit
   b. Audible alarms as described above
   c. System test button
   d. NEMA 4 housing
   e. Wall mounting capabilities
   f. Dry contact relay for each input circuit
   g. Two (2) dry contacts for remote generator control panel interface
   h. ALPHA numeric display
   i. Printer option

6. Contractor shall provide all wiring from the power source to the control panel and from the control panel to the probe and sensor assemblies. Refer to Section 15010 -- Part 1.3: Electrical Requirements for Mechanical Equipment.

D. Sensor(s) with detection probe(s) and visual status indicator(s): Shall detect the presence of fluid, dry or overfill conditions of the tank, provide hydrostatic monitoring of the annular space, and containment collar. The tank level shall be continuously monitored by monitor system, and recorded by the monitor panel daily.

1. All sensors shall be compatible and interface with the Tank Alarm/Inventory
2. Control Panel.

2. The leak detection performance of the hydrostatic monitoring system shall be tested and verified by a qualified independent consultant to detect leaks as small as 0.10 gallons per hour within a one-month period.

3. Containment Collar Sensor: Float switch shall be capable of detecting 2” or more of liquid accumulation in the turbine enclosure. Assembly shall be preassembled for ready for field installation. All electrical components shall be UL listed or accepted.

4. Annular Space Sensor: Sensor shall be compatible with the tank manufacturer's brine solution and be compatible with any control panel that accepts normally open or closed switches. The sensor shall detect high or low brine conditions, and be capable of wiring to a control panel that can alarm both high and low conditions.

5. Tank Gauge Probe: Probe shall be capable of continuously monitoring liquid levels and detecting water in hydrocarbons at the bottom of the tank. The probe shall be compatible with the liquid that it is intended to be submerged in and sized properly to fit into the tank without damaging the tank during installation or operation. Tank gauge probe shall not be rigidly mounted in the tank.

E. Instrumentation Control Cable: Connect probes and sensors to alarm panel, as recommended by manufacturer of leak and overfill monitor system.


G. All monitoring equipment, including the electronic controls, shall be UL listed or accepted.

H. The leak detection and overfill monitoring system shall have the capability to interface with the generator control panel in order to provide remote, annunciated alarms for any leak, overfill, or low fuel conditions within the existing building.

2.3 PIPE AND FITTINGS

A. Fuel Oil Supply, Return, and Suction Piping:


2. Install underground piping in continuous lengths from tank to point inside building.

B. Fill, Vent, Gage, and Sounding Stick Storage

C. Secondary Containment Piping:
   1. General: Secondary containment piping shall be provided on all underground fuel oil piping and shall be constructed of two-piece fiberglass reinforced plastic. Piping shall be joined, sealed, and installed per manufacturer's installation instructions and pipe shall be in compliance with ASTM D2996.

D. Acceptable Manufacturers:
   1. Smith Fiberglass - Red Thread II.
   2. Ameron.

2.4 VALVES

A. Valves General
   1. All gate and globe valves shall be designed for repacking under pressure when fully opened, and shall be equipped with packing suitable for intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. All gate and globe valve shall have a gland follower.
   2. If the wedge in OS&Y valves is fastened to the stem by threads, it shall be secured by nickel alloy or monel pin.
   3. Face-to-face and end-to-end dimensions of iron body valves shall conform to ANSI B16.10. Design, workmanship, materials and testing of all valves shall conform to MSS-SP-70, MSS-SP-80 and MSS-SP-85. All valves shall be pressure rated, tested and marked in accordance with ANSI/ASME Standards.
   4. Gate valves shall be of the solid wedge type, designed and manufactured in such a way that seating surfaces are prevented from contacting until near the point of closure.
   5. Hand wheels shall be ASTM A197 malleable iron.
   6. Select valves for proper operating pressure and temperature for service intended. Select valves with flanged, threaded or solder ends as required for system piping.

B. Ball Valves (Up To and Including 2 Inch)
   1. Manufacturers
      a. Jenkins
      b. Watts
      c. Apollo
      d. Jamesbury
   2. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.
   3. Ball valves shall be full port type.

C. Gate Valves (Over 2 Inches)
   1. Manufacturers
a. Jenkins  
 b. Nibco  
 c. Crane  
 d. Stockham  

2. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

D. Globe Or Angle Valves (Over 2 Inches)

1. Manufacturer  
   a. Jenkins  
   b. Nibco  
   c. Crane  
   d. Stockham  

2. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.5 JOINING AND SEALANT MATERIALS

A. Thread Sealant:  
   1. Arnco.C-950 Thread-Seal; Lake Chemical Co., Slic-Tite.  
   2. Loctite pipe sealant with Teflon.  

B. Oakum: FSWW-L-171.  


D. Mechanical Modular Seals: Link Seal or Pyro-Pac wall and floor seals by Thunderline Corporation.  


F. Cover Plates: Solid, unplated, cast iron, with set screws.

2.6 FUEL FOR TESTING AND COMPLETION  

A. Fuel: Provide fuel for testing the system. Fill all tanks after testing is completed to maximum capacity. Assure that tanks and piping are clean and dry before delivering fuel.
3.1 INSTALLATION

A. Install the work of this section in accordance with the item manufacturer's printed installation instructions.

3.2 TANK MONITOR AND ALARM PANEL

A. Calibrate sensors and test all alarms for proper functions.

END OF SECTION 15537
SECTION 15782 - PACKAGED TERMINAL AIR CONDITIONING UNITS

PART 1- GENERAL

1.1 SECTION INCLUDES
   A. Packaged terminal air conditioning units.
   B. Controls.

1.2 REFERENCES
   A. ARI 210 - Unitary Air-Conditioning Equipment.
   B. ARI 240 - Air Source Unitary Heat Pump Equipment.
   C. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
   D. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS
   A. Submit under General and Special Provisions.
   B. Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.

1.4 QUALITY ASSURANCE
   A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.5 REGULATORY REQUIREMENTS
   A. Products requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION
   A. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.
1.7 WARRANTY

A. Provide a five-year warranty to include coverage for refrigeration compressors.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

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

1. Carrier.
2. Trane.
3. McQuay.
4. Approved equal.

2.2 AIR CONDITIONING UNITS

A. Description: Packaged, self-contained, through-the-wall air cooled terminal air conditioning units, with room cabinet, electric refrigeration system, electric heating, built-in temperature controls; fully charged with refrigerant and filled with oil.

B. Electrical Characteristics:

1. Refer to Division 16.
2. Disconnect Switch: Factory mount disconnect switch on equipment in accordance with Division 16.

2.3 CABINET

A. Cabinet: Wall mounted of 18 gauge galvanized steel with baked enamel finish, removable front panel with concealed latches, manufacturer standard color.

B. Discharge Grille and Access Door: Removable extruded aluminum discharge grilles with hinged door in top of cabinet for access to controls.

C. Wall Cabinet: Matching cabinet in construction and finish, allowing diversion of 40 percent of unit air flow to adjoining room, with grille.

2.4 CHASSIS

A. Refrigeration System:

1. Direct expansion cooling coil.
2. Hermetically sealed compressor with internal spring isolation, external isolation, permanent split
capacitor motor and overload protection.

3. Condenser coil and fan.

B. Air System: Centrifugal forward curved indoor fans with two speed permanent split capacitor motor, permanent washable filters, positive pressure ventilation damper with concealed manual operator.

C. Heating Coil: Electric.

D. Condensate Drain: Drain pan to direct condensate to condenser coil for re-evaporation.

E. Condenser Fan: Centrifugal, forward curved type with separate permanent split capacitor motor.

2.5 CONTROLS

A. Control Module: Unit mounted adjustable thermostat with heat anticipator, off-heat-auto-cool switch, high-low fan switch.

B. Low Ambient Lockout Control: Below 35 degrees F outdoor thermostat shall prevent compressor operation and switch to heat mode.

2.6 PERFORMANCE

A. See schedules on drawings.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install Package Terminal Air Conditioning Unit in accordance with manufacturer's instructions.

C. Coordinate installation of units with other work.

END OF SECTION 15782
SECTION 15835 - TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section

1.2 SECTION INCLUDES

A. Electric unit heaters.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under General and Special Provisions.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:

1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.

2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

3. Indicate mechanical and electrical service locations and requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
1.7 WARRANTY

A. Provide five-year manufacturers warranty for unit heaters.

1.8 EXTRA MATERIALS

A. Provide operation and maintenance manuals under General and Special Provisions.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

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

1. Qmark.
2. Approved Equal.

B. Assembly: UL Listed and labeled assembly with terminal box and cover, and built-in controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

D. Cabinet: 0.0478" steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated with thermal overloads, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Integral two stage thermostat.

I. Electrical Options:

1. Power Disconnect Switch: Factory mount disconnect switch.
2. Refer to Division 16.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install in accordance with manufacturer's instructions, including but not limited to all secondary support materials required to maintain manufacturer warranties.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Unit Heaters: Hang from building structure. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

E. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Division 16.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION 15835
SECTION 15870 - POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY
   A. Section includes
      1. Centrifugal Inline Cabinet Fans.

1.3 REFERENCES
   B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
   C. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal.
   D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
   F. NEMA MG1 - Motors and Generators.
   G. UL 705 - Power Ventilators.

1.4 SUBMITTALS
   A. Submit under General and Special Provisions.
   B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
   C. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements. Shop drawings shall show motors, drives, type, construction, capacity, motor horsepower, wheel diameter, special construction features, fan designation, air
flows, static pressure, other items as indicated in the schedule or specifications and other requirements as required to determine compliance with the Contract Documents. Submit for approval fan curves or tables which indicate pressure, volume and horsepower.

D. Operation and Maintenance Manuals: Submit procedure description as required by General and Special Provisions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Fans shall have certified performance and sound ratings in accordance with AMCA Standards and shall bear the AMCA Certified Rating Seal.

C. Fans shall be fabricated to conform to AMCA fabrication standards.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Deliver materials in the manufacturer's original undamaged packages or acceptable containers.

B. Protect motors, shafts, and bearings from weather and construction dust.

C. Store and protect all materials, apparatus and equipment from physical damage, the elements, moisture, dirt, debris and Work of other trades. Use of paper, cardboard or other flimsy material for protection shall not be permitted. Replace damaged protective materials immediately. Do not install damaged materials, apparatus or equipment. Remove damaged materials, apparatus or equipment from the site immediately.

D. Handle all materials as recommended by the manufacturer and to prevent physical damage with seals and labels intact and legible.

E. Deliver, store and handle materials in accordance with requirements of General and Special Provisions and manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.
1.9 EXTRA MATERIALS

A. Provide operation and maintenance data under General and Special Provisions.

1.10 WARRANTY

A. Provide a one-year warranty for both the fan and the motor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide fans complete with motors and drives. Type, capacity, wheel diameter, horsepower, direct/belt drive, spark-proof wheels, explosion proof motors, special construction features, and other requirements shall be as scheduled on the Drawings.

B. When scheduled, the sound generated by the fan shall not exceed the sound level indicated. Basis shall conform to that scheduled.

C. The first critical speed of the fan shaft, wheel and bearing arrangement shall be at least 125% of the maximum cataloged speed of the fan assembly.

D. Fans shall be statically and dynamically balanced for maximum rated speed.

E. Fans shall be catalog rated for 15% greater static pressure than specified at specified air volume.

F. Fans shall be selected so that the specified air volume is greater than that at the apex of the pressure volume curve.

G. Fans shall be selected to provide stable operation down to 85% of design volume operating at the required speed for the specified conditions.

H. Fan bearings shall be lubricated and shafts rotated, whenever fans are shutdown for extended periods or when stored, every four (4) weeks until fans are put into permanent operation.

I. Fans with motor operated dampers or back-draft dampers shall have access doors to both damper and motor.

2.2 PERFORMANCE

A. Capacity: Provide capacities in accordance with the drawings and schedules.

B. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
C. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA certified sound rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Performance Base: Sea level conditions.

G. Temperature Limit: Maximum 300 degrees F.

H. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

2.3 CENTRIFUGAL INLINE CABINET FANS

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

1. Greenheck

B. Centrifugal ceiling fans shall have acoustically insulated housing, silent back-draft damper and electrical terminal box with cord, plug and receptacle inside housing. Fan housing and scroll shall be constructed of galvanized steel. Power assembly shall be easily removed for inspection and service.

C. The inlet and discharge duct connection shall be adaptable to horizontal or vertical positions. Motor shall be mounted on vibration isolators. The fan shall have forward curved centrifugal wheels.

D. Provide accessories as scheduled on drawings.

2.4 MOTORS, BEARINGS, SHAFTS, AND DRIVES

A. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball or roller bearings. Bearing shall have a minimum AFBMA L-50 life of 100,000 hours based on maximum cataloged speed for fan class unless otherwise indicated.

B. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.

C. Fans shall be direct or belt driven as scheduled. Belt drive fans shall have internal and external belt guards as required by fan type. Equip belt driven fans with matched set of belts and belt guards meeting OSHA requirements with provisions for speed measurement at motor and fan without removing guard.

D. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 20 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 25 hp and over, matched belts, and drive rates as recommended by manufacturer or minimum 1.5 times
nameplate rating of the motor. Provide additional pulleys and belts, if necessary, to adjust speed if required for final air balance. Statically and dynamically balance pulleys over 4” face width and 18” diameter.

E. Belt Guard: Fabricate to SMACNA Standard; 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.5 FAN ACCESSORIES

A. Inlet/Outlet Guards/Screens: Provide removable 1/2" heavy gauge wire mesh bird screen complete with angle frame where fan inlet or outlet is exposed.

B. Access Doors: Provide access door with quick opening latches and gaskets for access to dampers and other maintenance items.

C. Disconnect Switch: Provide in accordance with Division 16 in housing for thermal overload protected motor.

D. Provide disconnect switch in accordance with Division 16 requirements complete with factory wiring and mounting. All wiring and electrical components shall comply with the NEC and shall be U.L. Listed.

E. Back-draft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power open, spring return. Provide back-draft dampers where indicated for installation in the roof curb. Dampers shall be multiple blade type constructed of aluminum. Blades shall be felt edged with nylon bearings, full opening type.

F. Motor Operated Damper: Motor actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and line voltage motor drive, power open, spring return. Provide motor operated dampers with spring return where indicated. Dampers shall be multiple blade type constructed of aluminum. Blades shall be felt edged with nylon bearings, full opening type. Damper motor shall operate at line voltage or reduced voltage through internally mounted transformer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fans level and plumb in accordance with manufacturer's instructions and where shown on the Drawings. Bolt fans securely to bases, supports or curbs.

B. Adjust belts, drives and lubricate motors and bearings. Disconnect fan drive from motor, verify proper motor rotation and direction, and verify fan wheel free rotation and smooth bearing operations. Reconnect fan drive system, align belts and install belt guards.
C. Provide motor starters, disconnects, controls and interlock wiring for a complete and operable system. Install fans with vibration isolation mountings and flexible electrical leads. Refer to Section 15245 - Vibration Isolation.

D. Install fan restraining snubbers; refer to Section 15245 - Vibration Isolation. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Provide sheaves required for final air balance.

