
**Atlantic City Expressway
2022 SIGN SHOP REHABILITATION PROJECT**



PROJECT MANUAL

Contract
General Construction

BIDS DUE
Tuesday January 24, 2023 @ 1:00 P.M.

Administration Building, Farley Service Plaza
Atlantic City Expressway, M.P. 21.3
Elwood, NJ 08217
609-965-6060

Prepared for
SOUTH JERSEY TRANSPORTATION AUTHORITY



Bid Documents

**SPECIFICATIONS
COVERING
THE**

**ATLANTIC CITY EXPRESSWAY
2022 SIGN SHOP REHABILITATION PROJECT**

SOUTH JERSEY TRANSPORTATION AUTHORITY

DECEMBER 2022



**Prepared By:
REMINGTON & VERNICK ENGINEERS, INC.
2059 Springdale Road
Cherry Hill, New Jersey 08003
856-795-9595
www.rve.com**

OUR FILE NO.: ACEXX780

A handwritten signature in blue ink, appearing to read 'Kenneth C. Ressler', is positioned above a horizontal line.

Kenneth C. Ressler, P. E. - NJ Lic. No.: 34559

12-5-2022

DATE

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SOUTH JERSEY TRANSPORTATION AUTHORITY NOTICE TO BIDDERS

NOTICE is hereby given that **ELECTRONIC** bids will be received by the South Jersey Transportation Authority for:

ATLANTIC CITY EXPRESSWAY 2022 SIGN SHOP REHABILITATION PROJECT

The Atlantic City Expressway 2022 Sign Shop Rehabilitation Project consists of furnishing all labor, equipment, and materials and performing all work required to rehabilitate the Sign Shop Building located at Central Maintenance Yard, Milepost 28 along the Atlantic City Expressway in Hammonton Town, New Jersey.

The rehabilitation to the building is detailed within the project manual and contract plans which includes but is not limited to the following:

1. Removal and replacement of portions of the roof including new timber joists
2. New concrete foundations and CMU walls
3. Replacement of overhead garage doors and access doors
4. New partitioned office within the building complete with steel studs and joists including insulation and gypsum board
5. New concrete floor slab
6. New aluminum gutters and downspouts
7. HVAC upgrades including new gas fired heater units, electric baseboard heaters and ductless heat pump
8. New gas pipes and refrigerant pipes
9. Electrical and lighting upgrades

Bidders are advised to review the detailed scope of work and restrictions noted in the Instructions to Bidders ITB-1, Section 1.

Pursuant to certain specifications prepared by the South Jersey Transportation Authority, Department of Engineering.

Bid Documents will be made available through Bid Express on **Wednesday, December 14, 2022, after 1:00 PM**. Electronic bids will be opened and read aloud on **Tuesday, January 24, 2023** at 1:00 PM** via Go To Meeting at <https://global.gotomeeting.com/join/735066341>. Bidders can also dial into the meeting by phone at +1 (646) 749-3122, access code 735-066-341. Bidders may also attend the bid opening in person at the address below.

South Jersey Transportation Authority
Administration Building
Farley Service Plaza
Atlantic City Expressway, MP 21.3
Elwood, NJ 08217
(609) 965-6060

****Important Note:** The South Jersey Transportation Authority will only accept electronic bid submissions through the Bid Express electronic bidding portal. If you are not already registered for electronic submissions, please visit <https://www.bidexpress.com> in order to bid with the Authority. To subscribe, follow the directions on the website. The fee schedule is available, and all fees are payable to Bid Express.

Any emailed, mailed or physical bids delivered to the Authority will not be accepted and/or will be returned to the bidder unopened.

Specifications and Bid Documents are through Bid Express. All Bidders are encouraged to attend a non-mandatory pre-bid meeting on Tuesday, December 20, 2022 at 1:00 PM via Go To Meeting at <https://global.gotomeeting.com/join/735066341>. Bidders can also dial into the meeting by phone at +1 (646) 749-3122, access code 735-066-341. A **one-time** non-mandatory site visit is scheduled for **Wednesday, December 21, 2022 at 2:00 PM** at the address below and bidders are strongly encouraged to attend.

South Jersey Transportation Authority
Engineering Building
100 Trooper Lane & Route 54
Hammonton, NJ 08037
(sign shop in rear)

A Bid Security in the amount of ten percent (10%) of the TOTAL BID PRICE but not to exceed \$20,000.00, is required to accompany all bid submissions. The Authority, in accordance with law, reserves the right to reject any or all bids either in whole or in part and also to waive any minor informality in any bid or bids so received.

In order to bid this project, the bidder shall be pre-qualified under one (1) of the following NJDPMC Trade Codes: The bidder shall be prequalified at the time of bid submission.

- Trade Code C008 – General Construction
- Trade Code C009 – General Construction/Alterations & Additions

The Bidder and/or the following subcontractors shall be pre-qualified under the following NJDPMC Trade Code(s)

The Plumbing and Gas Fitting and Kindred Work Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C030 Plumbing**

The Heating, Ventilating, and Air Conditioning, and Kindred Work Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C032 HVACR**

The Electrical Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C047 Electrical**

The Structural Steel Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C029 Structural Steel and Ornamental Iron*

*To be declared on Subcontractor Declaration on Bid Express

**To be declared on Subcontractor Declaration on Bid Express including submission of the matching License

The subcontractor shall be pre-qualified at the time of submission.

The Authority, in accordance with applicable law, reserves the right to reject any or all bids and also to waive any minor informality or non-material exceptions in any bid or bids so received.

Notice of this bid and all procurement opportunities can also be downloaded from the Authority's website at www.sjta.com, under the "Bids and Contracts" tab. Any questions regarding this solicitation should be directed to bids@sjta.com

Bidders are required to comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 Mandatory Equal Employment Opportunity Regulations.

By order of the Chief Engineer.

INSTRUCTIONS TO BIDDERS

1. **INVITATION TO BID:** Bids submitted for the **ATLANTIC CITY EXPRESSWAY 2022 SIGN SHOP REHABILITATION PROJECT** for the South Jersey Transportation Authority (hereinafter referred to as the “Authority”) shall be completed and executed by the bidder and electronically submitted through Bid Express only.

Scope of Work:

The Atlantic City Expressway 2022 Sign Shop Rehabilitation Project consists of furnishing all labor, equipment, and materials and performing all work required to rehabilitate the Sign Shop Building located at Central Maintenance Yard, Milepost 28 along the Atlantic City Expressway in Hammonton Town, New Jersey.

The rehabilitation to the building is detailed within the project manual and contract plans which includes but is not limited to the following:

1. Removal and replacement of portions of the roof including new timber joists
2. New concrete foundations and CMU walls
3. Replacement of overhead garage doors and access doors
4. New partitioned office within the building complete with steel studs and joists including insulation and gypsum board
5. New concrete floor slab
6. New aluminum gutters and downspouts
7. HVAC upgrades including new gas fired heater units, electric baseboard heaters and ductless heat pump
8. New gas pipes and refrigerant pipes
9. Electrical and lighting upgrades

A NON-MANDATORY PRE-BID MEETING has been established for this project, and **prospective bidders are strongly encouraged to attend** via Go To Meeting at <https://global.gotomeeting.com/join/735066341>. Bidders can also dial into the meeting by phone at +1 (646) 749-3122, access code 735-066-341.

Date: Tuesday, December 20, 2022
Time: 1:00 P.M.

A ONE-TIME, NON-MANDATORY SITE VISIT has been established for this project as follows, and **prospective bidders are strongly encouraged to attend.**

Date: Wednesday, December 21, 2022
Time: 2:00 P.M.

**SOUTH JERSEY TRANSPORTATION AUTHORITY
ENGINEERING BUILDING
100 TROOPER LANE & ROUTE 54
HAMMONTON, NJ 08037
(sign shop in rear)**

2. **UNIT PRICES AND EXTENSIONS:** Where applicable, bidders shall state on such form a unit price (**written in numbers**) for each item bid, and such unit prices shall be extended and extensions added to produce a total bid price. For the purpose of the comparison of bids received, they are re-tabulated by the Authority. The total re-tabulated by the Authority will prevail.
3. **BID DISCREPANCIES:** When evaluating bids, the following shall apply:
 - Discrepancies between unit prices and totals of unit prices will be resolved in favor of the unit prices.
 - Discrepancies in the multiplication of units of work and unit prices will be resolved in the favor of the unit prices.
 - Discrepancies between the indicated total of multiplied unit prices and units of work and the actual total will be resolved in favor of the actual total.
 - Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the corrected sum of the column of figures.
 - Discrepancy where a unit price is bid for a Pay Item, but no extension is provided, the Authority will provide the extension based on the unit price bid and the estimated quantity for that Pay Item.
 - Discrepancy where an extension is provided by the Bidder in the "Item Total" column, but no unit price appears in the "Unit Price" column of the Proposal Form, the Authority will provide the unit price by dividing the "Item Total" figure provided by the Bidder by the estimated quantity.
4. **DELIVERY AND DEFECTIVE MATERIALS:** Bidders must insert prices for furnishing all of the materials and/or labor required by these specifications. Prices shall be net, including any charges for packing, crating, containers, etc. All transportation shall be fully prepaid by the contractor F.O.B. destination and placement at locations specified by the Authority. As specified, placement may require inside deliveries. No additional charges will be allowed for any transportation costs resulting from partial shipments made at the contractor's convenience.

The vendor shall guarantee any or all materials supplied under these specifications. Defective or inferior items shall be replaced at the expense of the vendor. In case of rejected materials, the vendor will be responsible for return freight charges.
5. **BRAND NAMES:** Any reference to brand names and/or descriptions used in this bid are to acquaint bidders with the type of commodity desired and will be used as a standard by which alternate or competitive materials offered will be judged. Competitive items must be equal to the standard described and be of the same reputation for quality and workmanship. Variations between materials described and materials offered are to be fully explained by the bidder. In the absence of any changes by the bidder, it will be presumed and required that materials, as described in these specifications, shall be delivered.
6. **BID SECURITY OR GUARANTEE:** Each bid submitted must be accompanied by a bid security or guarantee in the form of a bid bond, certified check, or cashier's check in the amount of ten percent (10%) of the total base bid price, but not to exceed \$20,000, payable to the Authority to be held as a guarantee that in the event a bid is accepted, a contract will be promptly executed, acknowledged and accepted by the bidder, and in default thereof, said bid security in the amount represented thereby shall be forfeited to the Authority as liquidated damages. **Please be advised that Consent of Surety is required with all Bid submissions.** All bid guarantees except those of the three (3) lowest responsible submitted bids shall be returned to bidders as soon as possible upon award of the contract.
7. **INSURANCE REQUIREMENTS:** For complete, detailed insurance requirements, please refer to the General Conditions Section, Pages GC-83 through GC-88. The South Jersey Transportation Authority is to be recognized

as an additional insured with respect to General Liability and Umbrella Excess Liability insurance. The successful bidder must provide certificates of insurance satisfactory in form and content to the Authority, prior to the award of any contract to the bidder.

8. **FAMILIARITY WITH BID SPECIFICATIONS:** At the time of opening bids each bidder will be presumed to have read and to be thoroughly familiar with the detailed specifications and instructions to bidders. The failure or omission of any bidder to receive or examine any form, instrument, or document or to familiarize itself with the specifications or, where applicable, with the site where delivery is to be made shall in no way relieve any bidder from any obligations in respect to its bid.
9. **QUESTIONS OR REQUESTS FOR CLARIFICATION:** All questions about the meaning or intent of the Bid/Proposal and Contract documents, including these instructions or the specifications, shall be submitted in writing to the Authority's Purchasing Department. Any questions or requests for clarification are to be emailed to bids@sjta.com.