F. Provide motor operated or back-draft dampers on inlet or discharge of exhaust fans as indicated. Refer to specifications herein and Section 15910 - Ductwork Accessories.

G. Do not operate fans in normal operation until ductwork is clean, filters are in place, bearings are lubricated, and fan has been test run under observation.

H. Secure roof or wall exhausters with cadmium plated steel lag screws to roof curb or structure as required.

I. Extend ducts to roof or wall exhausters onto roof curb or structure. Flash and counter flash duct to roof or wall opening. Secure prefabricated roof curbs to roof deck.

END OF SECTION 15870
SECTION 15890 – DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY
   A. Section includes
      1. Metal ductwork.

1.3 REFERENCES
   A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
   B. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
   E. SMACNA - Rectangular Industrial Duct Construction Standards. (Herein referred to as SMACNA-RIDC).

1.4 PERFORMANCE REQUIREMENTS
   A. No variation of duct configuration or sizes permitted except by written permission from the Representative. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS
   A. Submit under General and Special Provisions.
   B. Shop Drawings: 1/4" scale drawings to indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems. Shop drawings shall be original documents produced for the fabrication and installation of ductwork. Enlargements/reproductions of contract documents shall not be acceptable.
1. Ductwork shop drawing submittals shall include sheet metal shop fabrication and construction standards to be used on this project as applicable which include, but are not limited to the following:
   a. Duct Layout Drawings
   b. Duct Construction Standards
   d. Flexible Ducts and Flexible Connections
   e. Duct Liner, Duct Insulation and Fasteners
   f. Adhesives, Mastics and Sealants

2. Duct Construction Standards shall include the following in table form for each pressure classification specified:
   a. Duct size range
   b. Duct section length
   c. Duct gauge and material
   d. Horizontal joint type and material gauge
   e. Vertical joint type and material gauge
   f. SMACNA rigidity class
   g. Longitudinal seam type
   h. Intermediate reinforcement size and spacing
   i. SMACNA duct sealant class

3. Simply copying SMACNA Standards shall not be acceptable; the Contractor shall explicitly indicate the appropriate SMACNA construction techniques to be used on this project for each duct size range in each pressure classification specified.

C. Product Data: Provide data for duct materials, duct liner, and duct connectors.

D. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

E. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed recommended fabrication and installation requirements.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under General and Special Provisions.

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC.

1.8 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Install duct sealants when temperatures are within ranges recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 - PRODUCTS

2.1 GENERAL

A. For details not specified, such as hangers, elbow construction, offsets, obstruction streamlining, branch connections, dampers the above referenced ASHRAE and SMACNA standards shall apply. Ducts shall be supported with hangers in accordance with SMACNA Standards. Wire, string, wood, plastic or other non-standard hangers shall not be permitted. Refer to Section 15140 - Supports and Anchors and Section 15245 - Vibration Isolation.

B. Offsets, changes in duct shape, transitions or divided ducts required to avoid structural or other interference shall be made without additional cost to the Owner. Inspect the Drawings and verify that field conditions are as shown on the Drawings. Report conflicts before starting fabrication.

C. Certain items such as rises and drops in ductwork, access doors, volume dampers are indicated on the Drawings for clarity for a specific location requirement and shall not be interpreted as the extent of the requirements for these items.

D. All ductwork dimensions, as shown on the Drawings, are internal and duct sizes shall be increased to compensate for duct lining thickness. Provide insulated build outs at dampers, turning vanes, etc., to maintain continuity of thermal barrier.

E. Provide all 90 degree elbows of radius construction with centerline radius of 1 to 1-1/2 times the width of the duct wherever space permits. If radius must be less than duct width, provide full length metal turning vanes. All turning vanes shall be double radius.

F. Provide all 90 degree square elbows with double radius turning vanes unless otherwise indicated. Provide 3/4" trailing edge on turning vanes of 90 degree square elbows wherever elbow is less than one duct perimeter upstream of change in duct size or direction. Where a size change must occur at a square elbow, runners shall extend from throat to heel and vanes shall be securely positioned on runners and be parallel with duct sides.

G. Provide access doors upstream of all elbows with turning vanes.
H. Make ducts true to indicated dimensions, straight and smooth on inside with neatly finished airtight joints. All ducts shall be sealed and made airtight. Bolt and seal damper and louver to duct, casing or masonry opening.

I. Brace or reinforce ducts in accordance with SMACNA Standards listed previously where necessary to overcome vibration, buckling or breathing.

J. Provide offsets of 30 or 45 degrees with centerline radius of 1 to 1-1/2 times the width of the duct unless otherwise indicated. Offsets shall not exceed 45 degrees.

K. Unless otherwise noted, all ductwork is overhead, tight to the underside of structure, with space for insulation if required.

L. Ductwork shall be capable of passing all tests and meet all functional criteria as specified in SMACNA Standards. Tests shall be conducted by the Contractor at his expense when directed by the Representative to prove ductwork construction meets SMACNA Standards. All ductwork found not in accordance with SMACNA Standards shall be removed and new ductwork installed in accordance with SMACNA Standards and the Contract Documents.

M. All ductwork accessories, such as vanes, runners, dampers, access doors and other accessories shall be constructed of the same material as the duct. All sides of a section of duct shall be of gauge specified for its maximum dimension.

2.2 MATERIALS

A. Galvanized Steel Ducts (GS):
   1. Galvanized steel ducts constructed of ASTM A525 and ASTM A527 galvanized steel sheet, having G90 zinc coating meeting ASTM A90, lock-forming quality, including reinforcing, galvanized tie rods, and hangers. Metal specification, gauges and construction of seams, joints, and reinforcing shall be in accordance with SMACNA. All sides of a section of duct shall be of gauge specified for its maximum dimension.
   2. Seal all seams, openings and joint corners with sealing compound.
   3. Clean and paint welds and threads with zinc dust paint.
   4. Spiral conduit and fitting manufacturers shall be United Sheet Metal; Peabody and Wind Engineering; Semco; and Spira-Matic.

B. Fasteners: Rivets, bolts, or sheet metal screws.

C. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

D. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Trapeze Hangers: Same material as the supported duct for metallic ducts.

2.3 DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA-HVAC. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct Ts, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide double radius air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Rectangular Ductwork: Provide standard 45 degree entry fittings for all branch takeoffs.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated. Materials and fabrication shall be as specified above for galvanized steel ductwork unless otherwise indicated.

B. Transverse Duct Connection System

1. Rigidly class connection shall meet the requirements of SMACNA- HVAC, with interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips. The transverse duct connection system shall be Ward or Ductmate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install and seal ducts in accordance with SMACNA-HVAC.

C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Connect flexible ducts to metal ducts with draw bands.

G. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

H. Use double nuts and lock washers on threaded rod supports.

3.2 CLEANING

A. Clean work under the General and Special Provisions.

B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.3 SCHEDULES

A. Ductwork Material and Construction Schedule

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>MATERIAL</th>
<th>PRESS. CLASS</th>
<th>SMACNA SEAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>INCHES W.C.</td>
<td>CLASS</td>
</tr>
<tr>
<td>General Exhaust</td>
<td>GS</td>
<td>1</td>
<td>B</td>
</tr>
<tr>
<td>Emergency Generator Intake or Exhaust</td>
<td>GS</td>
<td>1</td>
<td>B</td>
</tr>
</tbody>
</table>

B. Furnish and install ductwork in accordance with SMACNA-HVAC unless otherwise indicated.

END OF SECTION 15890
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Volume control dampers.
   3. Motor operated dampers.
   4. Flexible duct connections.
   5. Duct access doors.
   6. Duct test holes.
   7. Gaskets and sealing compound.

1.3 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
B. NFPA 70 -- National Electrical Code.
C. SMACNA - HVAC Duct Construction Standards - Metal and Flexible (Herein after referred to as SMACNA-HVAC).
D. AMCA 500-D - Laboratory Method of Testing Dampers for Rating.
E. AMCA 511- Certified Ratings Program for Air Control Devices.

1.4 SUBMITTALS

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.
C. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.
D. Include pressure drop data for all damper sizes in accordance with AMCA 500-D.
1.5 PROJECT RECORD DOCUMENTS
   A. Submit under General and Special Provisions.
   B. Record actual locations of volume control dampers.

1.6 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 REGULATORY REQUIREMENTS
   A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.
   B. Dampers shall bear the AMCA Certified Ratings Seal for Air Performance in accordance with AMCA 500-D and AMCA 511.

1.8 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect and handle products to site under General and Special Provisions.
   B. Protect dampers from damage to operating linkages and blades.
   C. Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft. Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finished during handling and installation to prevent damage.

1.9 EXTRA MATERIALS
   A. Furnish under General and Special Provisions.
   B. Provide one of each size and type of motorized damper operator.

PART 2 - PRODUCTS

2.1 VOLUME CONTROL DAMPERS
   A. Manufacturers:
      1. Ruskin.
      2. Pottorff.
3. Greenheck
4. Penn Ventilator.
5. Arrow Louver and Damper.
6. American Warming and Ventilating.
7. Air Balance, Inc.

B. Ductwork pressure rating between -2" w.g. and 2" w.g. inclusive: SMACNA-HVAC.
   1. Smaller than 12" duct width: SMACNA-HVAC Figure 2-12 A, B, and C, 12" maximum blade width no internal frame.
   2. 12" and larger duct width: SMACNA-HVAC Figure 2-13, multi-opposed blade, 8" maximum blade width.
   3. Recess frame totally out of the airstream. Limit stop penetration into airstream to 1/2". Dampers less than 5 feet upstream of outlets, equivalent to Young Regulator 817.

C. Ductwork pressure rating lower than -2" w.g. and higher than 2" w.g.:
   1. Round ductwork use rectangular duct type with pocket recess for frame and unused portions of damper or butterfly type damper.
   2. Rectangular ductwork use SMACNA-HVAC Figure 2-13, multi-opposed blade, 8" maximum blade width with closed end bearings.
   3. Recess frame totally out of the airstream. Limit stop penetration into airstream to 1/2".

D. Volume dampers shall be constructed in accordance with SMACNA-HVAC. Volume dampers shall be constructed of the same material as the associated ductwork.

E. End Bearings: Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

F. Locate volume dampers where accessible for adjusting after completion of Work.

G. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.
   4. Elevate dial to face of insulation and mark balanced position.
   5. Provide volume damper dial with locking nuts.

H. Locate pressure regulators where accessible for adjusting after completion of Work. Furnish access panels where regulators are concealed. Damper regulators shall be as follows:
   1. Concealed or exposed in unfinished space:
      a. 2" w.g. and lower -- Ventlock #641
      b. Higher than 2" w.g. -- Ventlock "Hivel"
   2. Exposed in finished space:
      a. 2" w.g. and lower -- Ventlock #688
      b. higher than 2" w.g. -- Ventlock "Hivel"
   3. Manufacturers:
      a. Ventlock
b. Ventfabrics  
c. Young Regulator

2.2 BACKDRAFT DAMPERS

A. Manufacturers:

1. Ruskin.  
2. Pottorff.  
4. Penn Ventilator.  
5. Arrow Louver and Damper.  
6. American Warming and Ventilating.  
7. Air Balance, Inc.

B. Gravity Back-draft Dampers, Size 12 x 12 inches or smaller, furnished with air moving equipment: air moving equipment manufacturer’s standard construction.

C. Multi-Blade, parallel action gravity balanced back draft dampers: 16 gauge galvanized steel or extruded aluminum, with center pivoted blades of maximum 6" width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90° stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 MOTOR OPERATED DAMPERS

A. Manufacturers:

1. Ruskin.  
2. Pottorff.  
4. Penn Ventilator.  
5. Arrow Louver and Damper.  
6. American Warming and Ventilating.  
7. Air Balance, Inc.

B. Performance: Test in accordance with AMCA 500.

C. Frames: Extruded aluminum or galvanized steel welded or riveted with corner reinforcement.

D. Blades: Extruded aluminum or galvanized steel, attach blades to minimum 1/2-inch shafts by permanent means.

E. Blade Seals: Synthetic elastomeric or Neoprene mechanically attached, field replaceable.

F. Jamb Seals: Stainless steel.

G. Shaft Bearings: Lubricant free, stainless steel, single row, un-ground, flanged, radial, antifriction type with extended inner race.
H. Ductwork pressure rating between -2" w.g. and 2" w.g. inclusive

1. Smaller than 12" duct width: SMACNA-HVAC Figure 2-12 A, B, and C, 12" maximum blade width no internal frame.
2. 12" and larger duct width: SMACNA-HVAC Figure 2-13, multi-opposed blade, 8" maximum blade width.
3. Recess frame totally out of the airstream. Limit stop penetration into airstream to 1/2". Dampers less than 5 feet upstream of outlets, equivalent to Young Regulator 817.

I. Ductwork pressure rating lower than -2" w.g. and higher than 2" w.g.:

1. Round ductwork use rectangular duct type with pocket recess for frame and unused portions of damper or butterfly type damper.
2. Rectangular ductwork use SMACNA-HVAC Figure 2-13, multi-opposed blade, 8" maximum blade width with closed end bearings.
3. Recess frame totally out of the airstream. Limit stop penetration into airstream to 1/2".

J. Dampers shall be ultra-low leakage type dampers with 6.0 cfm/sq. ft. at 4.0" w.g. differential maximum.

K. Motor operated dampers shall be constructed in accordance with SMACNA-HVAC. Motor operated dampers shall be constructed of the same material as the associated ductwork.

L. End Bearings: Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

M. Locate motor operated dampers where accessible for adjusting after completion of Work.

N. Actuators:

1. Provide voltage as required
   a. 120V Electric: Operators shall be stainless steel closure spring return electric type, modulating, fail open or closed as required by control sequence, suitable to operate on 120 volt, 60 hertz.
3. Provide all motor operated damper actuators with position indicators and damper end switches.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and flexible, and as indicated.

B. Connector: Fabric crimped into metal edging strip.

1. Fabric: Provide 6" wide, UL Listed fire-retardant neoprene impregnated glass fabric collar to NFPA 90A, minimum density 30 oz per sq. yd. between fans, air handling units and other air handling devices and ducts or casings and wherever ducts cross building expansion joints.
2. Metal: 3 inch wide, 24 gage metal of same material as associated ductwork.
3. Provide and install copper grounding strap for installation across all flexible connections.
4. Secure flexible connections to duct and equipment with galvanized steel straps holding the material in formed galvanized channels.
5. Flexible connections shall be installed at the point of connection to the equipment unless otherwise noted.

2.5 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Access door material shall be the same as associated ductwork.

B. Fabrication: Provide 18-inch square rigid and close fitting galvanized steel doors with sealing gaskets, quick fastening locking devices with two hinges and two sash locks.

C. Access doors with sheet metal screw fasteners are not acceptable.

D. Provide airtight access doors in ductwork in locations and sizes to provide access for all volume dampers, back-draft dampers, motor operated dampers, after generators, and for adjustment and maintenance of all mechanical equipment. Access doors shall also be provided to permit cleaning of all ductwork systems without requiring the ductwork to be dismantled or disassembled.

E. Access doors located in ductwork that is not internally lined or externally insulated shall be un-insulated access doors.