****When submitting a question or request for clarification, the subject line of the email must contain the word "Question" followed by the title of the Bid. ****

Questions must be received by **Tuesday, January 10, 2023, at 4:00 P.M.** Questions received after the deadline may not be answered. Only questions answered by formal written addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

10. **ISSUANCE OF ADDENDA:** Responses to all questions of substantive nature will be answered in the form of an addendum. The SJTA shall be the sole judge of the question viability. Any informal explanation, clarification, or interpretation will not bind SJTA, oral or written, by whoever made, that is not incorporated into an addendum.

Notice of Addenda will be issued through Bid Express. It is the sole responsibility of the bidder/proposer to be knowledgeable of all addenda related to this procurement. The bidder/proposer must complete the "Acknowledgement of Receipt of Changes To Bid Document" form, which is included in this solicitation as a required document. Failure to acknowledge receipt of all addenda may render a bid/proposal as non-responsive.

A bidder's/proposer's failure to request a clarification, interpretation, correction or amendment will preclude such bidder/proposer from, thereafter, claiming any ambiguity, inconsistency or error.

11. **BID SUBMISSION:** The South Jersey Transportation Authority will only accept electronic bid submissions through the Bid Express electronic bidding portal. If you are not already registered for electronic submissions, please visit <https://www.bidexpress.com> in order to bid with the Authority. To subscribe, follow the directions on the website. The fee schedule is available, and all fees are payable to Bid Express.

Any emailed, mailed or physical bids delivered to the Authority will not be accepted and/or will be returned to the bidder unopened.

12. **BID DOCUMENTS:** Each bidder shall electronically complete the required bid documents, to the extent applicable. Failure to complete all bid documents in the electronic bid package may be grounds for rejection.
13. **SIGNATURES:** On form(s) contained in the bid where the signature of the bidder is required, electronic signatures will be accepted.

14. **ASSIGNMENT:** Each bid form submitted by a bidder must be signed by a company official for it to be accepted by the Authority as a valid bid.
15. **BID WITHDRAWAL:** Bids may be modified or withdrawn up to bid opening time.
16. **LATE BIDS:** Bid Express will not allow the late submission of bids
17. **TIE BIDS:** In the event of “tie” bids for the commodity(s) herein specified, the South Jersey Transportation Authority reserves the right to split the bid or award to one or more bidders.
18. **SPLIT BIDS:** The Authority will act to award this contract to one vendor for the lowest amount that is advantageous to the Authority. Only if it is not advantageous to the Authority, then the award may be split between one or more bidders.
19. **BOARD RIGHTS:** The Commissioners of the Authority, in accordance with law, reserve the right, in their discretion, to reject any and all bids, to waive any informalities or irregularities in the bids received, and to accept any bid which is deemed most favorable to the Authority at the time and under the conditions stipulated. Failure to observe the instructions set forth herein may be considered grounds for rejection of any bid. The decision of the Commissioners shall be final and binding on each bidder and no bidder shall have recourse from such decision.
20. **AWARD OF CONTRACT:** The Authority will act to award a contract to the successful bidder or to reject all bids within ninety (90) calendar days after receipt of bids as prescribed by law unless a time extension is obtained in accordance with Authority rules. At the time of the opening, the three (3) lowest bids cannot be withdrawn for a period of ninety (90) calendar days, unless with the express permission of the Authority.
21. **TRANSFER OF INTEREST:** No bidder shall assign its contract or transfer its interest therein to any other person, firm, or corporation without first securing the written consent of the Commissioners of the Authority. Any such transfer or assignment without the prior written consent of the Authority shall be invalid.
22. **DISCRIMINATION:** There shall be no discrimination against any employee who is employed in the work covered by any contract resulting from this bid, or against any application for such employment, because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality, or sex.
23. **INVESTIGATION:** The Authority may make such investigation as is necessary to determine the ability of the bidder to perform under the contract. Each bidder shall furnish to the Authority such information and data for this purpose as the Authority may request within five (5) days of any such request. The Authority reserves the right to reject any bid if evidence submitted by, or investigation of such bidder fails to satisfy the Authority that such bidder is properly qualified to carry out the obligations of the contract and to complete the work therein contemplated. The Authority reserves the right to request such financial data and previous experience, as it may deem appropriate. Conditional bids will not be accepted. Bids that are incomplete, unbalanced or obscure may be rejected at the Authority’s option.
24. **TITLE/RISK OF LOSS:** The title and risk of loss of the goods **shall not** pass to the AUTHORITY until the AUTHORITY actually receives, takes possession, and accepts the goods at the point of delivery.
25. **TERMINATION OF AGREEMENT:** The Authority reserves the right to terminate this agreement with ten (10) days written notice if the successful Bidder fails to perform in a manner deemed acceptable to the Authority. Upon delivery of such notice by the Authority to the successful Bidder, the successful Bidder shall discontinue all

services in connection with the performance of this agreement and shall proceed to cancel promptly all existing order and contracts insofar as such order or contracts are chargeable to this agreement. The Authority may also terminate the contract for the Contractor's failure to pay Expressway tolls (or other amounts due) when due and owing, or for any other matter as authorized by law.

26. **INDEMNITY:** The successful bidder shall at all times observe and comply with all federal, state, and local laws, statutes, ordinances, regulations and codes, that in any manner affect the conduct of the work and shall indemnify and hold harmless the Authority and all of its officers and agents against any claim or liability arising out of the contract, or arising out of any violation of laws, ordinances, statutes or regulations.
27. **PUBLIC FUNDS:** No corporation, partnership, or limited liability company shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, the cost of which is to be paid with or out of any public funds, by the State, or any county, municipality or school district, or any subsidiary or agency of the State, or of any county, municipality or school district, or by any authority, board, or commission which exercises governmental functions, unless prior to the receipt of the bid or accompanying the bid, of said corporation, said partnership, or said limited liability company there is submitted a statement setting forth the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be. If one or more such stockholder or partner or member is itself a corporation or partnership or limited liability company, the stockholders holding 10 percent or more of that corporation's stock, or the individual partners owning 10 percent or greater interest in that partnership, or the members owning 10 percent or greater interest in that limited liability company, as the case may be, shall also be listed. The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member, exceeding the 10 percent ownership criteria established in this act, has been listed.

To comply with this section, a Bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest.

28. **AVAILABILITY OF FUNDS:** The award of the contract will be made subject to the availability of funds. The contract to be executed by the successful bidder will provide that it shall not become effective until the necessary funds are available.
29. **TOLLS:** It is the policy of the South Jersey Transportation Authority **not to** offer toll free passage on the Atlantic City Expressway for its vendors; New Jersey Title 19:2-6.2(a) (Subchapter 6. Tolls).
30. **AFFIRMATIVE ACTION:** Proposers shall be required to comply with all applicable affirmative action and equal employment opportunity laws, orders, rules and regulations including, but not limited to N.J.S.A. 10:5-31 et seq., N.J.A.C. 17:27 (See Exhibit A). The successful proposer shall be required to submit the applicable Affirmative Action form as described in Exhibit A within seven (7) days after receipt of the SJTA's intent to award a contract.

Equal Employment Opportunity (EEO) Clause:

By the submission of its bid, each bidder acknowledges that he or she understands and agreed to be bound by the equal employment requirements, throughout the performance of work under any contract awarded pursuant to this

solicitation. Each bidder agrees that if awarded a contract, it will similarly bind contractually each subcontractor. In implementation of the foregoing policies each bidder further understands and agrees that if awarded a contract, it must engage in affirmative action directed at promoting and ensuring equal opportunity in the work force used under the contract (and that it must require contractually the same effort of all subcontractors whose contracts exceed \$100,000). The bidder understands and agrees that "Affirmative Action" as used herein shall constitute a good faith effort to achieve and maintain minority employment in each trade in the on-site work force used on the Contract.

Notification of Subcontractor:

The contractor and subcontractor shall include by reference the EEO clause and applicable bid conditions in all advertisements or other solicitations for Bids and shall include the EEO clause and applicable bid conditions in all contracts. The contractor and subcontractor must provide written notice to each subcontractor of the specific reporting and record keeping requirements under the EEO clause and applicable bid conditions. Upon award of a subcontract, each contractor shall immediately notify the compliance agency of the contract number, the subcontractor's name, dollar amount of the contract, estimated state and completion dates, and the craft which will perform work under the subcontract.

Law Against Discrimination

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

The Contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, or sex. The Contractor will take affirmative action to ensure that such applicants are recruited and employed, and that employees are treated during employment without regard to their age, race, creed, color, national origin, ancestry, marital status, or sex. Such action shall include but not be limited to the following employment, upgrading, demotion, or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or compensation, and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

The Contractor or Subcontractor, where applicable will in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, or sex.

The Contractor or Subcontractor where applicable, will send to each labor union or representative or workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the Agency Contracting Officer, advising the labor union or workers representative of the Contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

Each prospective Bidder on a public works contract and each Subcontractor must formulate and submit to the State Treasurer an affirmative action program of equal opportunity which guarantees minorities employment in all employment categories. The State Treasurer must approve or disapprove the affirmative action program within sixty (60) days of its submission. Any existing federally approved or sanctioned affirmative action program must be approved by the State Treasurer. Any violator of this law will be subject to a fine of up to \$1,000 for each violation for each day during which the violation continues.

31. **DIVISION OF REVENUE REGISTRATION (NJ BRC):** Pursuant to N.J.S.A. 52:32-44, the South Jersey Transportation Authority is prohibited from entering into a contract with an entity unless the bidders/proposer/contractor, and each subcontractor that is required by law to be named in a bid/proposal/contract

has a valid Business Registration Certificate on file with the Division of Revenue and Enterprise Services within the Department of Treasury.

Prior to contract award or authorization, the contractor shall provide the South Jersey Transportation Authority with its proof of business registration and that of any named subcontractor(s).

Subcontractors named in a bid or other proposal shall provide proof of business registration to the bidder, who in turn, shall provide it to the South Jersey Transportation Authority prior to the time a contract, purchase order, or other contracting document is awarded on authorized.

If you are already registered go to https://www1.state.nj.us/TYTR_BRC/jsp/BRCLoginJsp.jsp to obtain a copy of your Business Registration Certificate. Information for registering your business with the New Jersey Division of Revenue can be obtained by visiting the following link:

<https://www.state.nj.us/treasury/revenue/busregcert.shtml>

Questions regarding this requirement should be referred to the Division of Revenue hotline @ 609-292-9292.

- 32. **PUBLIC LAW 2005, CHAPTER 51/EXECUTIVE ORDER 117:** Public Law 2005, Chapter 51 (formerly Executive Order #134) and Executive Order 117 effective November 15, 2008, prohibit state departments, agencies and authorities from entering into a contract that exceeds \$17,500 with an individual or entity that has made a political contribution to gubernatorial candidates or to any state or county political party committee.

Each bidder must complete the attached Ownership Disclosure Form. In addition, each individual owning 10% or more of Ownership Interest as indicated on Ownership Disclosure Form must complete a separate Certification and Disclosure Form.

Form DPPc51-C&D “Certification and Disclosure” must be completed and included with this bid package.

- 33. **SMALL BUSINESS SET-ASIDE:** New Jersey’s Small Business Set-Aside Program obligates the Authority to make 25% of all purchases for goods and services from small businesses. Firms classified as a Small Business Enterprise must be registered with the New Jersey Department of Revenue and Enterprise Services. Registration instructions can be obtained by visiting the State’s website:

<https://www.njportal.com/DOR/SBERegistry/Default/>

The South Jersey Transportation Authority requests the following for informational purposes only.

This is not a Set-Aside bid; however, please indicate below (if applicable).
Our firm is certified/registered with the State of New Jersey Set-Aside Program.