1. Ductwork Pressure Rating between -2" w.g. and 2" w.g. inclusive: Figure 2-12 of SMACNA-HVAC; Door A, Frame 1, Hinge Position 1.

2.6 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

C. Test holes shall be constructed of same material as ductwork.

2.7 GASKETS AND SEALING COMPOUND

A. Gaskets shall be 3M Company EC-1202 tape sealer with a minimum size and thickness of 1" x 1/8". Gaskets shall overlap at the corners.

B. Sealing compound shall be 3M Company Premium Grade Duct Sealer, United Sheet Metal "United Duct Sealer" or Benjamin Foster 32-14. Install in accordance with manufacturer's written instructions. If necessary to achieve and airtight joint, additionally apply a duct tape to
wet sealant compatible with the sealer used. Allow adequate curing time before pressurizing the system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics. Provide power and control connections as required by drawings, specifications, and sequences of operations.

3.2 INSTALLATION

A. Install in accordance with the NFPA, UL and SMACNA Standards. Install in accordance with manufacturer's printed instructions.

B. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15890 for duct construction and pressure class.

C. Provide back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Provide duct access doors for inspection and cleaning before and after automatic dampers and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Review locations prior to fabrication.

E. Provide duct test holes where indicated and required for testing and balancing purposes.

F. Provide flexible connections immediately adjacent to equipment in ducts associated with motorized equipment and supported by vibration isolators. Refer to Section 15245.

G. All dampers must be accessible to allow inspection, adjustment, and replacement of components. The contractor shall furnish any access doors in ductwork or plenums required to provide this access. The contractor shall furnish any access doors required in walls, ceilings, or other general building construction.

END OF SECTION 15910
SECTION 15940 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section includes:

1. These Specifications and accompanying Drawings are intended to cover the furnishing of all labor, materials, installation of air outlets and inlets and related items. Small items of material, equipment and appurtenances not mentioned in detail or shown on the Drawings but necessary for a complete and operable system.

2. Provide air inlet and outlet devices in accordance with the paragraphs below. The types of air inlet and outlet devices are indicated below.
   a. Stationary Louvers

1.3 REFERENCES

A. AMCA 500 - Test Method for Louvers, Dampers and Shutters.

B. ARI 650 – Air Outlets and Inlets


D. SMACNA - HVAC Duct Construction Standard - Metal and Flexible. (Herein after referred to as SMACNA - HVAC).


F. NFPA 70 - National Electrical Code.

G. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.


1.4 SUBMITTALS

A. Submit under General and Special Provisions.
B. Product Data: Submit manufacturer's catalog sheets and product description in accordance with General and Special Provisions. Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets indicating type, size, location, application, noise level, finish, and mounting method. Submit manufacturer's installation instructions. Provide for initial selection purposes in form of manufacturer's color selection charts showing full range of colors available for those units with factory-applied color finishes.

C. Shop Drawings: Submit shop drawings in accordance with General and Special Provisions. Shop drawings of louver units and accessories shall include plans, elevations, sections and details showing profiles, angles, spacing of louver blades; unit dimensions related to wall openings and construction; free area for each size indicates; and profiles of frames at jambs, heads and sills. Provide product test reports.

D. Operation and Maintenance Manuals: Not Required.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under General and Special Provisions.

B. Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

C. Conform to the requirements of ANSI/NFPA 90A.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in the manufacturer's original undamaged packages or acceptable containers.

B. Store and protect all materials, apparatus and equipment from physical damage, the elements, moisture, dirt, debris and Work of other trades. Use of paper, cardboard or other flimsy material for protection shall not be permitted. Replace damaged protective
C. Handle all materials as recommended by the manufacturer and to prevent physical damage with seals and labels intact and legible.

D. Deliver, store and handle materials in accordance with requirements of Division 1 and manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Louvers

1. Design, engineer, fabricate and install exterior metal wall louver to withstand the effects of loads and stresses from wind and normal thermal movement, without evidencing permanent deformation of louver components including blades, frames and supports; noise or metal fatigue caused by blade rattle or flutter, and permanent damage to fasteners and anchors.

2. Wind loads acting inward or outward shall be in accordance with local codes.

3. Provide louver complying with performance requirements indicated as demonstrated by testing manufacturer's stock units, of height and width indicated, in accordance with AMCA 500. Products shall bear AMCA Seal for Water Penetration and Air Performance based on tests made in accordance with AMCA 500 and complying with AMCA Certified Ratings Program.

4. Provide acoustical louver complying with airborne sound transmission loss ratings indicated, as demonstrated by testing manufacturer's stock units in accordance with ASTM E90.

5. Comply with SMACNA-ASMM recommendations for fabrication, construction details and installation procedures.

6. Preassemble louver in shop to minimize field splicing and assembly. Disassemble units as required for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

7. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

8. Provide supports, anchorages, fasteners and accessories required for a complete assembly. Supports, anchorages, fasteners and accessories shall be of same basic metal and alloy as louver.

2.2 LOUVERS - STATIONARY

A. Acceptable Manufacturers:

1. American Warming and Ventilating, Inc.
2. Ruskin Manufacturing Division
3. Arrow United Industries.
4. Construction Specialties Inc.
5. Greenheck

B. Stationary Louvers - Extruded Aluminum

1. American Warming Model LE-21: Louver shall be constructed of 0.081" thick 6063-T5 extruded aluminum frame and blades, architectural design, "J" blades, channel frame, 1/2" mesh, 16 gauge aluminum wire removable bird screen and frame on interior face. Maximum distance between vertical supports shall be 72". Caustic etch, 30 minute anodized (204R1) finish, followed by protective coat butyrate lacquer. Blade spacing shall be 5", blade depth shall be 4" and louver blade angle shall be 45 degrees unless otherwise indicated.
2. Louver shall be fixed blade drainable louver.
3. Minimum free area shall be 50 percent.
4. Maximum pressure loss shall be 0.10" w.g. at an air flow of 500 fpm free area intake velocity.
5. Louvers shall be finished with color anodized finish; color selected by Representative from manufacturer's standard color chart.

2.3 BLANK OFF PANELS FOR EXTERIOR WALL LOUVERS

A. Blank off panels shall be insulated and fabricated from materials, finish, coating type, color and gloss to match louver.

B. Attach blank-off panels to back of louver frame with self-locking clips.

C. Panels shall be laminated metal faced panels consisting of insulating core surfaced on back and front with metal sheets to match louver material, 1" thick rigid glass fiber board insulation complying with ASTM C612 Class 1 and 2, perimeter trim edges of channel frames with mitered corners and seal perimeter joints between panel faces and louver frames with polyvinyl chloride compression gaskets, 1/8" by 1".

D. Fabricate blank-off panels of sizes required to completely cover unused portion of louver.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with SMACNA - HVAC and SMACNA - ASMM.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement. Make minor duct modifications to suit.

D. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry.
construction.

E. Locate and place louver units plumb, level and in proper alignment with adjacent work.

F. Repair all damages to louver finish, construction or appearance. Restore to original condition.

G. Install concealed gaskets, flashings, joint fillers and insulation, as louver installation progresses where required to make louver joints weather-tight and watertight. Joint sealers shall comply with Division 7.

H. Before final inspection, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes. Rinse thoroughly and dry surface.

END OF SECTION 15940
SECTION 15980 - INSTRUMENTS AND CONTROL ELEMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Division 01 Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section includes:
   1. Thermostats.
   2. Automatic dampers.
   3. Damper operators.
   4. Miscellaneous accessories.

1.3 REFERENCES

A. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
B. NEMA DC 3 - Low-Voltage Room Thermostats.
C. NFPA 70 - National Electrical Code.
D. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
E. NEMA 250 - Standard for Enclosures for Electrical Equipment.

1.4 SUBMITTALS

A. Submit under General and Special Provisions.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves, indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers; Subject to compliance with requirements, provide products by one of the following:
   1. Automated Logic Corporation
   2. TAC/CSI
   3. Johnson Controls, Inc.
   4. Andover Controls
   5. Delta Controls
   6. KMC Controls
   7. Approved Equal.

2.2 CONTROL PANELS

A. Unitized cabinet type for automatic building temperature control and outline in Section 15985 “Sequence of Operations”. System includes; generator inlet, recirculation/by-pass and exhaust dampers and building exhaust fan. Provide relays, controllers, temperature indicators, push buttons and switches as required.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.3 DAMPERS

A. Refer to specification Section 15910 -- Ductwork Accessories.

2.4 DAMPER ACTUATORS

A. Refer to specification Section 15910 - Ductwork Accessories
2.5 THERMOSTATS

A. Line Voltage Thermostats:
   1. Integral manual On/Off/Auto selector switch, single or two pole as required.
   2. Dead band: Maximum 2 degrees F.
   3. Cover: Locking with set point adjustment, set-point indication, with thermometer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that systems are ready to receive work.

B. Beginning of installation means installer accepts existing conditions.

C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

D. Coordinate installation of system components with installation of mechanical systems equipment such as air terminal units.

E. Ensure installation components are complementary to installation of similar components.

F. Coordinate installation of system components with installation of mechanical systems equipment such as air terminal units.

3.2 INSTALLATION

A. Install in accordance with manufacturers instructions.

B. Check and verify location of thermostats, and other exposed control sensors with plans and room details before installation. Locate 60" above finished floor. Align with lighting switches.

C. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

E. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position. Include selector switches to allow manual operation of inlet and exhaust dampers as well as exhaust fan.
F. Provide conduit and electrical wiring in accordance with Division 16. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.

**END OF SECTION 15980**
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Division 01 Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Sequence of operation:
   a. Emergency generator intake, exhaust and recirculation dampers.
   b. Unit heater.
   c. Exhaust fan.

1.3 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 SUBMITTALS FOR REVIEW

A. Submit under General and Special Provisions:

B. Shop Drawings: Indicate mechanical system controlled and control system components.

   1. Label with settings, adjustable range of control and limits. Include written description of control sequence.
   2. Include flow diagrams for each control system, graphically depicting control logic.
   3. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Project Record Documents: Record actual locations of components and set-points of controls, including changes to sequences made after submission of shop drawings.
PART 2 – PRODUCTS – Not Applicable

PART 3 - EXECUTION

3.1 EMERGENCY GENERATOR

A. When the generator is not operating, the generator intake and exhaust dampers shall be closed and recirculation dampers shall be open.

B. When the generator begins to operate, the intake damper shall open. The exhaust and recirculation dampers shall modulate to maintain a space temperature of 70 degrees F.

C. A solenoid valve shall be provided to shut off fuel supply when generator is not operating. The solenoid valve shall open when the generator is indexed to operate.

3.2 ELECTRIC UNIT HEATER

A. A wall mounted thermostat or integral thermostat shall maintain a constant space temperature of 68 degrees F (adjustable) by cycling the unit fan and electric heating elements.

3.3 EXHAUST FAN

A. A local wall switch shall allow the exhaust fan to be indexed on by the space occupant, and continue to operate until indexed off by the space occupant.

B. On a room temperature rise above 85 degrees F, the intake damper shall open and the exhaust fan shall start. When the room temperature drops to 80 degrees F, the exhaust fan shall stop and the intake damper shall close.

C. The exhaust fan shall be locked out when the generator is operating.

END OF SECTION 15985
SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section

1.2 SUMMARY

A. Section Includes:

1. The purpose of this section is to describe the requirements of the Contractor to provide all necessary services to perform testing, adjusting and balancing (TAB); and to describe the commissioning process specific to testing, adjusting and balancing (TAB) systems and equipment.

2. Systems include, but are not limited to:

   a. Testing, adjustment, and balancing of air systems.
   b. Measurement of final operating condition of HVAC systems.
   c. Sound measurement of equipment operating conditions.
   d. Vibration measurement of equipment operating conditions.

1.3 CODES, REGULATIONS, STANDARDS AND REFERENCES

A. All work shall conform to the following codes, regulations and standards of latest issue:

   1. Associated Air Balance Council (AABC), "National Standards for Field Measurement and Instrumentation for Total System Balance".
   5. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) HVAC Systems Testing, Adjusting and Balancing.

1.4 RELATED WORK

A. Refer to Division 15 specifications and plans and approved shop drawings for system configuration and details of required construction.
B. During the balancing work, list all items which are installed incorrectly or have not been
installed in accordance with the contract drawings and/or specifications. This shall include all
air distribution, piping, pumping, heating and cooling systems.

C. During the balancing work, correct any deficiencies in the construction or systems such as lack
of balancing valves, dampers, etc., that adversely impact the "balance ability" of systems.

D. During the balancing work, report and correct all deficiencies in controls, air valve leakage,
damper leakage, mixing box leakage, thermostat malfunction, excessive noise in the HVAC
system, etc., that adversely impacts the quality of the HVAC systems.

E. Obtain from the Contractor an unmarked copy of the plans and specifications to be used during
the system balance. These drawings are to be maintained on the job site with notes and red
lines indicating as-built conditions discovered in the course of the TAB work.

F. Records and test data shall be kept throughout the course of the project that pertains not only to
test results, but observations relative to quality of construction, completeness of components
and systems, and overall integrity of the HVAC systems.

1.5 SUBMITTALS

A. Submit Testing, Adjusting and Balancing (TAB) Report under provisions of General and
Special Provisions.

B. Shop Drawings: Submit drawings showing test and instrument locations and additional
dampers, valves and other equipment required for proper air and water balancing for approval in
accordance with General and Special Provisions.

C. Instrument Calibrations: Certificate of all instrument calibrations shall be submitted to
Representative prior to commencing with Work.

D. Operation and Maintenance Manuals: Certificate of all instrument calibrations shall be inserted
into O&M manuals.

E. Submit name of testing, adjusting and balancing agency for approval. Refer to paragraph 1.7.

F. Field reports: Submit under provisions of General and Special Provisions.

G. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and
balancing of systems and equipment to achieve specified performance.

H. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and
equipment data required.

I. Submit draft copies of report for review prior to final acceptance of Project. Provide final
copies for Representative and for inclusion in operating and maintenance manuals.

J. Provide reports complete with index page and indexing tabs, with cover identification at front
and side. Include set of reduced drawings with air outlets and equipment identified to
correspond with data sheets, and indicating thermostat locations.
K. Include detailed procedures, agenda, and sample report forms prior to commencing system balance.

L. Test Reports: Report data on any one of the following industry standard forms.

1. AABC National Standards for Field Measurement and Instrumentation for Total System Balance forms.
2. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems forms.

1.6 SYSTEM CHANGES

A. General: Changes or additions of sheaves, belts, blade pitch, volume dampers, and access to system components shall be provided by Division 15, as required by the testing and balancing agency, at no additional cost to the Commission.

1.7 TESTING AND BALANCING AGENCY QUALIFICATIONS

A. Agency Qualifications: The Contractor, as part of this contract, shall obtain the services of a qualified agency to perform the testing and balancing work as herein specified. The Contractor shall submit the name of the proposed agency to the Owner's Representative for review within 60 days after the contract award. The criteria for determining qualifications shall be membership in the AABC, or certification by the NEBB, and the agency shall have not less than 5 years experience on projects of similar scope and complexity. The agency shall be independent of the installing contractors or equipment suppliers for this project. Submit a current list of projects for which the balancing contractor provided services, including references and phone numbers, and name of principal technician.

B. Submit for approval a detailed proposal containing the following:

1. Qualifications of supervisory and TAB personnel. Included shall be special training and number of years experience in this field that qualifies the employee for this Work.
2. List of test instruments to be used.
3. Examples of test reports or report forms that will be used to produce the final report.
4. List five (5) most recent TAB jobs of comparable complexity.

1.8 PROJECT COORDINATION

A. General: Prior to the start of construction, review the plans, specifications and installation of all of the affected systems. Submit a written report to the Representative indicating any recognized deficiencies in the systems that would preclude the proper adjusting, balancing and testing of the systems.

1.9 QUALITY ASSURANCE

A. Perform total system balance in accordance with recognized industry standards as specified
herein.

1.10 SEQUENCING
A. Sequence work under the General and Special Provisions.
B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.11 SCHEDULING
A. Schedule work under the General and Special Provisions.

1.12 AGENDA
A. General: Submit two copies of an agenda for review by the Representative at least 30 days prior to the start of testing and balancing. The agenda shall include the following:
   1. An outline of tasks to be performed at the job site (in the sequence they are to be performed).
   2. An explanation of the equipment to be used for each type of field measurement. Indicate the correction factors to be used for area, velocity, CFM, density, GPM, etc.
   3. Indicate equations to be used for data that is to be calculated.
   4. Indicate the location of each air velocity measuring device traverse to be performed.
   5. An organized compilation of all of the forms that will be used to record data at the job site. Each form shall be filled in with installation and design data as specified and shall include blank spaces for the recorded test data. Indicate all data specified to be recorded. The forms shall be organized in a manner that is satisfactory to the Representative. The final organization format of the submitted forms shall be used for the finished testing and balancing report.

1.13 GENERAL PROCEDURES
A. Perform TAB operations on systems only after systems have been cleaned, completed and are in proper working order, or when directed by the Representative. Systems shall be in continuous operation and full operation before TAB begins and during each working day of TAB.
B. Procure the services of a TAB agency to perform the testing, adjusting and balancing of all air and water flows including air outlets in HVAC systems. Report all instances in which the specified quantities cannot be provided by the installed equipment so that corrections to the equipment can be made under the Section wherein it was specified. The agency shall also check the operation of all equipment through their full range of capacity control.
C. The TAB agency shall directly oversee all Work performed by employing a competent supervisor subject to the approval of the Representative.
D. Conduct capacity and operating tests on all equipment. Tests shall be made during a period of
stable operations and minimum load fluctuation. Submit a performance report for each item tested which includes a comparison of installed capacity and design capacity.

E. Requirements: Adjust systems and components thereof to perform as required by drawings and specifications.

F. Initial Testing: Prior to actual start of testing and balancing verify in writing to the Representative that the systems and equipment are ready for balancing. If not so, describe any deficiencies found. Correct air and water system performance deficiencies disclosed by initial testing prior to balancing the system.

G. Test Duration: Operating tests of heating coils, fans and other equipment shall be of not less than 4 hours duration, after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measure during such tests.

H. Off-season Testing: In consideration that testing and balancing may be scheduled in the season other than that for which the equipment applies, the agency shall provide load to test the equipment. The heating system shall be tested under whatever sustained load can be provided by combination of ambient and cooling apparatus. Full operation tests shall be performed during the next available heating as may be requested by the Representative and scheduled with the Representative. Utility expenses for these tests will be provided by the Contractor.

I. Instrumentation: Method of application of instrumentation shall be in accordance with the approved agenda. Furnish all personnel, instruments, and equipment for tests specified herein.

1. Accuracy of Instruments: Instruments used for measurements shall be accurate to within the requirements of NEBB. Provide calibration histories for each instrument for examination. Calibrate each test instrument by an approved laboratory or by the manufacturer. The Representative has the right to request instrument recalibration, or the use of other instruments and test methodology, where accuracy of reading is questionable.

2. Application of Instruments: Comply with manufacturer's certified instructions.

J. Wiring and Controls: All wiring and controls shall be completed and tested before the start of testing and balancing. Installation shall be completed and approved by the Representative before the start of balancing.

K. Before any TAB Work is started, an inspection of all HVAC equipment and systems shall be performed. The inspection shall establish that all systems are ready for testing, adjusting and balancing and have been operating for a minimum period of 24 hours. The TAB Agency shall familiarize himself with all systems to be tested, adjusted and balanced and the test points required. Any test openings, test wells, dampers, valves or other items required for testing, adjusting and balancing, as proposed by the TAB Agency, shall be furnished at no additional cost to the Commission.

L. Balancing objectives:

1. Balance all air outlets and water flow terminals to plus or minus 5 to 10 percent of design flow.
2. Adjust fan speed and modify pumps or controls as required to produce design flow.
3. Adjust system for design outside air quantity.
4. Adjust system for design exhaust air quantity.
5. Adjust system for design supply air quantity.
6. Test and record heating, apparatus entering and leaving air, water, and refrigerant temperatures.
7. Adjust flow patterns from air distribution devices to minimize drafts.

M. Prepare the airside balancing in the following manner:
   1. Fans shall be mechanically checked and ready to operate under design conditions.
   2. Controls, whether they are electric, electronic, pneumatic, DDC, or a combination thereof, shall be mechanically checked and ready to operate under design conditions.
   3. Dampers and locking devices shall be marked to accurately indicate the position of the respective balanced position.
   4. Changes in pulleys, belts or addition of any dampers required for correct balance during testing shall be made at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Provide all testing, adjusting and balancing equipment, materials and supplies required to conduct testing, adjusting and balancing.
   B. Materials other than those specified for jointing shall not be permitted in the ductwork or piping systems for the purpose of stopping leaks.
   C. Instrument calibrations shall have been conducted on all equipment and instruments used to test, adjust and balance the mechanical systems no more than 30 days prior to commencing with the TAB Work.

2.2 TEST EQUIPMENT
   A. Instrumentation shall be provided as necessary and appropriate to perform the work. The type and number of instruments utilized shall be determined by the type of systems involved and the number of personnel required to complete the work by the time stipulated. The instruments shall be calibrated in accordance with the manufacturer's instructions and shall be used with the factory-determined application factors. This instrumentation shall include, as appropriate, but not be limited to, the following or approved equal.
   B. Airflow/Pressure
      1. Capture box
      2. Inclined manometer
      3. Anemometer; 4 inch Biram type
      4. Anemotherm; Anemostate Model 60
      5. Velometer; Alnor Type 3002
      6. Dwyer "Magnehelic"; 0 to 4 inch wg; 0 to 10 inch wg
7. Pitot tubes; static and velocity; Dwyer Model 400

C. Temperature

1. Pressure and Temperature insert probes
2. Duct probes
3. Surface temperature pyrometer; Alnot Type 4200
4. Electronic readout devices
5. Recorders

D. Electrical

1. Amphobe
2. Voltmeter

E. The Contractor shall provide all necessary test equipment.

F. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Representative to facilitate spot checks during testing.

PART 3 - EXECUTION

3.1 CONSTRUCTION OBSERVATION

A. Obtain and review design documents for overall design intent and the overall required systems and configurations.

B. Obtain and review shop drawings and submittals for installation criteria and the required construction details and their support and further define the systems features.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Duct systems are clean of debris. Fans are rotating correctly.
5. Access doors are closed and duct end caps are in place.
6. Air outlets are installed and connected.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

3.3 GENERAL TESTING, ADJUSTING, AND BALANCING PROCEDURES
A. Records shall be maintained at all times which shall readily indicate all steps, adjustments, and intermediate the final readings. The records shall indicate on each trial whether a damper or balancing device was cut or opened. The records shall be maintained on reproducible type forms which shall include measurement locations, design capacities, appropriate manufacturers' performance factors, and dates and names of personnel involved; and shall be included in the report.

B. Final settings shall be clearly marked on each balancing valve, quadrant, etc.

C. Occasionally, work may have to be performed in areas that are partially or fully occupied by the Commission, which may require the work to be accomplished during other than normal working hours. Such occupancy shall not be considered justification for any deviation for the requirements outlined herein or any extra payments.

D. System operation will be by the Contractor to suit the requirements of the balancing work. System filtrates shall be new at start of testing, adjustment and balancing work.

E. Demonstrate agreement of recorded and measured data. Upon completion of final balance settings, notify the Representative. Repeat flow readings at five percent of the outlets as directed by the Representative. If repeat readings differ by more than five percent from the final values recorded on the balance report forms, balancer shall make corrections to the system balance and this procedure shall then be repeated.

F. Resourcefulness is frequently required in order to properly balance some of the more complex and intricate systems. This may dictate the use of methods and techniques not herein before stated. Where "standard" balancing procedures cannot, due to physical conditions or other circumstances by employed, alternate methods shall be determined and approved by the Representative.

3.4 INSTALLATION TOLERANCES

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

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 TESTING, ADJUSTING, AND BALANCING

A. Test, adjust and balance systems in accordance with AABC National Standards for Field Measurement and Instrumentation for Total System Balance.

B. Test, adjust and balance systems in accordance with ASHRAE HVAC Applications Handbook; ANSI/ASHRAE 111; and AST-RAE Guideline 1.

C. Balance air and water systems complete and prove capacity of systems and their components. All leaks disclosed by testing procedures shall be stopped and testing repeated until the system is proven tight. Testing, adjusting and balancing requirements are minimum requirements and are not intended to be limiting where additional testing methods are required by the Authority.
having jurisdiction. Systems shall remain under test for sufficient length of time to prove
tightness thereof and for adequate observation by the Representative.

D. All equipment shall be operated during the test period. Add dampers valves, and like items
required by the TAB agency for proper and intended operation at no additional cost to the
Commission. Changes required by TAB Agency, in belts, pulleys, sheaves, test cocks and like
items shall be made at no additional cost to the Commission.

E. Operate fans at slowest fan speed that will deliver the indicated air quantity.

F. Record positions of outdoor, return and relief dampers as set for cooling cycle. Also record
positions of bypass dampers and vortex dampers.

G. Operating Tests: Demonstrate to the Representative the specified performance of all systems
and components.

H. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings
to be restored. Set and lock all memory stops.

I. After adjustment, take measurements to verify balance has not been disrupted or that such
disruption has been rectified.

J. Leave systems in proper working order, replacing belt guards, closing access doors, closing
doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURES

A. General: Prior to air system balancing, verify the following:

1. Systems shall be running in control and modulating with reasonable flows and pressures.
2. All ducts intact with less than 3% leakage.
3. Test and adjust blower rpm to design requirements.
4. Test and record motor actual and full load amps.
5. Test and record system preliminary static pressure profiles across all fan system
components at intermediate points in branch ducts, and at end of runs.

B. Balance: Use flow adjusting (volume control) devices to balance air quantities only; i.e.
proportion flow between various terminals comprising system, and only to the extent that their
adjustments do not create objectionable air motion or sound. Make final measurements of air
quantity, after the air terminal has been adjusted to provide the optimum air patterns of
diffusion.

1. Effect volume control by duct internal devices such as volume dampers and minimize
volume control at diffusers, registers, and grilles.
2. Vary total system air quantities by adjustment of fan speeds. Provide drive changes
required. Vary branch air quantities by damper regulation.
3. Where modulating dampers are provided, take measurements and balance at extreme
conditions.

C. Fan Adjustment: Total air system quantities shall be varied by adjustment of fan speeds
utilizing sheaves. Terminal control boxes, manual volume dampers, etc. shall not be used for fan adjustment. Fans, air handling equipment, or other equipment with vibration levels considered by the balancer to be excessive shall be brought to the attention of the Representative.

D. Air Measurement:

1. General: Total system air quantities shall be determined by summing the air quantities at the terminals served. Total system air quantities shall also be determined by pitot tube traverse and by fan performance data.

2. Pitot Tube Traverse: Perform pitot-tube traverses at each fan, and (in addition); if the fan serves more than one floor, perform traverses on each branch feed to each floor. Pitot tube traverses may be omitted at branch feeds to each floor if all of the branch feeds are individually less than 2,000 CFM.

3. Test Holes: Test hole shall be in a straight duct, as far as possible from elbows, bends, takeoffs, and other turbulence generating devices, to optimize reliability of flow measurements. Plug holes after testing and patch insulation where required. Indicate test hole location with marker.

4. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

5. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

6. Check all duct mounted motorized dampers for leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

7. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

3.7 SCHEDULES

A. Equipment Requiring Testing Adjusting, and Balancing

1. Supply, Return, Relief and Exhaust Duct Mains and Branches

2. Motors

3. Starters and Disconnect Switches

4. Vibration Isolation

5. Fans

6. Terminal Heat Transfer Units

7. Emergency Generators

3.8 PERFORMANCE TESTS AND BALANCING REPORT

A. Report Submittals

1. First submittal: Submit two (2) copies of the rough draft report for review by the Representative, to include:

   a. A list of items which will prevent the balancer from providing a full and complete balance.
b. Narratives that describe all problem areas that may require major construction or design changes.
c. Narratives that describe the building systems and control systems to demonstrate comprehension of systems operation, including system diversity.
d. The balancing agenda which reiterates the scope of the balancing work and the intended order of activity.

2. Final submittal: Submit four (4) copies of the report to the Representative in binders per requirements indicated in the General and Special Provisions. Imprint bound edge of volumes with the name of the project and the words "Testing, Adjusting, and Balancing Report". Imprint front of the volume with the name of the building, project name, project number, Owner, Contractor, and the TAB firm.

B. The pre-final and final reports shall include a narrative and the data necessary to describe the system(s), operating equipment, and how they function. Identify equipment using the construction drawing identifiers. Include data required by Paragraph 3.6 "Air System Procedures".

C. Conduct capacity tests on all equipment. Tests shall be made during a period of stable operations and minimum load fluctuation. A performance report shall be submitted for each item tested which includes a comparison of installed capacity and design capacity.

D. Guidelines for the required tests and reports are as specified in the paragraphs that follow.

E. Provide complete test analysis to the Representative prior to acceptance for review and approval. After approval, provide additional copies in the Operation and Maintenance Manuals.

F. Certified Project Performance Reports: The completed project performance report shall be submitted upon the conclusion of the testing, adjusting and balancing work. The report shall contain, but not be limited to, the following:

1. Title Page
   a. Name of Testing, Adjusting and Balancing Agency
   b. Address of Testing, Adjusting, and Balancing Agency
   c. Telephone number of Testing, Adjusting and Balancing Agency
   d. Project name
   e. Project location
   f. Project Representative
   g. Project Contractor
   h. Project altitude
   i. Report date and time
   j. Weather conditions on day of Testing, Adjusting and Balancing.

   NOTE: If TAB work takes more than one (1) day, record date, time, weather conditions, and systems tested for each day of TAB work.

2. Table of Contents

3. Instrument List
a. Instrument  
b. Manufacturer  
c. Model number  
d. Serial number  
e. Range  
f. Calibration date  

   a. Design versus final performance  
   b. Notable characteristics of system  
   c. Description of systems operation sequence  
   d. Nomenclature used throughout report  

5. Summary report of any deficient items or operation not conforming to contract requirements.  

6. Summary report of all Systems upon re-verification of ensuing season operation.  

7. Records of all readings taken. All quantities recorded in report shall be measured unless report notes it as a calculated value. Calculate values only where measuring is not possible.  