Certification # _____

Check here

MBE (Minority Business Enterprise) _____
WBE (Women Business Enterprise) _____
SBE (Small Business Enterprise) _____
None of the Above _____

POLICY STATEMENT OF THE SOUTH JERSEY TRANSPORTATION AUTHORITY

In accordance with Executive Order No. 84 signed by Governor James J. Florio on March 5, 1993 and Executive Order No. 71 signed by Governor James E. McGreevey on October 2, 2003, it is the policy of the South Jersey Transportation Authority (the “Authority” or “SJTA”) that Small Business Enterprises (“SBE”), as determined and defined by the Department of the Treasury, Division of Revenue and Enterprise Services (“Division of Revenue”) in N.J.A.C. 17:13 et seq., have the opportunity to compete for and participate in the performance of contracts to the purchase of goods and services and for construction services required by the Authority. The Authority further requires that its contractors shall agree to take all necessary and responsible steps, in accordance with the aforementioned regulations, to ensure that SBE’s have these opportunities.

It is the policy of the South Jersey Transportation Authority (SJTA) that small businesses (each a “small business enterprise” or “SBE”), as determined and defined by the New Jersey Department of the Treasury, Division of Purchase and Property, Contract Compliance and Audit Unit, EEO Monitoring Program (“EEO Monitoring Program”) in N.J.A.C. 17:27 et seq. or other application regulation, should have the opportunity to participate in SJTA Contracts.

To the extent the Firm engages subcontractors or sub-consultants to perform Services for the SJTA pursuant to this Contract, the Firm must demonstrate to the SJTA’s satisfaction that a **good faith effort** was made to utilize subcontractors and sub-consultants who are **registered with the EEO Monitoring Program as SBEs**.

Furthermore, Proposers and subcontractors shall be evaluated by the EEO Monitoring Program, based on its attainment of the Participation Goals set forth in N.J.A.C. 17:27-5.2

Please refer to the following link for current applicable procurement target(s) guidelines set forth by the NJ Department of Treasury:

https://www.state.nj.us/treasury/contract_compliance/

Evidence of a “good faith effort” includes, but is not limited to:

1. Whether the vendor or subcontractor has agreed to make a good faith effort to adhere to targeted minority and women employment goals;
2. Whether the vendor or subcontractor has met or documented that it has made a good faith effort to meet targeted employment goals;
3. Whether the vendor or subcontractor has adopted an Equal Employment Opportunity (EEO) Policy;
4. Whether the vendor or subcontractor has posted an EEO Policy on the job site bulletin board;
5. Whether the vendor or subcontractor has disseminated the EEO Policy to its workers through various means including company meetings, preconstruction job meetings, written notices, etc.;
6. Whether the vendor or subcontractor has posted Federal or State issued EEO posters on the job site bulletin board;
7. Whether the vendor or subcontractor has identified an EEO Officer and established job duties in writing for such position;
8. Whether the vendor or subcontractor has developed a basic complaint procedure;
9. Whether the vendor or subcontractor has knowledge of and has considered the general availability of minorities and women having requisite skills in the immediate labor area;
10. Whether the vendor or subcontractor has knowledge of and has considered the percentage of minorities and women in the total workforce in the immediate labor area;

11. Whether, when the opportunity has presented itself, the vendor or subcontractor has considered promoting minority and women employees within its organization;
12. Whether the vendor or subcontractor attempted to hire minorities and women based upon the anticipated expansion, contraction and turnover of its workforce;
13. Whether the vendor or subcontractor has the ability to consider undertaking training as a means of making all job classifications available to minorities and women and whether it has done so;
14. Whether the vendor or subcontractor has utilized the available recruitment resources to attract minorities and women with requisite skills, including, but not limited to, public and private training institutions, job placement services, referral agencies, newspapers, trade papers, faith-based organizations, and community-based organizations;
15. Whether the vendor or subcontractor has requested qualified minorities and women from a labor union with whom it has an exclusive hiring or referral arrangement;
16. Whether the vendor or subcontractor has actively recruited beyond the traditional sources to attract minority and women applicants;
17. Whether the vendor or subcontractor has reviewed all personnel actions to ensure actions are taken in compliance with the company's EEO policy; and
18. Whether the vendor or subcontractor has retained records of employment and personnel actions and payroll records for a three year-period from the date of the contract or project closing.

SOUTH JERSEY TRANSPORTATION AUTHORITY SUBSTITUTION POLICY

The contractor or consultant must notify and obtain written approval from a small or women or minority-owned or Disadvantaged Business Enterprise (DBE) sub-contractor, sub-consultant, or vendor (SMWBE or DBE contractor) before including that contractor in a bid proposal or similar contract-related submission.

The contractor, consultant must notify and obtain written consent and obtain authorization from South Jersey Transportation Authority's Public Agency Compliance Officer/DBE Liaison Officer before it substitutes a SMWBE or DBE sub-contractor, sub-consultant named in a bid proposal or other contract related submission; and if the substitution is approved by the Public Agency Compliance Officer/DBE Liaison Officer, the contractor, consultant shall make a good faith effort to utilize another SMWBE or DBE sub-contractor sub-consultant to replace the previous SMWBE and/or DBE contractor, consultant.

The prime contractor or consultant must give the Public Agency Compliance Officer/DBE Liaison Officer five days to respond to the prime contractor's, consultant's notice and advise the contractor, consultant approval or the reasons, if any, why it objects to the proposed termination of its subcontract subconsultant and why you should not approve the prime contractor, consultant's action.

The Contractor agrees to make a good faith effort to award at least 25% of this contract to subcontractors registered by the Division of Revenue as a SBE. Subcontracting goals are not applicable if the prime contractor is a registered Small Business Enterprise (SBE) firm.

34. **PAYMENT and TAXES:** Payment to the successful Bidder will be made after satisfactory receipt of the product(s) and or service(s), as determined by the Authority, and receipt of invoices or other billing instrument used by the successful Bidder. The Authority is exempt from Federal Excise and State Tax; therefore tax **must not** be included in the bid price. All prices quoted shall include all charges, including delivery and set-up fees.
35. **JOINT VENTURES:** If a joint venture is submitting a bid or proposal, the agreement between the parties related to such joint venture should be submitted with the joint venture's bid or proposal. Authorized signatories from each party comprising the joint venture must sign the bid or proposal. A separate Ownership Disclosure Form,

Chapter 51 and Executive Order 117 Certification and Disclosure forms, Affirmative Action Employee Information Report and NJ Business Registration Certificates must be supplied for each party in the joint venture.

36. PRE-QUALIFICATION: The bidder shall be prequalified under one (1) of the following **NJDPMC PRE-QUALIFICATION TRADE CODE(S)**:

- Trade Code C008 – General Construction
- Trade Code C009 – General Construction/Alterations & Additions

The bidder shall be pre-qualified at the time of submission.

The Plumbing and Gas Fitting and Kindred Work Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C030 Plumbing**

The Heating, Ventilating, and Air Conditioning, and Kindred Work Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C032 HVACR**

The Electrical Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C047 Electrical**

The Structural Steel Subcontractor shall be pre-qualified under the following NJDPMC Trade Code:

- NJDPMC Trade Code C029 Structural Steel and Ornamental Iron*

*To be declared on Subcontractor Declaration on Bid Express

**To be declared on Subcontractor Declaration on Bid Express including submission of the matching License

The subcontractor shall be pre-qualified at the time of submission.

Any portion of the project that falls under the following work: **Plumbing, HVACR, Electrical, and Structural Steel/Ornamental Iron** shall only be performed by the entity (Bidder or Subcontractor) prequalified to perform the specified work and is to be declared on the Subcontractor Declaration on Bid Express.

37. TIME TO COMPLETE: The Contractor shall commence the work required by the Contract Documents within seven (7) calendar days after the date of the notice to proceed. The Contractor shall complete all work required by the Contract Documents within the number of calendar days noted below from and including the date of the written notice to proceed unless the period of completion is extended otherwise pursuant to the Contract Documents:

One Hundred and Twenty (120) Calendar Days

Work Hours: Monday – Friday, 7:00 AM – 3:30 PM, excluding any major holidays, unless otherwise directed by the Engineer

38. FAILURE TO COMPLETE WORK ON TIME: Time of completion for this work is of the essence to the Contract. For each and every calendar day that the CONTRACTOR shall be in default in completing the work to be done under the Contract, the CONTRACTOR shall pay to the AUTHORITY the actual cost for engineering,

inspection and other costs to the South Jersey Transportation Authority, estimated to be \$1,000 per day, which sum is agreed upon not as a penalty but as liquidated damages which the AUTHORITY shall suffer by reason of such default.

39. **SAFETY AND HEALTH REGULATIONS:** The CONTRACTOR shall comply with all applicable safety and health regulations to include, but not be limited to, the following:

U.S. Department of Labor regulations promulgated under Occupational Safety and Health Act of 1972 (P.L. 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (P.L. 91-54) and all subsequent amendments thereto.

40. **PROMPT PAYMENT TO SUBCONTRACTORS:** The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than thirty (30) days from the receipt of each payment the prime contractor receives from South Jersey Transportation Authority. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the South Jersey Transportation Authority.

41. **CERTIFICATION OF NON-INVOLVEMENT IN PROHIBITED ACTIVITIES IN IRAN:** Pursuant to N.J.S.A. 52:32-58, the bidder must certify that neither the bidder, nor one of its parents, subsidiaries, and/or affiliates (as defined in N.J.S.A. 52:32-56(e)(3)), is listed on the Department of the Treasury's List of Persons or Entities Engaging in Prohibited Investment Activities in Iran and that neither is involved in any of the investment activities set forth in N.J.S.A. 52:32-56(f). If the bidder is unable to so certify, the bidder shall provide a detailed and precise description of such activities.

42. **RIGHT TO AUDIT:** The Successful Contractor shall keep and maintain proper and adequate books, records and accounts accurately reflecting all costs and amounts billed to the SJTA with regard to this RFP/Bid. The SJTA, its employees, officers, or representatives shall have the right upon written request and reasonable notice, to inspect and examine all books and records related to the Successful Proposer's books and records specific to the Proposal and Agreement. Such records shall be retained by Successful Contractor for at least five (5) years after termination of the Service Agreement. In no event shall books and records be disposed of or destroyed prior to five (5) years or during any dispute or claim between the Contractor and the Successful Contractor with regard to the RFP/Bid.

In accordance with the New Jersey Office of the State Comptroller ("OSC") document retention policy N.J.A.C. 17:44-2.2, Contractor shall maintain all documentation related to products, transactions or services under this contract for a period of five years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

43. **ELECTRONIC BIDDING PROCESS:** Registration for Electronic Bidding. In an effort to make the bid and/or RFP solicitation process more efficient and cost effective for both vendors and the Authority, the Purchasing Department has adopted an electronic bidding process for public bids and/or RFPs. Electronic bids and/or proposal submissions shall be submitted at bidexpress.com as the method of submission. All electronic bidders must first register on bidexpress.com and create an Info Tech digital identification ("Digital ID") at no cost to the vendor. The Digital ID is used to sign bids and serves important functions including: a) assuring the Authority, that the digital signature is from the entity submitting the bid and/or proposal (forgery deterrence); b) ensuring that no one can alter a bid and/or proposal (non-falsification); c) preventing the information in a bid and/or proposal from disclosure to unauthorized parties (confidentiality); and d) safeguarding that even authorized parties cannot access the bid and/or proposal prior to the public bid opening (sealing) and/or proposal receipt. Since it can take up to five (5) business days to process your Digital ID, it is highly recommended that a Digital ID be enabled at least 48 hours in advance of submitting an electronic bid and/or proposal. Please plan accordingly. In lieu of paying the

traditional paper bidding costs (overnight delivery costs), Bid Express charges a nominal fee to those who wish to bid electronically on a pay-per solicitation basis. Alternatively, you may subscribe for monthly fee for unlimited electronic bid and/or proposal submission to all entities that (nationally) post solicitations on the bidexpress.com website plus get email notifications by agency/work type/commodity code. Furthermore, bidders who wish to utilize the electronic bid bond option, please see the FAQs page regarding electronic bid bonds at <https://bidexpress.com>. For additional guidance on the electronic process, please contact the Bid Express team toll free at (888) 352-2439 (select option 1).

Please Note: During COVID-19, The South Jersey Transportation Authority is accepting Electronic Signatures however it is strongly recommended that all vendors secure Digital IDs in anticipation of restoring this requirement. Please see www.bidexpress.com for more details.

44. **PUBLIC WORKS CONTRACTOR REGISTRATION ACT:** The “Public Works Contractor Registration Act” (PWCRA), N.J.S.A. 34:11-56.48 et seq., applies to all contractors (including subcontractors and lower tier subcontractors) who bid on or enter into SJTA contracts that are subject to the “New Jersey Prevailing Wage Act.”

To ensure compliance with the PWCRA, all contractors and subcontractors intending to bid or perform on SJTA contracts must have a valid and current public works registration certificate (PWRC) issued by the New Jersey Department of Labor and Workforce Development (Phone: 609-292-2305) at the time of the bid submission. Contractors that are not currently registered are advised to register as soon as possible, so that their ability to bid on or perform work on SJTA contracts is not affected.

Visit the New Jersey Department of Labor and Workforce Development web site at:
<https://www.nj.gov/labor/wagehour/content/prevwageapplication.html>

Contractors should take special note of the following requirements:

Bidding - Effective August 16, 2003, bidders must be registered with the New Jersey Department of Labor and Workforce Development in accordance with the N.J.S.A. 34:11-56.48 et seq., at the time of bid. A contractor and/or subcontractor’s failure to have a valid, current public works registration certificate (PWRC) at the time required shall be cause for rejection of the bid. Proof of a contractor/subcontractor’s valid, current PWRC should be submitted at the time of the bid submission and must be submitted prior to the SJTA’s award of the contract.

Subcontracting - subcontractors (including lower tier subcontractors) must be registered with New Jersey Department of Labor and Workforce Development, Division of Wage and Hour Compliance and in accordance with N.J.S.A. 34:11-56.55 et seq. and must possess a valid PWRC at the time of the bid submission.

Submission of all subcontractor registration certificates by contractor - Each contractor shall, after the bid is made and prior to the awarding of the contract, submit to the public entity the PWRC for all subcontractors listed in the bid proposal. Applications for registration shall not be accepted as a substitute for a PWRC for the purposes of this section. Contractors must attach their PWRC as proof of the subcontractor’s valid, current New Jersey Department of Labor and Workforce Development registration. The Authority will not consent to the proposed subcontracting, and the subcontractor shall not perform any work under the Contract, unless the required proof of the subcontractor’s PWRC is first provided. Contractors should ensure full compliance with the PWCRA registration requirements by their subcontractors.

Effective May 1, 2019, all contractors and subcontractors applying for a new PWRC or applying to renew their PWRC must be compliant with the “registered apprenticeship program” requirements, as set forth under P.L. 2019, c.21.

45. **SOURCE DISCLOSURE (SERVICES CONTRACTS):** Pursuant to N.J.S.A. 52:34-13.2, all services performed under this Contract or performed under any subcontract awarded under the Contract shall be performed within the United States. Bidders are required to submit the Source Disclosure Form as part of their bid. If a service cannot be performed within the United States, the bidder shall disclose on the Source Disclosure Form the description of services to be performed outside of the United States and the reason why the services cannot be performed within the United States. The Authority will review the justification and, if the Authority concludes that the services cannot be performed within the United States, may issue a waiver of this requirement.

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GENERAL INFORMATION

1. GENERAL

These GENERAL CONDITIONS contain contractual-legal Articles that establish the requirements and conditions governing responsibility, policy and procedures that apply during the Contract and guarantee period. Any revisions, additions, or deletions to the following Articles that are special to the work under this Contract will be made in the SUPPLEMENTARY CONDITIONS. Additional requirements and conditions that have special significance to the Contract for the work are as set forth elsewhere in these Contract Documents.

2. ABBREVIATIONS

AAN	American Association of Nurserymen
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGC	Association of General Contractors of America
AI	Asphalt Institute
AIA	American Institute of Architects
AIP	Airport Improvement Program
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANG	Air National Guard
ANSI	American National Standards Institute
AOA	Airport Operations Area
API	American Petroleum Institute
ARA	American Railway Association
AREA	American Railway Engineering Association
ARTBA	American Road and Transportation Builders Association
ASCE	American Society of Civil 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
B&S	Bown & Sharpe Wire Gage
CFR	Code of Federal Regulation
CIAP	Construction Industry Advancement Program of New Jersey
CRSI	Concrete Reinforcing Steel Institute
CTC	Concrete Technology Corporation
EEI	Edison Electrical Institute
EPA	Environmental Protection Agency of the United States Government
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FHWA	Federal Highway Administration
FSS	Federal Specifications and Standards, General Services Administration
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMSA	International Municipal Signal Association
ISO	International Organization for Standardization

ITE	Institute of Transportation Engineers
MIL	Military Specifications
MUTCD	Manual on Uniform Traffic Control Devices (FHWA)
NBFU	National Board of Fire Underwriters
NCSA	National Crushed Stone Association
NEC	National Electric Code
NELA	National Electrical Light Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Code
NFPA	National Fire Prevention Association
NIST	National Institute for Standards and Technology
NJAC	New Jersey Administrative Code
NJANG	New Jersey Air National Guard
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airman
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Pre-stressed Concrete Institute
PEI	Porcelain Enamel Institute, Incorporated
SAE	Society of Automotive Engineers
SI	International System of Units
SRL	Skid Resistance Level
SSPC	Steel Structures Painting Council
UL	Underwriter's Laboratories
UNC	Unified National Coarse
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USSWG	United States Steel Wire Gage

3. DEFINITIONS

Wherever in the Contract Documents the following terms are used, the intent and meaning shall be interpreted as stated below.

ACCEPTANCE -The term "Acceptance" means the formal written acceptance of the Project by the South Jersey Transportation Authority, which has been completed in all respects, including changes, in accordance with the Contract Documents.

ADDENDA (Addenda or Addendum used interchangeably) - The term "Addenda" means the written and/or graphic documents and/or computer disk issued prior to the opening of bids, which clarify, correct, or change the Contract Documents.

ADDITIONAL WORK - Work, of a type already provided by the contract and for which the contract has established a unit price under a Pay Item.

ADVERTISEMENT - The public announcement, as required by law, inviting bids for work to be performed or materials to be furnished.

AIR OPERATIONS AREA (AOA) – The term "air operations area" shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operations area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or

apron. Only persons with security clearance who are properly badged shall have access to the air operations area.

AIR TEMPERATURE - The measured temperature, in the shade, not in the direct rays of the sun, and away from artificial heat.

AIRPORT – “Airport” means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft, and includes buildings and facilities, if any.

AIRPORT IMPROVEMENT PROGRAM - The “Airport Improvement Program, a grant-in-aid program, administered by the Federal Aviation Administration.

ARCHITECT – “Architect” shall mean the Chief Engineer’s duly authorized representative(s), such representative(s) acting within the scope of the particular duties delegated to him or the firm designated in the Contract Documents as Architect for the project, with its associated consultants, or their duly authorized representatives or agents, such firm being the authorized representative of the Authority, acting directly for the Authority. The Architect is referred to throughout the Contract Documents as if singular in number and masculine in gender.

AS APPROVED - The words "as approved," unless otherwise qualified, shall be understood to be followed by the words "by the Engineer."

AS SHOWN, AS INDICATED, AND AS SPECIFIED - The words "as shown," "as indicated" or "as specified" shall be understood to be followed by the words "in the Contract Documents."

AUTHORITY - The term "Authority" means the SOUTH JERSEY TRANSPORTATION AUTHORITY of the State of New Jersey, as created by law acting through its Executive Director or his duly authorized representative. Throughout the Contract Documents the Authority is referred to as singular in number and masculine in gender.

AUTHORITY’S REPRESENTATIVE - “Authority’s Representative” shall mean the firms or individuals designated in the Contract Documents as Engineer or Construction Manager for the project, with associated consultants, or their duly authorized representatives or agent, such firms or individuals being the authorized representatives of the Authority, acting directly for the Authority. The Authority’s Representative is referred to throughout the Contract Documents as if singular in number and masculine in gender.

AWARD - The term "Award" means the decision of the Authority to accept the Proposal of the lowest responsible Bidder, subject to the execution and approval of a satisfactory Contract based thereon and bonds to secure the performance thereof, and such conditions as may hereinafter be specified or as may be specified or required by law.

BID FORM - The term "Bid Form" means the approved form furnished by the Authority on which the Authority requires bids to be prepared and submitted for the Work.

BID SECURITY - The term “Bid Security” means the security furnished with a bid to guarantee that the Bidder shall enter into the Contract if awarded the Contract.

BIDDER - The term "Bidder" means an individual, firm, partnership, corporation, or any acceptable combination thereof, acting directly or through a duly authorized representative, legally submitting a bid for the advertised work defined in the Contract Documents.

BRIDGE - A structure, including supports, spanning and providing passage over a waterway, a railroad, a highway, or other obstruction; more than 20 feet long, measured along the center of

the roadway or railroad, between faces of abutments. In the case of boxes or arches, the length is measured between the face of the sidewalls and, in the case of multiple boxes, between the inside faces of the outside walls.

BUSINESS ENTITY – The term “Business Entity” means any natural or legal person, business corporation, professional services corporation, limited liability company, partnership, limited partnership, business trust, association of any other legal commercial entity organized under the laws of New Jersey or any other state or foreign jurisdiction. It also includes (i) all principals who own or control more than 10 percent of the profits or assets of a business entity or 10 percent of the stock in the case of a business entity that is a corporation for profit, as appropriate; (ii) any subsidiaries directly or indirectly controlled by the business entity; (iii) any political organization under 26 U.S.C.A. 527 that is directly and indirectly controlled by the business entity, other than a candidate committee, election fund or political party committee; and (iv) if a business entity is a natural person, that person’s spouse or child, residing in the same household.

BY OTHERS - The term "by others" refers to a person, firm, or corporation other than the Contractor or its surety including persons, firms, or corporations in a contractual relationship with the Contractor or its surety, such as a Subcontractor, supplier, fabricator, or consultant at any tier. "By others" shall include the Authority or other public body.

CALENDAR DAY - Each and every day shown on the calendar.

CLAIM - A "claim" is a written statement requesting additional time and/or money for acts or omissions during the performance of the Contract. The Contractor must set forth the facts and circumstances for which the Authority or Engineer is responsible in order to be entitled to additional compensation and/or time.

COMPLETION - The term "Completion" means Completion of the Work. Completion shall occur when:

1. the Work has been satisfactorily completed in all respects in accordance with the Contract Documents;
2. the Project is ready for use by the Authority to the degree required by the terms of the Contract, and;
3. the Contractor has satisfactorily executed and delivered to the Engineer all documents, certificates, and proofs of compliance required by the Contract Documents, it being understood that the satisfactory execution and delivery of said documents, certificates, and proofs of compliance is a requirement of the Contract.