3.9 GENERAL EQUIPMENT AND SYSTEM DATA  

A. Provide information listed below for all applicable equipment and systems, on approved report forms.  

B. Electric Motors  
   1. Visual Inspection - External  
   2. Manufacturer  
   3. Model/Frame  
   4. HP/BHP  
   5. Phase, voltage, amperage - nameplate, actual, no load, full load  
   6. Motor speed - RPM  
   7. Service factor  
   8. Starter size, rating  
   9. Disconnect size, rating  
   10. Fuse and overload heater element size  
   11. Sheave Make/Size/Bore  
   12. Motor Temperature  
   13. VFD test data when applicable  

C. Motor Starters and Disconnect Switches: For each device conduct and record the following:  
   1. Visual Inspection - External and Internal  
   2. Manufacturer  
   3. Model  
   4. Horsepower rating  
   5. Motor Data
D. Vibration Isolation Bases and Isolators
   1. Visual Inspection - External
   2. Isolators released
   3. Base or isolators bottomed out/overloaded

E. Sound Level Report
   1. Location
      a. Locate testing sensor within 5 feet of the emergency generator building
         at the intake and exhaust louver.
   2. Octave bands - equipment off
   3. Octave bands - equipment on

3.10 AIR SYSTEM DATA

A. Provide information listed below for all applicable equipment and systems, on approved report forms.

B. Duct Mains and Branches: (Supply, Return, and Exhaust): For each supply, return, and exhaust duct carrying 25% or more of the system airflow and upstream of each smoke detector record the following:
   1. System zone/branch
   2. Duct size
   3. Location, Area
   4. Number, location and cross-section sketch of each pitot-tube (pressure) measurement. Perform pitot tube traverses for all air handling system whose supply air, exhaust air, return air or outside air ductwork (riser and take-offs) have a cross section area of 400 square inches or larger.
   5. Sum of velocity measurement, excluding pressure measurements.
   6. Design velocity
   7. Design airflow – cfm
   8. Test velocity
   9. Test airflow - cfm
   10. Duct static and velocity pressures
   11. Air temperature
   12. Air correction factor
   13. Vibration Isolators

C. Duct Leak Test
   1. Description of ductwork under test
   2. Duct design operating pressure
   3. Duct design test static pressure
   4. Duct capacity, air flow
   5. Maximum allowable leakage duct capacity times leak factor
   6. Test apparatus
   7. Blower
8. Orifice, tube size
9. Orifice size
10. Calibrated
11. Test static pressure
12. Test orifice differential pressure
13. Leakage

D. Fan Data (Supply, Return, Exhaust): After air outlets and inlets have been balanced, determine total airflow through the fan. For each fan conduct and record the following:

1. Visual Inspections - Fan Internal and External
2. Identification number
3. Location
4. Manufacturer
5. Model number
6. Serial number
7. Size
8. Motor Data
9. Airflow specified and actual
10. Total static pressure (total external), specified and actual
11. Fan suction static pressure
12. Fan discharge static pressure
13. Fan Curve with Operation Point
14. Sheave Make/Size/Bore
15. Number of Belts/Make/Size
16. Fan RPM
17. Vibration isolation bases and isolators

E. Air Inlets and Outlets (Louvers): Test, adjust and balance all air inlets and outlets. Report and record the following:

1. Visual Inspection
2. Room number/location
3. Air outlet or inlet type
4. Area Factor
5. Design velocity and airflow (cfm)
6. Actual velocity and airflow (cfm)
7. Percent of design airflow

F. Terminal Heat Transfer Unit Data (Electric Unit Heaters) and similar items: Test, adjust and balance all terminal heat transfer units. Report and record the following:

1. Visual Inspection - Internal and external
2. Manufacturer
3. Model Number
4. Unit Size
5. Unit Type
6. Identification/number
7. Room number/location
8. Motor data
9. Fan Data (as applicable)
a. Motor Data
b. Fan Airflow specified and actual
c. Fan static pressure, specified and actual
d. Sheave Make/Size/Bore
e. Number of Belts/Make/Size
f. Fan RPM

10. Balance and record terminal heat transfer unit coil and heat exchanger data as indicated in the associated paragraphs.
11. Air filter data

3.11 ELECTRICAL SYSTEM DATA

A. Provide information listed below for all applicable equipment and systems:

1. Emergency Generators - Load Bank Testing
2. Automatic Transfer Switches
3. Power Centers
4. Breakers
5. Connections
6. Sequence of Operations
7. Panelboards
8. Grounding Resistance Check - Design versus Actual
   a. Cable testing

3.12 FINAL TESTS, INSPECTION AND ACCEPTANCE

A. Capacity and Performance Tests: Make tests to demonstrate that capacities and general performance of systems comply with contract requirements.

B. Retests: The testing agency shall recheck random selections of up to 10% of the data recorded in the balancing report in the presence of the Representative. The balancing report will be automatically rejected if more than 20% of the rechecked readings deviate more than 10% of the recorded reading in the balancing report.

C. Marking of Settings: Following final acceptance of the balancing report, the settings of all valves, splitters, dampers and other adjustment devices shall be permanently marked by the balancing agency, so that adjustment can be restored if disturbed at any time.

3.13 ACCEPTANCE CRITERIA

A. See criteria stated herein under Air Systems, paragraph 3.10.

3.14 TEST PROCEDURES

A. Submit for approval detailed Functional Performance Testing (FPT) procedures corresponding to the FPT criteria in Acceptance Criteria in this Section. FPT procedures shall be detailed test
instructions, written with sufficient step-by-step information to allow test to be repeated under identical conditions. List the value for all set-points and inputs, positions of adjustable devices and acceptable results for each condition tested. Provide unique alpha-numeric identification for each FPT procedure.

B. Submit for approval test procedure check-off sheets. Number each test procedure check-off item with the same number as the corresponding FPT procedure.

C. Demonstrate successful execution of FPTs listed under Acceptance Criteria in this Section. Sign-off each successful test and obtain the sign-off of the Representative or other Commission designated witness.

END OF SECTION 15990
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 STIPULATIONS

A. General Conditions of the contract documents including Publication 408, dated 2007-5, of the Department of Transportation of the Commonwealth of Pennsylvania, Special Provisions and General Provisions apply to all work in these entire contract specifications.

B. The Interchange facility shall remain operational during all phases of this project. Any interruption to the electrical service shall have prior written approval of the Pennsylvania Turnpike Commission.

C. Interruption to electrical service must be scheduled during off peak hours. All interruptions must be coordinated with the Commission's Representative.

D. Off peak hours are generally considered to be between 12:00 a.m. to 5:30 a.m.

E. The Contractor shall provide all temporary electric service required for operational use of the facility.

F. The Contractor shall provide all required wire tracing and troubleshooting of existing circuits for this project including but not limited to circuits which are affected resultant to National Electric Code compliance.

1.3 RELATED DOCUMENTS


B. Special Provisions and Supplementary Specifications.

1.4 SUMMARY

A. Every section of Division 16 described herein is binding upon the Contractor involved insofar as it can or does apply to the work.

B. This Contractor shall furnish, install and connect an operating electrical installation in accordance with these specifications and accompanying contract drawings. This shall include all
required labor, materials, apparatus and supervision.

1.5 DEFINITIONS

A. Contractor: "Contractor", "this Contractor" or "Electrical Contractor" when used in this specification refers to the Contractor responsible for all work under this Section.

B. Sub-Contractor: Any reference to, or letting of work contained in these specifications to any Subcontractor or Manufacturer does not relieve this Contractor of his responsibility for all work, material and equipment in this specification.

C. Provide: The term "Provide" when used separately shall mean to "Furnish and Install".

D. Furnish: The term "Furnish" when used separately shall mean to obtain and deliver to the project site, for installation by others.

E. Install: The term "Install" when used separately, shall mean to mount in place, connect and make operable.

F. Gauge of Materials: The sites of copper conductors and thickness metals shown on the drawings or mentioned herein shall be understood to be American Wire Gauge for conductors and US Gauge for sheet metal.

G. Singular Number: Any reference made to an item in the singular number shall apply equally to as many identical items that work may require.

1.6 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Provide mechanical equipment with voltages and other electrical characteristics as indicated on the drawings and specifications.

B. All starters and disconnect switches, except factory mounted starters and disconnect switches, for equipment provided under Division 15 shall be furnished under Division 15 and installed under Division 16.

C. All power wiring for mechanical equipment provided under Division 15 shall be furnished and installed under Division 16 (from source to starter, disconnect switch, or combination starter/disconnect switch, and to equipment, motor, or other connection point). Except where specifically indicated otherwise, all power wiring to the point of final connection, for equipment provided under Division 15, shall be accomplished under Division 16. In general, the point of final connection shall be the terminal housing on the equipment, motor or an integral junction box on the equipment item. If no junction box is furnished, a junction box shall be furnished and installed under Division 16. Wire leads of adequate length to ensure a proper connection at the final location shall be furnished and installed under Division 16.

D. All control wiring (line voltage and/or low voltage) for mechanical equipment provided under Division 15 shall be furnished and installed under Division 15. Wiring from power source to all control panels, controllers, and other control equipment required for a complete and operable control system serving mechanical equipment provided under Division 15 shall be furnished...
and installed under Division 15. All wiring from control panels to control devices for mechanical equipment provided under Division 15 shall be furnished and installed under Division 15. All control wire and conduit shall comply with the National Electric Code and Division 16 of the specification. All control wiring shall be in conduit.

E. Wiring, over-current protection devices, voltage, phase, rotation and final location of all equipment provided under Division 15 shall be coordinated with all similar devices and power wiring furnished and installed under Division 16. Coordination shall be accomplished prior to the running of any conduit or wiring.

F. Final electrical power connections to all equipment shall be furnished and installed under Division 16.

G. Electrical control wiring for connection of temperature controllers, push buttons, interlocks in motor controllers, pneumatic switches and like items is specified in the control section(s) in Division 15.

H. All motors, mounts, remote mounted push-button controls and all speed control switches for multi-speed motors for all mechanical equipment provided under Division 15 shall be furnished and installed under Division 15.

I. Division 15 shall fully cooperate with the other Divisions and trades on the job and their manufacturers in promptly providing the information required for proper coordination of motor protection and control equipment and wiring and the characteristics of the equipment.

J. It shall be the responsibility of the contractor to check for adequacy of supply wiring, over-current protection, proper voltage, phase rotation and final location of equipment provided prior to the running of any conduit or wiring. Coordinate with Division 16 to assure proper electrical service is provided to equipment provided under Division 15.

K. Equipment connections shall be made through conduit or raceways in accordance with Division 16, except that connections to motors shall be made be through liquid tight flexible metal conduit with equipment grounding conductor.

1.7 REGULATIONS AND CODES

A. All applicable laws, ordinances, rules and regulations of public bodies bearing on the conduct of the work, including not limited to the State Department of Health, Department of Labor and Industry, the National Fire Protection Association, and the Americans with Disabilities Act are hereby incorporated and made a part of these specifications.

B. The Contractor shall comply with all rules, regulations and recommendations of any public utility serving this project.

C. The entire electrical system shall be installed in accordance with the latest edition of the National Electric Code, approved by the governmental body having jurisdiction, including amendments thereto.

1.8 DRAWINGS AND SPECIFICATIONS
A. The drawings are generally diagrammatic and indicative of the work to be installed. Exact locations of equipment and points of termination shall be approved by the Representative. Should it be found that any system or equipment cannot be installed as shown on the drawings; the Representative shall be consulted before installing or making changes to the layout.

B. The drawings and specifications are intended to function as a common set of documents. Anything shown on the drawings but not in the specifications, or mentioned in the specifications and not shown on the drawings, shall be equally binding as if both noted on the drawings and called for in the specifications.

C. No measurement of a drawing by scale shall be used as a working dimension. Working measurements shall be taken from figured dimensions.

D. This Contractor shall carefully examine the Contract Drawings and Specifications. If any discrepancies occur between the drawings or between the drawings and specifications, report such discrepancies to the Representative in writing and obtain written instructions as to the manner in which to proceed. No departures from the Contract Drawings shall be made without prior written approval of the Representative.

1.9 FAMILIARITY WITH CONTRACT REQUIREMENTS

A. It is the responsibility of the Contractor; prior to submitting his bid on this Project, to satisfy himself as to the nature and location of the work, and quantity of the materials which will be required the character of equipment and facilities needed prior to and during the prosecution of the work, the general and local conditions, and of all other matters which can in any way affect the work under this contract.

B. Failure to make an on-site inspection prior to submitting a bid, or failure to comply with any or all of the above requirements will not relieve this Contractor from the responsibilities of properly estimating the requirements or costs of successful completion of the work nor from the responsibility for the faithful performance of the provisions of this Contract.

1.10 STANDARDS AND REFERENCES

A. Products of workmanship that are specified by association, trade, or federal standards shall comply with the requirements of the following reference Standards, except when more rigid requirements are specified or are required by applicable codes.

1. ANSI American National Standard Institute
2. ASTM American Society for Testing and Materials
3. PM Factory Mutual System
4. FS Federal Specification
5. IEEE Institute of Electrical and Electronics Engineers
7. NEMA National Electrical Manufacturers Association
8. NFPA National Fire Protection Association
9. UL Underwriters Laboratories, Inc.
1.11 SUBMITTALS

A. Approval of Materials

1. Within twenty (20) days after signing the contract, the Contractor shall submit to the Representative, for approval, a complete list of materials, equipment, and subcontractors proposed for use on this project.
2. List shall include, in itemized form, the name and address of the manufacturer, equipment or sub-contractor and when required, the trade name or catalog number of the proposed material.
3. Submit three (3) copies for approval.

B. Shop Drawings

1. The Contractor shall submit to the Representative, shop drawings, catalog cuts, data sheets, manufacturer’s instructions, etc., of all materials and equipment as called for in the specifications or on the drawings.
2. Shop drawings submitted for review shall identify the project, contractor, subcontractor or supplier, pertinent drawing number, detail and specification section number, as appropriate.
3. Shop drawings shall bear the Contractor's approval stamp, signed or initialed certifying that review, verification of the material required, dimensions, and coordination of the information is in accordance with the requirements of the work and contract documents. Drawings submitted without the Contractor's approval stamp will not considered and will be returned for resubmission.
4. No work shall be executed, no orders placed, no material shall be installed until final review has been approved.
5. Submit (3) copies for review.

C. Electrical Inspection Certificate

1. The electrical work on this project shall be inspected by an approved inspection agency. The Electrical Contractor shall pay all inspection costs. Any work failing to pass inspection shall be corrected and re-inspected at no additional cost to the Commission. The Electrical Contractor shall formally file for this inspection within thirty (30) days of signing the Contract.
2. Submit three (3) copies of final wiring certificates to the Representative.
3. Approved inspection agencies.
   a. Atlantic Inland, mc.
   b. Commonwealth Inspection Agency
   c. Middle Department Inspection Agency

D. Testing

1. Upon completion of the work, all parts of the electrical installation shall be tested by this Contractor and proved free of unwanted grounds and other defects. Preliminary testing with magneto will be permitted, but will not be accepted in obtaining final results. Final tests shall be accomplished by use of a megger or as covered in this specification.
2. All connections at panels and switches and all splices must be made, all fuses shall be in place, and all circuits continuous from point of service connections to switches,
receptacles and outlets at the time of final inspection.