CONTRACT DOCUMENTS - The "Contract Documents" consist of the Bidder’s completed Proposal Section, Project Manual, the Plans, all Addenda issued prior to the opening of Bids and all Contract Modifications or Change Orders issued after execution of the Contract. This Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Contract Modification as defined in Articles "CHANGES," "DIFFERING SITE CONDITIONS" and "SUSPENSION OF WORK" of these GENERAL CONDITIONS. The Contract Documents shall not be construed to create any contractual relationship of any kind between the Engineer and the Contractor.

CONSTRUCTION MANAGER - “Construction Manager” shall mean the firm or individuals designated in the Contract Documents as the construction manager for the project, with associated consultants, or their duly authorized representative or agent, such firm being the authorized representatives of the Authority acting directly for the Authority. The Construction

Manager is referred to throughout the Contract Documents as if singular in number and masculine in gender.

CONSTRUCTION OPERATIONS - Construction operations shall include site clearing, demolition, movement of utilities or other facilities, and actual construction of any of the temporary or permanent structures, roadways, or public improvements required by the Contract. The term shall not include mobilization, procurement and storage of materials and plants, providing engineering, Performance Bond and Payment Bond, surveys, working drawings, field offices, or other schedules, certificates, forms, or documents necessary prior to the performance of Work on Pay Items.

CONTRACT - The term "Contract" means the entire and integrated agreement between the parties thereunder and supersedes all prior negotiations, representations, or agreements, either written or oral. The Contract Documents form the Contract between the Authority and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to, the performance of the Work and the basis of payment.

CONTRACT COMPLETION - The "Contract Completion" is the date the Authority accepts the entire work as being in compliance with the Contract Documents, or formally waives nonconforming work to the extent of the nonconformity, and issues the final payment in accordance with the requirements set forth in Article "FINAL PAYMENT" of these GENERAL CONDITIONS.

CONTRACT MODIFICATIONS - "Contract Modifications" shall mean any written alteration to the specifications, delivery point, rate of delivery, contract period, price, quantity or other contract provision of an existing contract, whether accomplished by unilateral action in accordance with a contract provision, or by mutual action of the parties to the Contract and includes, but is not limited to, changes in the work, differing site conditions, delays in performance, suspensions of work, and acceleration of performance.

CONTRACT TIME - The term "Contract Time" means the number of working days or calendar days including authorized adjustments allowed for Completion. When a specified completion date is shown in the Specifications in lieu of the number of working or calendar days, Completion shall be on or before that date. Specified completion date and calendar day contracts shall be completed on or before the day indicated even when that date is a Saturday, Sunday, or holiday.

CONTRACTOR - The term "Contractor" means the individual, firm, partnership, corporation, or any acceptable combination thereof contracting with the Authority for performance of the prescribed Work. Throughout the Contract Documents, the Contractor is referred to as if singular in number and masculine in gender. The term "Contractor" means the Contractor or the Contractor's authorized representative.

CONTRIBUTION – The term "Contribution" means a contribution reportable as a recipient under "The New Jersey Campaign Contributions and Expenditures Reporting Act." P.L. 1973, c.83 (C.10:44A-1 et seq.), and implementing regulations set forth at N.J.A.C. 19:25-7 and N.J.A.C. 19:25-10.1 et seq. As of January 1, 2005, contributions in excess of \$300.00 during a reporting period are deemed "reportable" under these laws.

CROSS SECTIONS - Graphic representation of the ground elevations of the ground or other improvements taken at various intervals during the contract at right angles to the centerline or base line.

CULVERT - Any enclosed Structure, not classified as a bridge, which provides an opening under the roadway, runway, taxiway, or ground surface for the purpose of conveying storm water runoff.

DAYS - Unless otherwise designated, days as used in the Contract Documents means calendar days.

DEFECTIVE WORK - "Defective Work" is work that (i) is unsatisfactory, faulty, or deficient; (ii) does not conform to the Contract Documents; (iii) does not meet the requirements of any inspection, test, or approval referred to in the Contract Documents; (iv) has been damaged prior to the Engineer's recommendation for final payment; or (v) does not conform to generally accepted standards of workmanship.

DISPUTE - A disagreement between the Authority and the Contractor with regard to the Work or Contract Documents.

DRAWINGS - See "PLANS"

ENGINEER - "Engineer" shall mean the Authority's Chief Engineer or the Chief Engineer's duly authorized representatives, such representatives acting within the scope of the particular duties delegated to him or the firm designated in the Contract Documents as Engineer for the project, with its associated consultants, or their duly authorized representatives or agent, such firm being the authorized representatives of the Authority, acting directly for the Authority. The Engineer is referred to throughout the Contract Documents as if singular in number and masculine in gender.

EQUIPMENT - All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction of the Work.

EXECUTION OF CONTRACT - "Execution of Contract," or equivalent words, shall mean the signing of the Contract by the jurisdictional representatives of both the Authority and the Contractor.

EXTRA WORK - The term "Extra Work" means new and unforeseen work found essential to the satisfactory completion of the Project, as determined by the Engineer, and not covered by any of the various Pay Items for which there is a bid price or by combination of such items. In the event portions of such work are determined by the Engineer to be covered by one (1) of the various Pay Items for which there is a bid price or combinations of such items, the remaining portion of such work will be designated as Extra Work. Extra Work also includes work specifically designated as Extra Work in the Contract Documents.

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

FIELD ORDER - The term "Field Order" means a written order, signed by the Engineer, requiring performance by the Contractor without negotiation of any sort.

GRADE LINE - The profile of the finished roadway, runway or taxiway surface along the proposed construction centerline or base line.

INSPECTOR - The Engineer's authorized representative assigned to inspect contract performance, methods, and materials related to the Work both on and off the site of the Project.

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

JOBSITE - "Jobsite" shall mean the area upon or in which the Contractor's operations are carried on and such other areas adjacent thereto as may be designated as such by the Engineer.

LATENT DEFECT - The term "Latent Defect" means a defect that is present or potential but is not evident or active.

LAW - "Law" shall mean any Federal, State, or local law, statute, ordinance, rule, regulation or code.

LOT - An isolated quantity of specified material from a single source, or a measured amount of specified construction, to be produced by the same process.

MAJOR AND MINOR PAY ITEMS - The term "Major Pay Item" means any Pay Item having an original Contract value equal to or in excess of 10 percent (20 percent for Airport Improvement Program projects) of the total amount of the award contract. The original Contract value of a Pay Item equals the per unit price bid for said Pay Item multiplied by the estimated quantity of such item contained in the Proposal Form. All other Pay Items shall be considered "Minor Pay Items."

MANUFACTURER - A firm, company, or individual manufacturing material for the project.

MATERIALS - Any substances specified for use in the construction of the Project.

MODIFICATION ORDER - "Modification Order" shall mean a written order, which carries out a Contract Modification.

MULTIPLE DEFICIENCY - Deficiency in more than one (1) characteristic within the same lot.

NOTICE - The term "notice" or the requirement to notify, means a written communication delivered in person or by certified or registered mail (receipt required) to the person for whom it is intended. Certified or registered mail shall be addressed to that last known business address of the intended recipient.

NOTICE TO PROCEED - The term "Notice to Proceed" means the written notice to the Contractor to begin Work.

OR EQUAL - The term "or equal" shall be understood to indicate that the "equal" product is the same or better than the product named in the Specifications in the function, performance, reliability, quality, and general configuration in accordance with Article "SUBSTITUTES OR "OR EQUAL" ITEMS" of these GENERAL CONDITIONS.

OWNER - The term "Owner" means the South Jersey Transportation Authority of the State of New Jersey, as created by law acting through its Executive Director or his duly authorized representative. Throughout the Contract Documents, the Owner is referred to as singular in number and masculine in gender.

PAY ITEM (CONTRACT ITEM) - The term "Pay Item" means a specifically described item of Work for which the Bidder provides a per-unit or lump-sum price in the Proposal.

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

PERFORMANCE BOND - The term "Performance Bond" means the approved form of security, furnished by the Contractor and the surety, as a guarantee on part of the Contractor to execute the work, in accordance with the terms of the specifications and contract.

PLANS - The term "Plans" means the sealed plan, profiles, cross sections, elevations, details, and other working drawings, supplemental drawings, all adjustments made to the plans in Addenda or by Modification Order, or reproductions thereof, signed by the Engineer and accepted by the Authority; and which show the location, character, dimensions, and details of the work to be performed.

PRECONSTRUCTION CONFERENCE - The initial Project meeting conducted by the Engineer, normally held after Award of the Contract and prior to the start of Work. A separate utility preconstruction conference may be scheduled. The Contractor shall attend preconstruction conferences.

PROFILE - The trace of a vertical plane intersecting the top surface of the proposed improvement surface, usually along the longitudinal centerline. Profile grade means either the elevation or gradient of such trace according to the context. From this, cross-section elevations are established based on the typical section.

PROJECT - The specific section of airport, highway or other public improvement together with all appurtenances and construction to be performed thereon, under the Contract. The Project may include work by others under other contracts.

PROJECT MANUAL - The term project manual shall be synonymous with the term specifications as defined herein.

PROPOSAL - The term "Proposal" means the offer of a Bidder, properly signed and guaranteed, on the prepared form furnished by the Authority to perform the Work at the prices therein.

PROPOSAL FORM - The term "Proposal Form" means the approved form furnished by the Authority on which the Authority requires bids to be prepared and submitted for the Work.

REGISTRATION - The term "Registration" means the process by which any business can have its eligibility for participation in the New Jersey Commerce and Economic Growth Commission's small business programs determined.

RESIDENT ENGINEER - The term "Resident Engineer" means the field representative of the Engineer having direct supervision of the administration of the Contract and all work.

RUNWAY - The area on the airport prepared for the landing and takeoff or aircraft.

SHALL - Designates an obligation to perform the specified the specified directive, unless otherwise indicated.

SMALL BUSINESS ENTERPRISE - For a **goods and services Contractor**, the term "Small Business Enterprise" shall mean a business certified by the State of New Jersey to qualify as a business which has its principal place of business in the State, is independently owned and operated, has no more than 100 full-time employees, has gross revenues that do not exceed \$12 million.

For a **construction Contractor**, the term "Small Business Enterprise" shall mean a business certified by the State of New Jersey to qualify as a business which has its principal place of business in the State, is independently owned and operated, has no more than 100 full-time employees, has gross revenues that do not exceed either \$1 million or the applicable annual revenue standards set forth in 13 CFR 121.201, whichever is higher.

SPECIFICATIONS - The term "Specifications" means the terms, provisions, and requirements, bound together herein and designated the "Project Manual" and all revisions made to the Specifications in Addenda, or by Modification Order, signed by the Engineer and accepted by the Authority.

Unless a particular issue is designated, all references to the above specifications, standards, or methods shall be understood to refer to the issue in effect (including all amendments) on the date of the NOTICE TO BIDDERS.

STRAIGHTEDGE - An accurate, 10 foot square-edged straightedge used in testing variations in the surface to verify specified tolerances.

SUBCONTRACTOR - An individual, firm, partnership, corporation, or any acceptable combination thereof, to which the Contractor subcontracts part of the Work pursuant to the GENERAL CONDITIONS article entitled SUBCONTRACTING.

SUBGRADE - The surface of the roadbed upon which the first layer of the pavement structure and/or shoulder section is constructed.

SUBSTANTIAL COMPLETION - "Substantial Completion" shall be that degree of completion of the project or a designated portion of the project, sufficient to provide the Authority, at his discretion, the full-time use of the project or designated portion of the project of the purposes for which it was intended and if it is safe and convenient for use by the public.