3. All overload devices, including equipment furnished under other contracts, shall be set and adjusted to suit load conditions.

E. Operations and Maintenance Manuals

1. This Contractor shall carefully compile, during progress of work, all operation and maintenance manuals including all approved electrical shop drawings. Methods of care of all types of materials and descriptions of all systems and equipment and methods of operation thereof shall be provided. These instructions shall contain detailed operating and maintenance instructions and complete parts lists for each piece of equipment and diagrams of control wiring so arranged that the maintenance staff might easily trace the control in case of operating difficulties. Use manufacturer's printed information where possible; otherwise, obtain written instructions prepared by sub-contractors. Include names, addresses and phone numbers of all sub-contractors and of service firms for each item, for the Commission's use after expiration of the warranty period. The list shall be located immediately inside the front cover. Before completion of the work, submit a rough draft of the manual in a loose-leaf binder for approval.

2. After approval and before final payment, furnish three (3) corrected bound copies, properly identified, to the Representative.

3. The Contractor shall furnish to the Representative three (3) original Operations and Maintenance manuals for the generator as provided by the manufacturer. Copies of the original Operations and Maintenance manuals will not be acceptable.

F. Guarantee

1. Written one (1) year full warranty guarantees shall be submitted for the entire electrical installation installed under this project (except lamps). The emergency lighting system shall carry a full warranty guarantee for three (3) years. Where manufacturer's standard guarantee provides for a longer period, the longer period shall apply.

2. Where defects in the material, equipment and/or workmanship become evident within this guarantee period, the Contractor shall be responsible for replacing such material and equipment with the approved type of new items; and/or correcting the defective workmanship without any costs to the Commission.

G. Construction Record Drawings

1. The Contractor shall keep at the job site one complete set of drawings, which shall be used by the Contractor for the purpose of recording all changes, which occur during the construction. The Contractor shall accurately record on these drawings all changes in the electrical work.

2. Upon completion of this project, these drawings shall be turned Representative.

H. Final Wiring Certificates

1. Submit 3 copies of final wiring certificates to the Representative.
1.12 SUBSTITUTIONS AND SAMPLES

A. All material specified hereinafter shall be of the manufacturer's catalog number as specified. If the Contractor desires to substitute, Contractor must submit catalog cuts of the substituted materials to the Representative. Submission's for substitute materials or equipment does not relieve the Contractor of the specified time of completion.

B. No substitutions shall be made without approval. The words "approved equal" and "equal" shall mean equal in all respects in the sole opinion of the Representative.

C. The Electrical Contractor shall furnish, for review by the Representative; all samples specified or called for by the Representative. Finished work shall match approved samples and shop drawings.

D. When shop drawings are submitted on equipment different from the equipment specified hereinafter, this Contractor shall relate each item of the submitted equipment to its specified equivalent.

E. Substitutions that involved in changes in the building, to the equipment, to the arrangement of equipment, or to the work performed or to be performed under other sections of the specifications, due to the substitution of equipment in lieu of that shown on the drawings or Specification, are not acceptable.

1.13 QUALITY OF WORKMANSHIP

A. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. The quality of workmanship shall be subject to the approval of the Representative. Any work found by the Representative to be of inferior quality and/or workmanship shall be replaced and/or reworked until approval of the Representative is obtained. Any cost involved in obtaining said approval shall be the responsibility of the Contractor.

1.14 PERFORMANCE OF EQUIPMENT

A. All materials, equipment and appurtenances of any kind, shown on the drawings, hereinafter specified or required for the completion of the work in accordance with the intent of these specifications, shall be completely satisfactory and acceptable in operation, performance, and capacity. No approval, written or verbal of any drawings, descriptive data or samples of equipment or other appurtenances, shall relieve the Contractor of his responsibility to turn over to the Commission a fully functional standby power system in proper working order at the completion of the work.

B. Any new equipment, component or appurtenance which does not comply with the drawings or specification requirements, which is damaged prior to acceptance by the commission, will be held to be defective material and shall be removed and replaced with acceptable equipment, components or appurtenances that are in proper working order and satisfactory to the Representative without additional cost to the Commission.
C. All details of the installation of all equipment shall be electrically and mechanically correct all equipment shall operate without objectionable noise or vibration as determined by the Representative. If objectionable noise or vibration is produced and transmitted to occupied portions of the building by apparatus, conduit or other parts of a system, any corrections to eliminate noise and vibration shall be made without cost to the Commission.

1.15 TEMPORARY ELECTRIC FACILITIES

A. The Contractor shall furnish, install, connect and maintain temporary electrical services to the building until new, permanent services are installed. Complete installation and maintenance of temporary Services shall meet all NEC and OSHA requirements.

1.16 METHODS AND MATERIALS

A. The Electrical Contractor shall confer will all other Contractors and shall apply for detailed and specific information regarding the location of all equipment as the final location may differ from that indicated on the drawings. Outlets, equipment or wiring improperly placed because of the Electrical Contractor's failure to obtain this information shall be relocated and reinstalled by the Electrical Contractor without additional expense to the Commission.

B. Each Contractor, upon request of the Representative, shall expedite the work of a specific area, section or part of the project to make provision for, or protect equipment or to permit the installation of another part of the work.

C. All materials and equipment supplied by this Contractor shall be new, of the best of their respective kinds, without imperfections and blemishes, and shall be protected from the elements prior to installation in the building.

D. All conduits, wire, cable, wiring devices and equipment shall be installed in such a manner as to preserve access to any existing equipment or to any new equipment installed under this specification.

E. The drawings are generally indicative of the work to be installed but do not indicate all bends, fittings, boxes, etc., which may be required. Contractor shall carefully investigate the structural and finish conditions affecting his work, arrange his work accordingly, and furnish such fittings as may be required to meet such conditions.

F. This Contractor shall coordinate his work with that of other trades so that all work may be installed in the most direct manner and so that interference between piping ducts, equipment, architectural or structural features will be avoided. In case interference or fouling results, the Representative shall decide which work is to be relocated, regardless of which is first installed. Such relocation shall be at no additional cost to the Commission.

G. All materials and equipment installed by the Contractor shall be firmly supported and secured to the building construction where required.

H. All items of labor, material and equipment not specified in detail or shown on the drawings incidental to or necessary for the complete and proper installation and proper operation of the several branches of the work described herein or reasonably implied in connection therewith,
shall be furnished as if called for in detail by the specifications or drawings.

I. Major items of equipment shall be the best grade and quality used for the purpose in commercial practice and shall have the manufacturer's name, address and catalog number on a plate securely affixed in a prominent place. All electrical equipment or apparatus of any one system must be the product one manufacturer. Equivalent products of a number of manufacturers, which are suitable for use in a unified system, must be approved by the Representative.

J. When available, all materials and equipment shall bear the label of approval of the Underwriters' Laboratory, Inc.

1.17 SLEEVES
A. The Electrical Contractor shall provide sleeves where required to protect equipment or facilities in the installation.

1.18 CHASES AND OPENINGS
A. All openings or chases required for the installation of the electrical work in the building shall be provided by the Contractor.
B. This Contractor shall seal all openings he has made in fire rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire rating equal to or greater than the rating of the floor, ceiling or partition material. All free stop material shall be UL. Classified.

1.19 ACCESS PANELS
A. The Electrical Contractor shall provide all access panels required by work under this contract. Access panels shall not be smaller than 24" x 24" for access to concealed pull boxes, junction boxes or similar items where no other means of access is provided.
B. Each access panel shall be all steel construction with a wall or ceiling frame and a hinged panel door. Doors shall be provided with full piano hinges and suitable clips and countersunk screws. Access panels, shall have a one-hour fire rating and shall be so labeled. Outside of access panels finish shall be flush with finished wall or ceiling surfaces and be prime painted.

1.20 SCAFFOLDING
A. The Electrical Contractor shall furnish and erect all scaffolding and ladders required in the installation of wiring, equipment and fixtures.

1.21 EQUIPMENT FOUNDATIONS
A. The provision of all concrete equipment foundations required for equipment furnished under
these electrical specifications shall be the responsibility of the Electrical Contractor. Foundations shall be of sufficient mass to suit the equipment furnished.

1.22 PROTECTION OF WORK, MATERIALS AND EQUIPMENT

A. This Contractor shall effectually protect at his own expense, all existing facilities and such of his new work, materials or equipment as is liable to injury during the construction period. All openings into any part of the conduit system as well as all associated fixtures, equipment, etc., both before and after being set in place must be securely covered or otherwise protected to prevent obstruction, damage, or injury due to carelessly or maliciously dropped tools or materials, grit, dirt, moisture, water or foreign matter. This Contractor shall be held responsible for all damage so done, until his work is fully accepted by the Representative. Conduit ends shall be covered with capped bushings.

B. All surfaces either finished or in preparation for finishing or finish material application, shall be protected against damage from welding, cutting, burning, soldering or similar construction functions. The protection shall be accomplished by care in operations, covering and shielding. Special care shall be directed to exposed finished masonry, metal or wood surfaces and painted surfaces. Corrective measures required shall be accomplished by the trade which made the original installation when and as directed by the Representative at the expense of the Contractor causing the damage, and at no cost to the Commission.

C. Any damage caused by neglect on the part of this Contractor or his representative, or by the elements due to neglect on the part of this Contractor or his representatives—either to the existing work, or to his work or to the work of any other Contractor, shall be repaired at the Contractor's expense and to the Representative's satisfaction.

1.23 PROTECTION OF SERVICES AND EQUIPMENT

A. The Contractor shall, at his own expense, repair, replace and maintain in service any utilities, facilities or services (underground, over ground, interior or exterior) damaged, broken, or otherwise rendered inoperative during the course of construction by him or his representatives. The method used by the Contractor in repairing, replacing or maintaining the services shall be approved by the Representative.

1.24 INSTRUCTIONS

A. After all tests and adjustments have been made, the Electrical Contractor shall fully instruct the representatives of the Commission in all details of operation and maintenance of equipment installed under this Contract. Allow eight (8) man-hours for instructions.

END OF SECTION 16010
SECTION 16020 - ELECTRICAL SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Electrical demolition.

1.2 RELATED SECTIONS
   A. General and Special Provision specification sections.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. All measurements shall be field verified for actual dimensions.
   B. Verify that abandoned wiring and equipment serve only abandoned facilities.
   C. Demolition Drawings are based on casual field observation and available existing record documents. Report discrepancies to the Representative before disturbing existing installation.
   D. Beginning of demolition means Contractor has confirmed existing conditions.

3.2 PREPARATION
   A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
   B. Coordinate utility service outages with the Representative and Utility Company.
   C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations coordinated with the Representative.
D. Existing Electrical Service: Verify system voltage and report to Representative any deviation from design. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration. Downtime and outages shall be scheduled during off-peak hours such that normal operations in the area are not disrupted - no extras shall be approved for premium time work. Note that institutional operations are generally 24 hour operations. Obtain permission from Representative in writing at least 2 weeks before partially or completely disabling any system.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under General and Special Provisions and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction, including but not limited to installation of conduit and conductors to extend existing circuits.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Remove all existing conduit not being reused back to the nearest junction box containing live circuits to be retained. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

F. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories where applicable.

G. Disconnect and remove automatic transfer switch (A.T.S) and emergency generator and associated electrical items and appurtenances, after installation of new system.

H. Repair adjacent construction and finishes damaged during demolition and extension work, in kind and as approved by the Representative, at no additional cost to the Commission.

I. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations and in compliance with current codes, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.
B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

3.5 INSTALLATION

A. Install relocated materials and equipment according to General and Supplementary Conditions and Division 16 Specifications.

END OF SECTION 16020
SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplemental Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.
B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals and grout.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

D. Roof Penetration Sleeves: Seal penetration on individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
      e. Approved equal

   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

   3. Pressure Plates: Plastic, include two for each sealing element.

   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.
B. Grout shall comply with PA DOT 408 Section 1001.2(d).

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways or cables penetrate slabs, walls, or floors.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Cut sleeves to length for mounting flush with both surfaces of walls.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Size pipe sleeves to provide \( \frac{1}{4} \) inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section 07920 “JOINT SEALANTS”.
I. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

J. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 16050
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Grounding systems and equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Informational Submittals: Plans showing dimensioned as-built locations of the following:


C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

1.4 QUALITY ASSURANCE

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

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Grounding Conductors, Cables and, Connectors

   a. Copperweld Corp
   b. ERITECH Grounding Products: Division of Erico Inc.
c. FCI-Burndy

d. Harger Lightning & Grounding

e. Kearney: Division of Cooper Power Systems

f. Lightning Master Corp.

g. Raco: Division of Hubbell Electrical Products

h. Thomas & Betts

2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Equipment Grounding Conductors: Insulated with green colored insulation.

C. Grounding Electrode Conductors: Stranded cable.

D. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

E. Bare Copper Conductors:


2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone and similar materials.

B. In raceways, use insulated equipment grounding conductors.
C. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
   1. Bury at least 24 inches below grade.

D. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Exothermic welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.
   8. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
3.4 LABELING

A. Comply with requirements in Division 16 Section 16075 "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.

B. Install labels at the at the grounding electrode conductor where exposed.
   1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: Ten (10) ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Representative promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060
SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2- PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Tag: Type 1:
   1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   2. Thickness: 4 mils.
   3. Width: Not less than 6 inches wide.
   4. Weight: 18.5 lb/1000 sq. ft.
   5. 3 inch Tensile According to ASTM D 882: 30 lbf, and 2,500 psi.

2.5 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. ¼ inch grommets in corners for mounting.
   3. Nominal size, 7 x 10 inches.

D. Metal-Backed, Butyrate Warning Signs:
   1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3- EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.
B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label. Install labels at 10 foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

2. Power.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch circuit conductors.

   a. Color shall be factory applied.
   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
3) Phase C: Blue.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, and control wiring.
   1. Install underground-line warning tape for cables in raceway.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.

G. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

H. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
      b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
   2. Equipment to Be Labeled:
a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Enclosed switches and circuit breakers.
e. Push-button stations.
f. Power transfer equipment.
g. Remote-controlled switches, dimmer modules, and control devices.
h. Battery racks.
i. Power-generating units.
j. Monitoring and control equipment.

END OF SECTION 16075
SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports: From a qualified testing and inspecting agency engaged by the Contractor.

1.5 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.
PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

2. General Cable Corporation.

B. Conductors: Comply with NEMA WC 70. Use solid conductor for size #10 AWG and smaller. Use stranded conductor for size #8 AWG and larger.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, and XHHW.

2.2 CONNECTORS AND SPLICES

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

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

1. AFC Cable Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than #4 AWG; copper or aluminum for feeders #4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.
B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
C. Branch Circuits: Type THHN-THWN, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
E. Identify and color-code conductors and cables according to Division 16 Section 16075 "ELECTRICAL IDENTIFICATION."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
B. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment for compliance with requirements
      a. Prefabricated building
b. Diesel generator set
c. Day tank
d. Monitoring system


C. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

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

END OF SECTION 16120
SECTION 16130 - RACEWAYS, BOXES, AND UNDERGROUND DUCTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY
   A. Section includes:
      1. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS
   A. FMC: Flexible metal conduit.
   B. LFMC: Liquidtight flexible metal conduit.
   C. RSC: Rigid steel conduit.