Substantial Completion of an operating facility or system shall be that degree of completion that will provide a minimum of seven (7) continuous calendar days of successful operation during which all performance and acceptance testing has been successfully demonstrated to the Engineer. All equipment contained in the work, plus all other components necessary to enable the Authority to operate the facility in the manner that was intended, shall be complete on the Substantial completion date at the end of the seven (7) calendar days. Substantial Completion of all or any designated part of the work is not to be construed as the Contract completion. Additional provisions regarding Substantial Completion are set forth in Article "SUBSTANTIAL COMPLETION DATE" and "AUTHORITY'S USE OF PORTIONS OF THE WORK" of these GENERAL CONDITIONS.

SUPERINTENDENT - The Contractor's authorized representative responsible for and in charge of the Work. The Superintendence shall be authorized to receive all communications from the Authority per Article "SUPERINTENDENCE."

SURETY - The corporate body bound with and for the Contractor for the full and complete performance of the Contract and for the payment of all debts and obligations pertaining to the Work.

TAXIWAY - For the purpose of this document, the term "taxiway" means the portion of the air operations area of an airport that has been designated by the competent airport authority for movement of aircraft to and from the airport's runway or aircraft parking areas.

TIME OF COMPLETION - "Time of Completion" is the duration allotted or completion date in the Contract for the Contractor to complete all or any portion of the Project called for under the Contract in all parts and requirements within the time or times for completion of the Contract set forth in the Information to Bidders.

UNBALANCED BID - The term "Unbalanced Bid" means a materially unbalanced bid where there is a reasonable doubt that award to the Bidder submitting a mathematically unbalanced bid,

which is structured on the basis of nominal prices for some work and inflated prices for other work, will result in the lowest ultimate cost to the Authority.

UNBALANCED BID, MATHEMATICALLY - A bid containing lump sum or unit bid items that do not reflect reasonable actual cost plus a reasonable proportionate share of the Bidder's anticipated profit, overhead costs, and other indirect costs. Some examples of a mathematically unbalanced bid are 'front-end loading' and 'covering' (moving money from one item to another).

UTILITY - A publicly, privately, or cooperatively owned agency or agencies operated by one (1) or more persons or corporations for public service. For purposes of the Contract, railroads shall be considered utilities.

WORK - The word "Work" within these Contract Documents shall include all material, labor, utility services, tools, supplies, expendable equipment, and all appliances, machinery, transportation, and appurtenances necessary to perform and complete the Contract; and such additional items not specifically indicated or described that can be reasonably inferred as belonging to the item described or indicated and as required by the good practice to provide a complete and satisfactory system or structure described in the Contract Documents and the carrying out of all duties and obligations imposed by the Contract Documents on the Contractor. As used herein, "provide" shall be understood to mean "furnish and install, complete in place."

WORKING DAY - Any calendar day, exclusive of:

1. Saturdays, Sundays, and holidays;
2. days on which the Contractor is specifically required by the Contract Documents to suspend construction operations; and
3. days on which the Contractor is prevented by inclement weather or conditions resulting immediately therefrom adverse to the current controlling operation or operations, as determined by the Engineer, from proceeding with regular work for at least 6 hours toward completion of the contract.

Unless work is suspended for causes beyond the Contractor's control, Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work, requiring the presence of an inspector will be considered as working days.

4. RESERVED

5. RESERVED

BIDDING REQUIREMENTS AND CONDITIONS

6. INQUIRIES REGARDING THE PROJECT

Inquiries prior to the receipt of bids regarding any discrepancy, error, or omission, or concerning the intent or meaning of the Plans, Specifications, or other Contract Documents shall be directed to the Authority as provided in the Information to Bidders section. Bidders shall rely only upon written responses to their inquiries. Oral responses will be of no effect.

7. PREQUALIFICATION OF PROSPECTIVE BIDDERS

For Bridge and Highway Projects - proposals will be received only from Bidders who, at the time of Bid, provide with the Proposal and have, as required by statute, submitted under oath, statements relating to their financial ability, adequacy of plant and equipment, organization and prior experience, and other matters, on forms furnished by the Authority; who have been

prequalified in the areas so designated by the SJTA in accordance with NJDOT Regulations Covering the Classification of Prospective Bidders issued in accordance with NJSA 27:7-35.1 *et seq.*

All Other Projects - The prime Contractor shall be prequalified by the New Jersey Department of Treasury, Division of Property Management and Construction (DPMC) in the areas so designated by the SJTA, which may include: Construction Manager as Contractor, Design Build, or General Construction

As set forth in the Bid Specifications, the Authority may also require DPMC classification or DOT Pre-qualification for Subcontractors in the following areas: Plumbing, HVAC, Electrical, and Concrete Repairs. Subcontractor DPMC OR DOT classification requirements shall be identified in the Listing of Subcontractors Declaration. General Contractors shall note on said list whether it will be performing the work in any such area that requires Subcontractor DPMC classification or DOT Pre-qualification and whether it is classified to perform such work.

SJTA reserves the right to require Bidders and/or Subcontractors to provide proof of both DOT prequalification and DPMC classification documentations in given disciplines as determined by the scope of the particular project.

8. DISQUALIFICATION OF PREQUALIFIED PROSPECTIVE BIDDERS

The Authority reserves the right to disqualify or refuse to receive a Proposal Form from a prospective Bidder even though prequalified as required by the Article titled "PREQUALIFICATION OF PROSPECTIVE BIDDERS," or reject a Proposal after having received same for any of the following reasons:

1. Lack of competency or lack of adequate machinery, plant, or other equipment.
2. Uncompleted work which in the judgment of the Authority, might hinder or prevent the prompt completion of additional work, if awarded.
3. Failure to pay, or satisfactorily settle, all bills due for labor, equipment, or material on previous Contracts.
4. Failure to comply with any prequalification regulations of the Authority.
5. Default under any previous contract.
6. Unsatisfactory performance on previous or current contracts.
7. Questionable moral integrity as determined by the Attorney General of New Jersey.
8. Failure to reimburse the Authority for monies owed on any previously awarded contracts including those where the prospective Bidder is a party to a joint venture and the joint venture has failed to reimburse the Authority for monies owed.
9. Documented failure to comply with the conditions of permits.

9. CONTENTS OF THE PROPOSAL

Upon request, the Authority will furnish prospective Bidders with a Proposal Form. The Proposal Form states the location and description of the Project, shows the approximate estimate of the various quantities and kinds of Work to be performed, and includes a schedule of Pay Items for which bid prices are invited. The Proposal Form and accompanying Specifications state the number of days or date in which the Project must be completed, the amount of the Bid Security, and the date, time and place of the opening of Proposals.

All papers bound with or attached to the Proposal Form are considered a part thereof and must not be altered and must be submitted with the Proposal. These papers must be submitted with

the Proposal Form for official bid. Other Contract Documents are considered a part of the Proposal whether attached or not.

Prospective Bidders are required to pay the Authority the sum stated in the Specifications for each copy of the Proposal Form, Specifications, and each set of Plans. Informational copies of the Proposal Form are available by the Authority for review upon written request to the South Jersey Transportation Authority Administration Building, Purchasing Department, P.O. Box 351 Farley Service Plaza, Atlantic City Expressway Milepost 21.4.

10. INTERPRETATION OF QUANTITIES IN BID FORM

The quantities appearing in the bid form are approximate only and are prepared for the comparison of bids. Payment will be made only for the actual quantities of Work completed in accordance with the Contract. Such payment will be made at the original unit prices for the quantities of Work accepted by the Engineer. The form quantities of Work may be increased or decreased, or Pay Items may be eliminated in their entirety as hereinafter provided.

11. "IF AND WHERE DIRECTED" ITEMS

The Proposal Form may request bids on one (1) or more Pay Items to be incorporated into the Project "if and where directed" by the Engineer. Such items may not be located on the Plans. The estimated quantities set out in the Proposal Form for such items are presented solely for the purpose of obtaining a representative bid price, but are not intended to indicate the Authority's anticipation as to the quantities of such items which are to be actually incorporated into the Project. Depending on field conditions, such "if and where directed" items may or may not be incorporated into the Project and if incorporated, may be many times the estimated quantity or only a fraction thereof.

Incorporation of such items shall only be made on written directions of the Engineer. In the absence of written directions, no such items shall be incorporated into the Project and if incorporated will not be paid for. The Engineer may order incorporation of such items at any location within the Project and at any time during the Contract Time. Claims for additional compensation shall not be made because of any increase, decrease, or elimination of such items, nor because of an increase or decrease in the amount of Work due to the field conditions encountered in incorporating such items into the Project.

12. EXAMINATION OF CONTRACT DOCUMENTS AND SITE OF PROJECT

The Bidder shall examine carefully the site of the proposed Project and the Contract Documents before submitting a Proposal. The submission of a bid is conclusive evidence that the Bidder has made such examination and is fully aware of the conditions to be encountered in performing the Work and is fully aware of the requirements of the Contract Documents and has considered the following:

- A. Investigation of Subsurface and Surface Conditions - Where the Authority has made investigations of subsurface conditions in areas where Work is to be performed under the Contract, or in other areas, some of which may constitute possible local material sources, such investigations are made only for the purpose of study, estimating, and design. Where such investigations have been made, Bidders may, upon written request, inspect the records of the Authority as to such investigations subject to and upon the conditions set forth herein. Such inspection of records may be made at the South Jersey Transportation Authority offices, Route 54 and Trooper Lane, Hammonton, New Jersey 08037, or at such other locations as directed in response to the written request. In the event the Bidder's site examination reveals that the site conditions are inconsistent with the Contract Documents, the Bidder shall immediately notify the Authority.

Boring logs, if borings are taken, are part of the subsurface information made available. Such borings, which are taken solely for design purposes, were obtained with reasonable care and recorded in good faith. The soil and rock descriptions shown are determined by a visual inspection of samples from the various explorations unless otherwise noted. These samples are made available for nondestructive examination. The observed water levels and other water conditions indicated on the boring logs are as recorded at the time of the exploration. These levels and other conditions may vary considerably, with time, according to the prevailing climate, rainfall, and other factors. Boring logs may be inspected at the South Jersey Transportation Authority offices, Route 54 and Trooper Lane, Hammonton, New Jersey 08037, or at such other locations as directed in response to the written request.

The records of the Authority's subsurface investigation are not a part of the Contract and are made available for inspection solely for the convenience of the Bidder or Contractor. This investigation, while considered by the Authority to be sufficient for design purposes in both scope and content, is not necessarily sufficient for construction purposes and is not keyed to the needs of the Bidder and Contractor.

It is expressly understood and agreed that the Authority assumes no responsibility whatsoever in respect to the sufficiency or accuracy of the subsurface investigations, the records thereof, or of the interpretations set forth therein or made by the Authority in its use thereof other than as used to establish a design for the Project's in-situ site conditions. There is no warranty or guarantee, either expressed or implied, that the conditions indicated by such investigations or records thereof are representative of those existing throughout such areas, or any part thereof, or that unlooked-for developments may not occur, or that materials other than, or in proportions different from those indicated, may not be encountered.

The availability or use of information described in this Article is not to be construed in any way as a waiver of the above provisions, and a Bidder is cautioned to make such independent investigation and examination as necessary to satisfy the Bidder as to conditions to be encountered in the performance of the Work and, with respect to possible local material sources, the quality and quantity of material available and the type and extent of processing that may be required in order to produce material conforming to the requirements of the Contract Documents.

Information derived from such inspection of records of investigations or compilation thereof made by the Authority, the Consultant, or assistants, does not relieve the Bidder or Contractor from any risk or from properly fulfilling the terms of the Contract.

Moreover, New Jersey is a small, heavily populated State whose physical geography has received thorough examination. The Bidder is charged with knowledge of the State's physical geography from publications prepared under the auspices of the Federal and State governments, educational institutions, and others. Therefore, the Bidder, in performing his site investigation, should be fully aware of the following publications and such others as may be listed in the Specifications:

1. State of New Jersey Department of Transportation Bulletin 50, Geologic Series, "The Geology of New Jersey" by H. Kummel, out of print, available generally as library reference material.
2. Geologic Maps of New Jersey, available through New Jersey Department of Environmental Protection (NJDEP).

3. Engineering Soils Survey of New Jersey, available through the Bureau of Research, College of Engineering, Rutgers University, New Brunswick, New Jersey 08903.
4. Soil Surveys of Individual Counties prepared by the US Department of Agriculture, Soil Conservation Service, in cooperation with the New Jersey Agricultural Experiment Station and Cook College, Rutgers University, available through local Soil Conservation District Offices.

The Bidder should also conduct such borings, soils tests, and other subsurface investigations and obtain such expert advice on site conditions, both surface and subsurface, as is required for bidding and for the construction of the Project.

- B. When contour maps have been used in the design of the Project and have not been incorporated in the Plans, the Bidders may inspect such maps upon written request, and if available, they may obtain copies for their use.
- C. Right-of-Way Availability - The Bidder shall consider the effect on his work schedule of any delays in right-of-way availability. The submission of a bid shall be considered conclusive evidence that the Bidder has considered such delays and made allowance for them in the progress schedule.
- D. Utilities - The Bidder shall consider the effect on his work schedule of GENERAL CONDITIONS Articles "COOPERATION WITH UTILITIES" and "COOPERATION BETWEEN CONTRACTORS." The Bidder shall make a diligent investigation of all utilities on the job site, including any necessary de-energization of power lines, and contact all utilities inquiring as to their planned operations and existing and proposed facilities prior to bidding.
- E. Other Contractors - The Bidder shall examine the Project site and adjacent areas so as to be fully aware of other Contractors working on or adjacent to the site. The Bidder shall become fully aware of the operations of such Contractors before bidding and how their operations affect his progress. The Bidder should also consider, and allow for in bidding, the right of the Authority at any time to contract for and perform other or additional work on or near the Project, and the conditions and terms of the Contract relative thereto as set forth in GENERAL CONDITIONS Article "COOPERATION BETWEEN CONTRACTORS."
- F. Mass Diagram and Cross-Sections - The swell or shrinkage of excavated material and direction and quantities of haul or overhaul as and if shown on said mass diagram are for the purpose of design only, and in like manner as provided in Subheading A above, concerning furnishing information resulting from subsurface investigations, the Authority assumes no responsibility whatever in the interpretation or exactness of any of the information shown on said mass diagram, and does not, either express or imply, make any guarantee of the same. Similarly, the cross-sections are not intended to be relied upon to accurately indicate the location or quantities of rock and soil. The Bidder should independently make an investigation as to the location, quality, and quantity of rock and soil.
- G. Existing Structures - A list of known existing structures within the Project will be listed in the Contract or on the Plans. If plans for such structures are available, the Bidder may, upon written request to the Authority, review the plans at the South Jersey Transportation Authority offices, Route 54 and Trooper Lane, Hammonton, New Jersey 08037, or at such other locations as directed in response to the written request. The Authority assumes no responsibility for the correctness of the Plans. Any information obtained from

the existing Plans shall be verified by the Bidder prior to use of such information for bidding for the construction of the Project. In the event the Bidder's site examination reveals that the site conditions are inconsistent with the Contract Documents, the Bidder shall immediately notify the Authority.

13. PREPARATION OF PROPOSAL

The Bidder shall submit a Proposal on the forms furnished by the Authority. The Bidder shall specify a price in figures for each Pay Item. For lump sum items, the price should appear solely in the box provided for the lump sum item under the column designated as "Item Total." For unit price items the per unit price shall appear under the column designated "Unit Price" in the appropriate box, and the product of the respective unit price times the approximate quantity for that item shall appear under the column designated "Item Total." The "Total Amount Bid" is the sum of all figures shown in the column designated "Item Total" and shall appear at the location provided therefor. When the Bidder intends to bid zero (\$0.00) for a Pay Item, a "0" should appear in the "Unit Price" and "Item Total" columns for unit price items or in the "Item Total" column for lump sum items.

When the Proposal contains alternate items, the Bidder shall only provide the unit price and amount for the lowest priced alternate item. When alternate items in the proposal have a lump sum pay quantity, the Bidder shall only provide the amount for the lowest priced alternate item. The alternate item for which a price has been provided shall be constructed. When the proposal contains alternate groups of items, the Bidder shall only provide the unit price and amount for each item within the lowest priced alternate group. The alternate group of items for which a price has been provided shall be constructed.

All figures entered in the "Unit Price" and "Item Total" columns and the figure entered for the "Total Amount Bid" shall be in ink or typed. Bids will be accepted only if submitted on the Proposal Form supplied by the Authority. In all instances, the Proposal Form shall govern. Bid prices presented on any other form by the Bidder, if different from those submitted on the Proposal Form, shall not govern.

The Proposal Form must be signed in ink by the Bidder. If the Bidder is an individual, the Bidder's name must be shown; by a partnership, the name of each partnership member must be shown; as a joint venture, the name of each member or officer of the firms represented by the joint venture must be shown; by a corporation, the name of the corporation and the authorized officers name must be shown.

14. BALANCED BIDS

Each Pay Item should reflect the actual cost which the Bidder anticipates incurring for the performance of that particular item, together with a proportional share of the Bidder's anticipated profit, overhead, and costs to perform work for which no separate Pay Item is provided. In no event will the Authority consider any claim for additional compensation arising from the bid on an item, or group of items, inaccurately reflecting a disproportionate share of the Bidder's anticipated profit, overhead, and other costs.

15. DELIVERY OF PROPOSALS

Each Proposal should be submitted in a sealed envelope or, if provided, in the special envelope furnished by the Authority. The envelope shall be filled in correctly to clearly indicate it as a Bid Proposal and not to open until date and time of bid opening. When an envelope other than the special one furnished by the Authority is used, it shall be of the same general size and shape and be similarly marked to clearly indicate its contents. The Proposal shall be mailed or hand carried

to the Authority at the address and in care of the official in whose office the bids are to be received. Proposals must be received prior to or at the time and at the place specified in the Advertisement. Proposals will not be accepted after the receipt of bids has been declared closed by the Presiding Officer. Enclosed in the sealed envelope with the Proposal shall be submitted the following documents:

- A. The BID SECURITY as described in GENERAL CONDITIONS Article "BID SECURITY."
- B. The Proposal Section is to be completed and submitted with the Proposal. The Proposal Section contains the following:
 - 1. Bid Document Submission Checklist
 - 2. Bid Guarantee
 - 3. Certificate from a surety company
 - 4. listing of Subcontractors
 - 5. Bidder's acknowledgement of receipt of any notice(s) or revision(s) or addenda to an advertisement, specifications or bid document(s)
 - 6. Bid Form
 - 7. Federal Affirmative Action Form
 - 8. Ability Questionnaire
 - 9. Debarred List Affidavit
 - 10. Submission of a Non-Collusion Affidavit
 - 11. Prevailing Wage Act Compliance Declaration
 - 12. Business Registration Certification
 - 13. Any other additional submissions identified on the Bid Document Submission Checklist
 - 14. General Contractor DPMC Classification or NJDOT Prequalification form(s) as required.

16. BID SECURITY

The Proposal, when submitted, shall be accompanied by a Bid Security satisfactory to the Authority, on the form furnished by the Authority, for a sum of not less than ten percent (10%) of the TOTAL BID PRICE but not to exceed \$20,000.00. The Bid Security shall be properly filled out, signed, and witnessed, and shall be furnished only by such surety company or companies authorized to do business in the State of New Jersey as are listed in the current US Treasury Department Circular 570 as of the date for receipt of bids for the particular Project. The Proposal Bond shall be accompanied by a copy of the power of attorney executed by the Surety Company or companies. The power of attorney shall set forth the authority of the attorney-in-fact who has signed the bond on behalf of the surety company to bind the company and shall further certify that such power is in full force and effect as of the date of the bond.

17. WITHDRAWAL OF PROPOSALS

A Bidder may withdraw a Proposal after it has been submitted to the Authority, provided the request for such withdrawal is received by the Authority, in writing or by telegram, before the time set for opening Proposals. Proposals shall not be withdrawn after the time designated for the public opening of such Proposal, except that when Proposals for more than one (1) project are to be opened at the same time, a Bidder, at his option, may submit a written request to withdraw his Proposal for the second or succeeding project. The Bidder shall notify the Authority, in writing, of his intent to exercise this option before the time set for opening of Proposals. In such event, a short interval of time will be allowed between project Proposal openings to allow the Bidder time to submit a written request for withdrawal of bid. Upon presentation of the written request at the proper time, a Bidder's Proposal will be returned unopened.

18. COMBINATION OR CONDITIONAL PROPOSALS

If the Authority so elects, Proposal Forms may be issued for projects in combination and/or separately, so that bids may be submitted either on the combination or on separate units of the combination. The Authority reserves the right to make awards on combination bids or separate bids to the best advantage of the Authority. Combination bids other than those specifically provided for in the Proposal Forms will not be considered. Separate Contracts will be awarded for each individual Project included in the combination. Conditional Proposals will be considered only when provided for in the Specifications.

19. ACKNOWLEDGEMENT OF REVISIONS

When Addenda and other forms of notice giving revisions and interpretations of the Contract Documents are mailed or otherwise transmitted to prospective Bidders, acknowledgement thereof must be made by the Bidder. The acknowledgment shall be sent or hand delivered to the office and/or individual noted on the form and must be received before the Proposal of the Bidder concerned is opened. If the acknowledgment has not been received prior to the opening of bids, the bid envelope will be returned to the Bidder unopened.

20. PUBLIC OPENING OF PROPOSALS

Proposals will be opened and read publicly at the time and place indicated in the *Notice to Bidders* or such other time and place as may be established by Addendum. Bidders, their authorized agents, and other interested parties are invited to be present.

21. IRREGULAR PROPOSALS

Proposals will be considered irregular and may be rejected for the following reasons:

- A. If the Proposal is on a form other than that furnished by the Authority or if the form is altered or any part thereof is detached or incomplete.
- B. If the Proposal is not properly signed.
- C. If the bid is not typed or not in ink
- D. If there are unauthorized additions, conditional or alternate bids, or irregularities of any kind which may tend to make the Proposal incomplete, indefinite, or ambiguous as to its meaning.
- E. If the Bidder adds any provisions reserving the right to accept or reject an award, or to enter into a contract pursuant to an award. The prohibition does not exclude a reservation limiting the maximum gross amount of awards acceptable to any one (1) Bidder at any one (1) bid letting. However, the Authority will make the selection of which Contract or Contracts are to be awarded to such Bidder within the maximum gross amount reserved.
- F. If the Bidder makes an alteration of the "Unit Prices" or "Amounts" that have been included by the Authority, unless otherwise directed by Addendum received prior to receipt of bids.
- G. Subject to GENERAL CONDITIONS Article "CONSIDERATION OF PROPOSAL," if the Proposal does not contain a unit price for each Pay Item listed or a Total Contract Price. In the case of alternate items or alternate groups of items, the Bidder shall provide prices as stated in GENERAL CONDITIONS Article "PREPARATION OF PROPOSAL" and the Proposal.
- H. If the Proposal is not accompanied by the Proposal Bond as specified in GENERAL CONDITIONS Article "PROPOSAL BOND."

- I. If acknowledgment of letters and other notices to prospective Bidders, giving revisions of or amendments to the Contract Documents, have not been received as prescribed in GENERAL CONDITIONS Article "ACKNOWLEDGEMENT OF REVISIONS."
- J. If the Executive Director deems it advisable to do so in the interest of the Authority.