1.4 SUBMITTALS
   A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
   B. Shop Drawings: For raceway components. Include plans, elevations, sections, details, and attachments to other work.

1.5 QUALITY ASSURANCE
   A. 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.
   B. Comply with NFPA 70.
PART 2- PRODUCTS

2.1 METAL CONDUIT

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

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
7. O-Z Gedney; a unit of General Signal.

B. Rigid Steel Conduit: ANSI C80.1.

1. Fittings: Threaded

C. EMT: ANSI C80.3.

1. Fittings: Compression and set screw type.

D. LFMC: Flexible steel conduit with PVC jacket.

E. Fittings for Conduit (Including all Types and Flexible), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

F. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 METAL WIREWAYS

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 3R, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Finish: Manufacturer's standard enamel finish.
E. Select features as required, unless otherwise indicated, to complete wiring system and to comply with NFPA 70.

2.3 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers.

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

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

   a. Thomas & Betts Corporation.
   c. Wiremold Company (The); Electrical Sales Division.

2.4 BOXES, ENCLOSURES, AND CABINETS

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

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
7. RACO; a Hubbell Company.
10. Spring City Electrical Manufacturing Company.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

PART 3- EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Galvanized Rigid steel conduit.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed: Galvanized rigid steel conduit.
   2. Concealed: Galvanized rigid steel conduit.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   4. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.

C. Minimum Raceway Size: 1 inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Galvanized Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 16 Section 16050 "Basic Electrical Materials and Methods."

E. Install temporary closures to prevent foreign matter from entering raceways.

F. Protect stub-ups from damage where conduits rise through floor slabs. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

G. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

H. Conceal conduit within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Install separate ground conductor across flexible connections.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

Q. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished par against box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box. Tighten chase nipple so no threads are exposed.

R. Install raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.

2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130
SECTION 16140 - WIRING DEVICES

PART 1- GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY
   A. Section includes:
      1. Receptacles, receptacles with integral GFCI, and associated device plates.
      2. Receptacles with integral surge suppression units.
      3. Snap switches.
      4. Device wall plates.

1.3 DEFINITIONS
   A. GFCI: Ground-fault circuit interrupter.
   B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
   C. UTP: Unshielded twisted pair.

1.4 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 QUALITY ASSURANCE
   A. 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.
   B. Comply with NFPA 70.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 5351 (single), 5352 (duplex).
   b. Hubbell; HBL5351 (single), CR5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. Design units for installation in a 2-3/4 inch deep outlet box without an adapter.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; GF20.
   b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.
B. Heavy Duty grade, quiet type.

C. Switches, 120/277 V, 20 A:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
      c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
      d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.5 COMBINATION SWITCH/RECEPTACLE

A. Both devices in single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
   1. Switch: 20A, 120VAC.
   2. Receptacle: NEMA WD 6, Configuration 5-20R.

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant die-cast aluminum with lockable cover.

2.7 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70 or device listing.
PART 3- EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

C. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
   7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
   8. Tighten unused terminal screws on the device.
   9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles up.
E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section 16075 "ELECTRICAL IDENTIFICATION."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports.

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operations with both local and remote fault simulations according to manufacturer’s written instructions.

END OF SECTION 16140
SECTION 16231 - PACKAGED ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

B. Related sections include the following:
   1. Section 16415 “Transfer Switches” for transfer switches including sensors and relays to initiate automatic starting and stopping signals for PACKAGED ENGINE GENERATORS sets.
   2. Section 03300 “Cast in Place Concrete” for concrete base.

1.2 SUMMARY

A. Section includes:
   1. Packaged engine-generator sets for emergency power supply with the following features and accessories:
      a. Diesel engine.
      b. Unit mounted cooling system.
      c. Unit mounted control and monitoring.
      d. Battery charger.
      e. Day Tank.
      f. Muffler.
      g. Exhaust piping external to generator set.
      h. Remote annunciator.
      i. Starting battery.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 SUBMITTALS

A. Product Data: For each type of PACKAGED ENGINE GENERATORS indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
1. Data on features, operating characteristics, rated capacities, furnished specialties and performance.
2. Thermal damage curve for generator.
3. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail 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 drawings of engine-generator set and other components specified.
   2. Wiring Diagrams: Power, signal, and control wiring.
   3. Certified summary of prototype unit test report.
   4. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

C. Qualification Data: For installer.

D. Source quality-control test reports.
   1. Certified factory test report on units shipped for this project, showing evidence of compliance with specified requirements.
   2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on units shipped for this project.
   4. Field quality control test reports.
   5. Report of exhaust emissions showing compliance with applicable regulations.

E. Operation and Maintenance Data: For PACKAGED ENGINE GENERATORS include in emergency, operation, and maintenance manuals. In addition include the following:
   1. List of tools and replacement items recommended for storage at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

F. Warranty: Documentation confirming conformance to special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
   1. Maintenance Proximity: Not more than four (4) hours normal travel time from Installer's place of business to Project site.
   2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

E. 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.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

J. Comply with UL 2200.

K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

L. Welding: Quality procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX for welding exhaust system piping.

M. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by PTC or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify the Pennsylvania Turnpike Commission no fewer than fourteen (14) days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without the Commission’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. Ambient Temperature: Minus 15 to 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1500 ft.

1.7 COORDINATION

A. Coordinate size and location of concrete bases for PACKAGED ENGINE GENERATORS. Verify structural requirements with the manufacturer. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of PACKAGED ENGINE GENERATORS and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) years or 1500 operating hours, whichever occurs first from the date of initial start up. Multiple warranties for individual components (engine, alternator, controls, etc.) shall be acceptable.

PART 2- PRODUCTS

2.1 MANUFACTURERS

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

2. Kohler Co.; Generator Division.
3. Caterpillar; Engine Div.
4. Spectrum Detroit Diesel.

2.2 ENGINE-GENERATOR SET

A. A complete, operable standby system, factory-assembled and -tested, engine-generator set; Cummins/Onan Model DQDAA or approved equal. Rated for continuous service at 250kW/313 KVA Standby at 0.8 PF, 277/480 volts 3 phase 4 wire, 60-Hz. Package shall be new and current equipment consisting of;

1. A diesel engine driven electric generating set to provide standby power.
2. An engine-alternator control console resiliently mounted on the generating set including engine start-stop control, solid state monitoring system and Mainline Circuit Breaker.
3. Automatic Transfer Switch to initiate automatic starting and stopping for the engine and switching of the load.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; be free from sharp edges and corners and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Output Connections: Three-phase, four (4) wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five (5) seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.
2.3 ENGINE

A. General Characteristics: Diesel fueled, turbocharged, four cycle (2-cycle engines are unacceptable), liquid cooled with mounted radiator, fan and coolant pump, 6 cylinders, minimum displacement of 543 cubic inches, standby minimum rating of 380 BHP, maximum BMEP of 302 psi at Rated Load.

B. Fuel: Fuel oil, Grade DF-2

C. Rated Engine Speed: 1800 rpm.

D. Intake and Exhaust Valves: Shall be heat resisting alloy steel and free rotating. Exhaust valve seat inserts shall be provided.

E. Filters: Coolant and oil filters with replaceable elements.

F. Lubrication System:
   1. Shall be full pressure lubrication and supplied by a positive displacement lube oil pump.
   2. Shall have a lube oil cooler installed.
   3. The following items are mounted on engine or skid:
      a. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
      b. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
      c. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

G. Engine Fuel System:
   2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

H. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

I. Governor: Adjustable isochronous, with speed sensing. Must be able to maintain alternator frequency form no-load to full-load alternator output. The engine shall have a 24 volt DC battery charging alternator with an electronic voltage regulator. Remote, 2-wire starting shall be by a 24 VDC, solenoid shift, electric starter.
J. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame, blower fan and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
   a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
6. Cooling Air Requirements: Maximum radiator cooling air and combustion air shall not exceed 14500 ACFM with maximum static restriction of 0.5” H2O.
7. Radiator Core Tubes: Nonferrous metal construction other than aluminum.
8. Fan: Driven by multiple belts from the engine shaft.

K. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 dBA or less.
3. Condensate Drain for Muffler: ASTM A53A/A53M, Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
5. Connection from Exhaust Pipe to Muffler: Stainless steel expansion joint with liner.

L. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

M. Starting System: 24VDC electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery: Adequate capacity within ambient temperature range specified in Part I "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.

5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part I "Project Conditions" Article. Include accessories required to support and fasten batteries in place.


8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
   a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:
   1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
      a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.
2. Tank Capacity: 100 gallons. (US)
3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
5. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.
6. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, isolation solenoid valve, overflow line; and tank drain line with shutoff valve.
7. Redundant High-Level Fuel Shutoff Interlock: Actuated by high-level alarm sensor in day tank to shutdown the day-tank pump motor and signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall remain in shutoff state until manually reset. Shutoff action shall initiate an alarm signal to control panel but shall not shut down engine-generator set.

2.5 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. 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. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel features shall include the following:


C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter: Dual range, indicates all voltages.
2. AC ammeter: Dual range, indicates current in each phase.
3. Ammeter-voltmeter, phase-selector switches with OFF position.
4. AC frequency meter.
5. AC Kilowatt meter.
6. Power Factor meter.
7. DC voltmeter (alternator battery charging).
8. Engine-coolant temperature gage.
9. Engine lubricating-oil pressure gage.
10. Running-time meter.
12. Generator-voltage adjusting rheostat
13. Overspeed shutdown device.
15. Coolant: Low-level shutdown device.
16. Oil: Low-pressure shutdown device.
17. Fuel tank derangement alarm.
18. Fuel tank high-level shutdown of fuel supply alarm.
19. Generator overload.

D. 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.

E. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Engine Shutdown Functions:
   a. Low oil pressure
   b. Low coolant level
   c. High engine temperature
   d. Overcrank shutdown
   e. Overspeed
   f. Overcrank
   g. Fail to crank

2. AC Alternator Shutdown Functions:
   a. AC Undervoltage fault
   b. AC Overvoltage fault
   c. Under frequency fault
   d. Alternator Overcurrent
   e. Alternator Short Circuit fault
   f. Magnetic pick-up failure
   g. Emergency stop fault

3. Warning Functions (Pre-alarms)
   a. Lube oil, low pressure
   b. High engine temperature
   c. Oil pressure sender failure
   d. Temperature sender failure
   e. Alternator overcurrent
   f. Low engine temperature
   g. Engine overload, w/shed contacts
   h. Low battery voltage
   i. High battery voltage
j. Weak battery
k. Maximum of four (4) customer defined inputs
l. Fuel tank derangement
m. Fuel tank high level shutdown of fuel supply
n. Generator overload
o. Battery charger malfunction
q. Fuel tank – Leak detection.
r. Fuel tank – Overfill.
s. Low coolant level.

G. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

H. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Insulated-case, electronic-trip type; 800 Amp, 100 percent rated; complying with UL 489.

2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class F as defined by NEMA MG1-1.65. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees C to provide additional allowance for internal hot spots.

D. Alternator: Shall be a 4-pole revolving field design with temperature compensated solid state voltage regulator and brushless rotating rectifier exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing and the rotor shall be driven through a semi-flexible driving flange to insure permanent alignment.
E. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
   1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Unit Performance: Frequency regulation shall be isochronous from no-load to rated load. Voltage regulation shall be within plus or minus +/-0.5 % of rated voltage, from no-load to full rated load. The instantaneous voltage dip shall be less than 35 % of rated voltage when full, 3-phase, load and rated power factor is applied to the alternator. Recovery to stable operation shall occur within 4.0 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or 1 % of rated voltage. A rheostat shall provide a minimum of plus or minus 5 % voltage adjustment from rated value. Temperature rise shall be within NEMA MG1-22.40 definition.

2.8 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
   2. Durometer Rating: As per manufacturer’s recommendations.
   3. Number of Layers: See manufacturer’s data for load capacities.

B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
   1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-thick, elastomeric isolator pad attached to baseplate underside; and
adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.10 SOURCE QUALITY CONTROL

A. This system shall be built tested and shipped by the manufacturer of the alternator, who has been regularly engaged in the production of engine-alternator sets and associated controls for a minimum of ten (10) years, so there is one source of supply and responsibility.

B. To be classified as a manufacturer, the builder of the generation set must manufacture at least the engine or the alternator.

C. The manufacturer shall be printed literature and brochures describing the standard series specified, not one-of-a-kind fabrication. The manufacturer shall furnish schematic and wiring diagrams for the engine-alternator set, use ASCO and an interconnecting diagram showing connections to individual components, which constitute the standby power system.

D. The performance tests to the generating set series shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generation set series offered which shall include:

1. Maximum power level.
2. Maximum motor starting capacity
3. Structural soundness.
4. Torsigraph analysis per MIL-STD-705B, Method 504.2
5. Fuel consumption.
6. Engine-alternator cooling sir flow.
7. Transient response and steady state governing.
10. Harmonic analysis and voltage waveform deviation per MIL-STD-705B, Method 601.4
11. Three phase short circuit test for mechanical and electrical strength.
13. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype shall have been factory tested to demonstrate compatibility and reliability.

E. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

F. 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.
7. Safety shutdown.
8. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in 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. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install PACKAGED ENGINE GENERATORS to provide access, without removing connections or accessories, for periodic maintenance.

C. Install PACKAGED ENGINE GENERATORS with restrained spring isolators having a minimum deflection of one (1) inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.
Flexible connectors and steel piping materials and installation requirements are specified in Division 15 Sections

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Division 15 Sections.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 15 Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to PACKAGED ENGINE GENERATORS to allow service and maintenance.

C. Connect cooling-system water piping to engine-generator set and heat exchanger with flexible connectors.

D. Connect engine exhaust pipe to engine with flexible connector.

E. Connect fuel piping to engines with a gate valve and union and flexible connector.

   1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Division 15 Section 15537 "FUEL-OIL SYSTEMS."

F. Ground equipment according to Division 16 Section 16060 "GROUNDING AND BONDING."

G. Connect wiring according to Division 16 Section 16120 "CONDUCTORS AND CABLES."

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

3.4 IDENTIFICATION

A. Identify system components according to Division 15 Section 15190 "MECHANICAL IDENTIFICATION" and Division 16 Section 16075 "ELECTRICAL IDENTIFICATION."

3.5 FIELD QUALITY CONTROL
A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Representative shall be notified in advance and shall have the option to witness the tests.

2. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a load test for (2) hours at 50% load and (2) hours at 100% load with a resistive-type load bank, and a single step rated load pickup test in accordance with NFPA 110 Para. 5-13.2.2. Provide a resistive load bank and make temporary connections for load testing. A summary of these test results shall be provided to the Representative at the completion of these tests.

3. After Load Bank Testing Simulate Power Failure and test for operable system. Train Maintenance Personnel in proper operation and maintenance of entire system.

4. 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.

5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

6. 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.

7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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

H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

I. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations.

3.6 STARTUP SERVICE

A. Engage a factory authorized service representative to perform startup service.

B. Inspect field assembled components and equipment installation, including piping and electrical connections. Report results in writing.

C. Complete installation and startup checks according to manufacturer’s written instructions.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Commission's maintenance personnel to adjust, operate, and maintain packaged engine generators. Provide (8) hours of training for (6) people at the site.

1. Coordinate this training with that for transfer switches.
2. Provide eight (8) hours of training for six (6) people at the site.

END OF SECTION 16231
SECTION 16415 - TRANSFER SWITCH

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Transfer switches rated 600 V and less, including the following:

   a. Automatic transfer switches.
   b. Bypass/isolation switches.
   c. Remote annunciation systems.

B. Automatic Transfer Switch: A complete factory assembled power transfer switch with electronic controls designed for fully automatic operation and including surge voltage isolation, voltage sensors on all phases of the normal source and one phase of the emergency source, positive mechanical and electrical interlocking and mechanically held contacts for both sources.

C. The generator set manufacturer shall warrant the transfer switch to provide a single source responsibility for all of the products provided. Technicians specifically trained to support the product and employed by the generator set supplier shall service the transfer switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

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. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switch, bypass/isolation switch, remote annunciator and control panel through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.


E. Comply with NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems that are in compliance to Articles 700, 701 and 702.

F. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.

G. Comply with UL 1008 unless requirements of these Specifications are stricter. The transfer switch shall be UL listed and labeled.

H. CSA C22.2, No. 14 – M91 Industrial Control Equipment.

I. CSA 282 – Emergency Power Supply for Buildings


L. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service in accordance with ISO 9001.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
PART 2- PRODUCTS

2.1 MANUFACTURERS

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

1. Contactor Transfer Switches:
   a. Emerson; ASCO Power Technologies, LP. – ASCO 7000 Series, Catalog # 7ATBB3400N5XC, Closed-Transition Automatic Transfer and Isolation By-Pass Switch or an approved equal.

2.2 GENERAL TRANSFER SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: The Transfer Switch shall be 400 ampere, three phase, four wire, 277/480 volts. Switch shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: The Transfer Switch shall have a closing and withstand rating of 60,000 amps, based on testing according to UL 1008. The Transfer Switch and its upstream protections shall be coordinated. The Transfer Switch shall be third party listed and labeled for use with the specific protective devices(s) installed in the application.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. The Transfer Switch shall be rated to carry 100 percent of the rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing) and altitudes up to 10,000 feet.

D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

E. 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.

F. Covers: Shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with line voltage components.

G. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
H. Switch Characteristics: Shall be designed for continuous duty and repetitive transfer of 100 percent of the rated current continuously between active power sources in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing) and altitudes up to 10,000 feet.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

I. Neutral Switching. Provide fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.

J. Battery Charger: For generator starting batteries.

1. Float type rated at 10 A.
2. Ammeter to display charging current.
3. Fused AC inputs and DC outputs.

K. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

L. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 16 Section 16075 "ELECTRICAL IDENTIFICATION."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

M. Enclosure for Automatic Transfer Switches: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508. Shall provide NEC wire bend space when both sources and the load are all connected from either the top or bottom of the transfer switch. The cabinet door shall be key-locking.

N. Enclosures for Non-Automatic Transfer Switches: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated. Shall provide NEC wire bend space when both sources and the load are all connected from either the top or bottom of the transfer switch. The cabinet door shall be key-locking. Manually operated handles and all control switches (other than key-operated switches)
shall be accessible to authorized personnel only by opening the key-locking cabinet
door. Transfer switches with manually operated handles and/or non-key-operated
control switches located on the outside of the cabinet do not meet this specification and
are not acceptable.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate
position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both
sources energized. Transfer time is same as for electrical operation. Control circuit
automatically disconnects from electrical operator during manual operation.

D. Digital Communication Interface: Matched to capability of remote annunciator panel.

E. Programmed Neutral Switch Position: Switch operator has a programmed neutral
position arranged to provide a midpoint between the two working switch positions, with
an intentional, tie-controlled pause at midpoint during transfer. Pause is adjustable
from 0.5 to 30 seconds, minimum and factory set for 0.5 second. Time delay occurs for
both transfer directions. Pause is disabled unless both sources are live.

F. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-
ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100
percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of
pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay
transfer and engine start signals. Adjustable from zero to six (6) seconds, and
factory set for two (2) seconds to avoid nuisance start-ups.

3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator.
Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory
set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100
percent of nominal. Factory set for pickup at 95 percent. Voltage and frequency
settings shall be field adjustable in 1% increments.

4. The control system shall include latching diagnostic indicators to pinpoint the
last successful step in the sequence of operation (control functions) and to
indicate the present status of the control functions in real time as follows:

<table>
<thead>
<tr>
<th>Normal Available</th>
<th>Start (Generator Set)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Available</td>
<td>Timing for Stop</td>
</tr>
<tr>
<td>Transfer Complete</td>
<td>Retransfer Complete</td>
</tr>
<tr>
<td>Transfer Timing</td>
<td>Retransfer Timing</td>
</tr>
</tbody>
</table>

5. The control system shall include field adjustable provisions to control the speed
of transfer of the transfer switch.

6. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 60 minutes,
and factory set for 5 minutes. The Time Delay feature will also automatically
defeat delay on loss of voltage or sustained undervoltage of the emergency source, provided normal supply has been restored.


8. Switch-Position Pilot Lights: Indicate source to which load is connected.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

10. Contacts: All contacts shall be Form C for compatibility with any generator set. The Transfer Switch shall provide:
   a. Two (2) isolated relay contacts for starting the permanent or temporary generator sets. The relays shall be held normally open and then close to start the generator set.
   b. Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 250 VAC.
   c. Relay contacts to indicate the following conditions: Source 1 available; Source 1 connected to load; Source 2 available; Source 2 connected to load.

11. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

12. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

13. Engine Shutdown Contacts: Time delay adjustable from zero to sixty (60) minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

14. Engine-Generator Exerciser: Solid-state, programmable-time switch starts PACKAGED ENGINE GENERATORS and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
   a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
   b. Push-button programming control with digital display of settings.
   c. Integral battery operation of time switch when normal control power is not available.

G. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.
H. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

I. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The applied generator source (permanent or temporary) shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

J. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

K. The controller shall include a user selectable algorithm to prevent repeated transfer cycling to a source on an installation which experiences primary side, single phase failures on a grounded wye-grounded wye transformer which regenerates voltage when unloaded. The algorithm shall also inhibit retransfer to the normal (utility) source upon detection of a single phasing condition until a dedicated timer expires, the alternate source fails, or the normal source fails completely and is restored during this time delay period. The time delays associated with this feature shall be adjustable by the user through the controller keypad and LCD.

L. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

1. Event Logging
   a. Data and time and reason for transfer normal to emergency.
   b. Data and time and reason for transfer emergency to normal.
   c. Data and time and reason for engine start.
   d. Data and time engine stopped.
   e. Data and time emergency source available.
   f. Data and time emergency source not available.

2. Statistical Data
   a. Total number of transfers.
   b. Total number of transfers due to source failure.
   c. Total number of days controller is energized.
   d. Total number of hours both normal and emergency sources are available.

M. Communications Module - A full duplex RS485 interface shall be installed in the ATS controller to enable serial communications. The serial communications shall be capable of a direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices. The serial communication interface shall be equal to ASCO Accessory 72A.

2.4 BYPASS/ISOLATION SWITCHES

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources.
Include the following features for each combined automatic transfer switch and bypass/isolation switch:

1. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
2. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations.
3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
4. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
6. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
7. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.

C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

1. Bypass to the load carrying source shall be accomplished with no interruption of power to the load (make before break contacts).

2.5 QUICK-CONNECT DOUBLE THROW SAFETY SWITCH (FOR PORTABLE GENERATOR)

A. Operation: Manually actuated by switch handle designated "Permanent Generator Source" and "Portable Generator Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

B. Double-Throw Switching Arrangement: As a double throw switch, the QCDT contains two vertically oriented switches in one enclosure that are operated by a single handle. In between the two switches is a common bus and lugs for outgoing cables. The handle has a three-position operation. In the upper position the upper switch is closed, in the middle position both switches are open, and in the lower position the lower switch is closed. Thus, the two switches are mutually exclusive - that is, they cannot both be closed at the same time. The outgoing lugs are fed either from the top switch or the bottom switch, but never by both.

C. The upper switch shall be fed from the Permanent Generator, and the lower switch shall be the Portable Generator Disconnect. The switch shall be supplied with the Portable Generator Disconnect factory-wired, color coded individual receptacles for each phase, neutral and ground conductor. Coordinate color coding of receptacles with the Representative to be consistent across the Turnpike. These receptacles are inlets for
temporarily connecting a portable generator to the switch without knocking holes in the enclosure to terminate the wires at mechanical lugs.

D. The switch used for the portable generator connection shall be fused as sized on the drawings to protect the incoming cables regardless of the size of the portable generator provided.

E. The receptacles shall be Posi-Lok style from Cooper Crouse-Hinds. Posi-Lok panel shall provide an added measure of safety by interlocking the receptacle covers with one another. This feature requires the user to connect the cables in the order Ground – Neutral – Phase – Phase – Phase, and to disconnect in reverse order. The benefit is personnel safety since a low-impedance ground is the first wire connected and the last that is disconnected.

F. Provide terminal leads and start signal circuit wired to Automatic Transfer Switch. Terminal shall be within manual transfer switch enclosure to allow portable generator connection to be made into the system and be capable of starting the generator from the automatic transfer switch.

G. The product shall be UL listed, (UL File 5239, Vol. 6,Section 19) and meets the requirements of the National Electrical Code including the requirements of 110.3 (B) that the product is listed and found suitable for a specified purpose (in this case, for use with portable electrical generators).

H. 400Amp copper bus, color coordinated Posi-Lok receptacles.

2.2 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.3 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay
settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3- EXECUTION

3.1 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.
   1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support.

B. Annunciator Panel Mounting: Flush in wall, unless otherwise indicated.

C. Identify components according to Division 16 Section 16075 "ELECTRICAL IDENTIFICATION."

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

E. 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 PTC if necessary to accommodate required wiring.

B. Ground equipment according to Division 16 Section 16060 "GROUNDING AND BONDING."

C. Connect wiring according to Division 16 Section 16120 "CONDUCTORS AND CABLES."

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

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform on-site tests and inspections and prepare test reports.
1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.


   
   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
   
   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
   f. 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.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   
   a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

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

F. Service and Support:

1. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location.

2. The transfer switch shall be serviced by a local service organization that is trained and 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. Record of Infrared Scanning:
Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action, and observations after remedial action.

3.4 OPERATION

A. Open-Transition Sequence of Operation:

1. Transfer switch normally connects an energized utility power source (Source 1) to loads and a generator set, either permanent or portable unit (Source 2) to the loads when normal source fails. The normal position of the transfer switch is Source 1 and a no-start signal is supplied to the generator set.

B. Generator Set Exercise (Test) With Load Mode: The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program or when manually initiated by the operator.

2. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall programmable in the controller.

3. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the load to the normal service.

4. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts and closing the normal source contacts a predetermined time later. The timing sequence for the contact operation shall programmable in the controller.

5. The transfer switch shall operate the generator set unloaded for a cool down period and then remove the start signal from the generator set. If the normal power fails at any tie when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

C. Generator Set Exercise (Test) Without Load Mode: The control system shall be configurable to test the generator set without the transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program or when manually initiated by the operator.

2. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.
3. On completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Commission’s maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.

B. Coordinate this training with that for generator equipment.

C. Provide eight (8) hours of training for six (6) people at the site.

END OF SECTION 16415
SECTION 16442 - PANELBOARDS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.
B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.
1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

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

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
      b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by PTC or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify the Representative no fewer than 10 business days in advance of proposed interruption of electric service.
2. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2- PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Finishes:
   a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Same finish as panels and trim.


B. Phase, Neutral, and Ground Buses:


2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material and sizes.


2. Main and Neutral Lugs: Compression type.

3. Ground Lugs and Bus-Configured Terminators: Compression type.

D. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals, 10,000 AIC minimum.

2.2 DISTRIBUTION PANELBOARDS

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker.


PART 3- EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor unless otherwise indicated.
C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install filler plates in unused spaces.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 16 Section 16075 "ELECTRICAL IDENTIFICATION."

B. Create a directory to indicate installed circuit loads; Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with an engraved or plastic laminated nameplate mounted with corrosion resistant screws.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 16442
SECTION 16491 - FUSES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-VAC and less for use in enclosed switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

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

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.
1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIAL

B. Provide (3) Spare Fuses of each type and size provided as part of this project.

PART 2- PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3-EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

F. Cartridge Fuses:
   1. Feeders: Class J, time delay.
   2. Motor Branch Circuits: Class RK5, time delay.
   3. Other Branch Circuits: Class RK1, time delay.
   4. NFPA 70 limits types of plug fuses that can be used in new construction and for replacing plug fuses in existing installations. Limited ampere, voltage, and interrupting

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

B. Install labels complying with requirements for identification specified in Division 16 Section 16075 "ELECTRICAL IDENTIFICATION" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 16491
SECTION 16511 - INTERIOR LIGHTING

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General and Special Provisions and other Supplementary Specification Sections of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Exterior Building lighting fixtures
3. Exit signs.

1.3 DEFINITIONS

A. BF: Ballast factor.
B. CCT: Correlated color temperature.
C. CRI: Color-rendering index.
D. HID: High-intensity discharge.
E. LER: Luminaire efficacy rating.
F. Lumen: Measured output of lamp and luminaire, or both.
G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Installation instructions.

D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

E. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

C. Comply with NFPA 101 visibility and luminance requirements for exit signs.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements.

2.2 BALLASTS FOR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than ten (10) percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 20 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.4 EMERGENCY LIGHTING UNITS

A. Internal Type: Self-contained with sealed battery factory mounted within lighting fixture body.
   1. Comply with UL 924.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      b. Indicator Light: LED indicates normal power on.
   5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
   6. Lithonia Lighting Model Numbers
      a. ELM1254-H2012-N-SD
      b. ELA-NX-H2012 (remote head)
2.5 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. Low Mercury Lamps: Comply with Federal toxic characteristic leaching procedure test and yield less than 0.2 mg of mercury per liter when tested to NEMA LL1.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Basic Electrical Material and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.


E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

PART 3- EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.

B. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

C. Connect wiring according to Section 16120.

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 16 Section 16075 "ELECTRICAL IDENTIFICATION."
3.3 ADJUSTING

A. Adjust aimable luminaires to provide required light intensities.

END OF SECTION 16511
PREVAILING WAGES PROJECT RATES

Project Name: Somerset Interchange Generator Installation
Awarding Agency: Pennsylvania Turnpike Commission
Contract Award Date: 6/14/2011
Serial Number: 11-02627
Project Classification: Building
Determination Date: 4/15/2011
Assigned Field Office: Altoona
Field Office Phone Number: 814-940-6224
Toll Free Phone Number:

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