22. DISQUALIFICATION OF BIDDERS

Any of the following reasons may be considered as being sufficient for the disqualification of a Bidder and the rejection of his Proposal:

- A. More than one (1) Proposal for the same work from an individual, firm, partnership, corporation, or combination thereof, under the same or different names. Reasonable grounds for believing that any individual, firm, partnership, corporation, or combination thereof, is interested in more than one (1) Proposal for the work contemplated may cause the rejection of all Proposals in which such individual, firm, partnership, corporation, or combination thereof, is interested.
- B. Evidence of collusion among Bidders. Participants in such collusion will not be permitted to submit bids for future work of the Authority until reinstatement as a qualified Bidder by the Executive Director.
- C. If any Pay Item bid price is obviously unbalanced. However, non-rejection of a bid on this basis shall not be deemed to be a determination by the Authority that the bid is balanced.
- D. Uncompleted work which, in the judgment of the Authority, might hinder or prevent the prompt completion of additional work, if awarded.
- E. Failure to satisfy the requirements of the Minority Utilization attachments included in the Specifications.

23. RESERVED

24. RESERVED

AWARD AND EXECUTION OF CONTRACT

25. CONSIDERATION OF PROPOSALS/BID DISCREPANCIES

Where applicable, Bidders shall state on such form a unit price (**written in words and numbers**) for each item bid, and such unit prices shall be extended and extensions added to produce a total bid price. For the purpose of the comparison of bids received, they are re-tabulated by the Authority. The total re-tabulated by the Authority will prevail.

When evaluating bids the following shall apply:

- Discrepancies between words and figures will be resolved in favor of words.
- Discrepancies between unit prices and totals of unit prices will be resolved in favor of the unit prices.
- Discrepancies in the multiplication of units of work and unit prices will be resolved in the favor of the unit prices.
- Discrepancies between the indicated total of multiplied unit prices and units of work and the actual total will be resolved in favor of the actual total.
- Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the corrected sum of the column of figures.

- Discrepancy where a unit price is bid for a Pay Item, but no extension is provided; the Authority will provide the extension based on the unit price bid and the estimated quantity for that Pay Item.
- Discrepancy where an extension is provided by the Bidder in the "Item Total" column, but no unit price appears in the "Unit Price" column of the Proposal Form, the Authority will provide the unit price by dividing the "Item Total" figure provided by the Bidder by the estimated quantity.

In the event a corporation not incorporated in the State of New Jersey is the lowest Bidder, it shall be authorized to do business in New Jersey pursuant to NJSA 14A:15 *et seq.*

The Authority may reject any and all Proposals when the Authority determines that it is in the public interest to do so. The Authority reserves the right to waive technicalities or to advertise for new Proposals.

26. AWARD OF CONTRACT

The Award will be made to the lowest responsible Bidder whose Proposal conforms in all respects to the requirements set forth in the Contract Documents. The Authority will award the Contract or reject all bids 90 calendar days after the bids are received. The Authority may make a Conditional Award pending the approval of the Federal Government, another State governmental body, or private party. Should the Contract not be awarded or conditionally awarded within 90 calendar days, all Bidders shall have the right to withdraw their bids. However, the Authority and the lowest responsible Bidder and/or the second lowest responsible Bidder can agree to extend the time within which the Authority may make an award or conditional award by mutual consent.

For AIP Contracts, unless otherwise specified in this Section, no award shall be made until the FAA has concurred in the Authority's recommendation to make such award and has approved the Authority's proposed contract to the extent that such concurrence and approval are required by 49 CFR Part 18.

At the time of Award or Conditional Award to a Bidder not a resident of the State of New Jersey, such Bidder shall appoint, on the form furnished by the Authority, a proper agent in the State of New Jersey on whom service can be made in event of litigation of any type arising under the Contract or as a result of performance of the Contract. Said agency shall remain in effect during the performance of the Contract and for six (6) years following Acceptance.

The Award or Conditional Award is not binding upon the Authority until the Contract has been executed by the Authority's Executive Director, nor shall any work be performed on account of the proposed Contract until the prospective Contractor has been notified that the Contract has been executed by the Executive Director, and then only as provided in GENERAL CONDITIONS Article "COMMENCEMENT OF WORK."

27. CANCELLATION OF AWARD

The Authority reserves the right to cancel an Award or Conditional Award at any time before the execution of said Contract by all parties without any liability against the Authority.

28. RETURN OF BID SECURITY

All Bid Securities except those of the three (3) lowest Bidders will be returned to Bidders as soon as possible after the award of a contract. The Bid Security of the lowest and next lowest Bidders will be returned when the Contract and Performance Bond and Payment Bond have been executed and delivered in accordance with the provisions of GENERAL CONDITIONS Article "EXECUTION AND APPROVAL OF CONTRACT," or, if not executed, when other disposition of

the matter has been made by the Authority. However, when the Award or Conditional Award has been annulled due to failure of the Bidder to whom award was made to execute and deliver the Contract and Performance Bond and Payment Bond, the Bid Security of such Bidder shall become operative as provided in GENERAL CONDITIONS Article "FAILURE TO EXECUTE CONTRACT."

29. EXECUTION AND APPROVAL OF CONTRACT

The Contract shall be signed by the successful Bidder and returned, together with the Performance Bond and Payment Bond, within ten calendar days of the date of receipt of the contract by the successful Bidder from the Authority. If the Contract is not executed by the Authority within 120 calendar days following receipt from the Bidder of the signed Contract and Performance Bond and Payment Bond, the Bidder shall have the right to withdraw his bid without penalty. The Contract is not effective until it has been fully executed.

30. PERFORMANCE BOND AND PAYMENT BOND

Within ten calendar days of the date of Award or Conditional Award, the Bidder to whom the Contract has been awarded shall complete and deliver a Performance Bond and a Payment Bond in accordance with the requirements of the Authority. Each bond shall be the sum of not less than the Total Contract Price and shall be maintained by the Contractor until Acceptance. In the event of the insolvency of the surety or if the Performance Bond and Payment Bond have not been properly authorized or issued by the Surety company, the Contractor shall furnish and maintain, as above provided, other surety satisfactory to the Authority.

All alterations, extensions of Contract Time, extra and additional work, and other changes authorized by the Contract Documents may be made without securing the consent of the surety or sureties of the bonds.

The surety corporation bonds shall be furnished by only those sureties listed in the US Treasury Department Circular 570 and authorized to do business in the State of New Jersey. The bonds shall be accompanied by a certification as to authorization of the attorney-in-fact to commit the surety company and a true and correct statement of the financial condition of said surety company.

31. FAILURE TO EXECUTE CONTRACT

Failure on the part of the Bidder to whom the Contract has been awarded to execute and deliver the Contract as provided in GENERAL CONDITIONS Article "EXECUTION AND APPROVAL OF CONTRACT", and the bonds as provided in Article "PERFORMANCE BOND AND PAYMENT BOND", in the manner and within the time provided, is just cause for annulment of the Award or Conditional Award and for the exclusion of the Bidder from bidding on subsequent projects for such period as the Authority may deem appropriate. If the Award is annulled for the above reasons, the Proposal Bond, as described in GENERAL CONDITIONS Article "PROPOSAL BOND," shall become forfeited and the Authority may proceed to recover under the terms and provisions of the Proposal Bond. Award may then be made to the next lowest responsible Bidder, or the Work may be re-advertised and constructed under contract, or otherwise, as the Authority may decide. The successful Bidder may file with the Authority a written notice, signed by the Bidder or the Bidder's authorized representative, specifying that the Bidder refuses to execute the Contract. The filing of such notice has the same force and effect as the failure of the Bidder to execute the Contract and furnish a Performance Bond and Payment Bond within the time herein before prescribed.

32. RESERVED**33. RESERVED**

SCOPE OF WORK

34. INTENT

The Contract Documents are complementary, and what is called for by one part shall be as binding as if called for by all. The intent of the Contract Documents is to describe a functionally complete and aesthetically acceptable Project to be constructed and completed by the Contractor in every detail in accordance with the Contract Documents. Any Work that may be reasonably inferred from the Contract Documents as being required to produce the intended result shall be supplied whether or not specifically called for. Where the Contract Documents describe portions of the Work in general terms, but not in complete detail, it is understood that only the best construction practice is to prevail and only materials and workmanship of the first quality are to be used. The intent of the Documents is to include all work (except specific items to be furnished by the Authority) necessary for completion of the Contract. Materials or work described in words that indicate the proper execution and a well-known technical or trade designation shall be held to refer to such recognized standards. Only where the Contract Documents specifically describe a portion of the Project as being performed by others is the Work deemed not to constitute construction of the entire Project. It is understood and agreed that the written terms and provisions of the Contract Documents represent the entire and integrated agreement between the parties hereto and supersede all prior negotiations, representations, or agreements, either written or oral.

35. CHANGES

The Authority reserves the right to make such alterations, deviations, additions to, or omissions from the Contract Documents, including the right to increase or decrease the quantity of any Pay Item or portion of the Work or to omit any Pay Item or portion of the Work, and to require Extra Work as needed for the satisfactory completion of the Project. Such increases or decreases, alterations, and omissions do not invalidate the Contract nor release the Surety, and the Contractor agrees to accept the Work as altered, the same as if it had been a part of the original Contract.

Changes which solely involve the increase or decrease in the quantity of Pay Items (not involving unit price adjustments pursuant to GENERAL CONDITIONS Articles "INCREASED OR DECREASED QUANTITIES" and "PAYMENT FOR MODIFICATIONS," the elimination of Pay Items, the adjustment of the estimated quantities in the Proposal as the result of as-built calculations, or minor changes in the Work as provided in GENERAL CONDITIONS Article "MINOR CHANGES IN THE WORK," may be effected by Field Order or Change Order, as determined by the Engineer. All other changes will be included in a Change Order which specifies, in addition to the Work to be done, an adjustment of Contract Time, if any, and the basis of compensation for such Work. A Change Order submitted by the Engineer does not become effective until appropriate signatures have been affixed. Once a certain monetary threshold has been exceeded, Change Orders require Board of Commissioners approval. Once the Board of Commissioners has approved the proposed Change Order, the Governor has a subsequent 30 day veto period.

Upon receipt of a Field Order or Change Order, the Contractor shall proceed with the ordered Work. Where the changes involved require a Change Order, and a Change Order has not yet been issued, the Engineer may direct, by Field Order, that the Contractor proceed with the desired Work, and the Contractor shall comply. In such cases, the Engineer will, as soon as practicable, issue a Change Order for such Work. When the compensation for an item of Work is subject to adjustment under the provisions of GENERAL CONDITIONS Articles "PROCEDURES AND PROTEST," "INCREASED OR DECREASED QUANTITIES," "ELIMINATED ITEMS," "CHANGES IN CHARACTER OF WORK," "EXTRA WORK," "NOTIFICATION OF CHANGES" or

“PAYMENT FOR MODIFICATIONS,” the Contractor shall, upon request, furnish the Engineer with adequate detailed cost data for such item of Work. If the Contractor requests an adjustment in compensation for an item of Work as provided in GENERAL CONDITIONS Articles “INCREASED OR DECREASED QUANTITIES” and “PAYMENT FOR MODIFICATIONS,” such cost data shall be submitted with the request.

In addition to Field Orders and Change Orders, the terms and conditions relating to changes may be negotiated with the Contractor. If the Contractor signifies acceptance of such terms and conditions by executing a Supplementary Agreement, and if such Supplementary Agreement is approved by the Authority, the Engineer will issue payment to the Contractor in accordance with the terms and conditions as to compensation and adjustments in the Contract Time therein set forth which shall constitute full compensation and mutually acceptable adjustment of Contract Time for all Work included therein or required thereby. The Contractor agrees that a proposed Supplementary Agreement which is not approved by the Authority and Governor or which is rejected by the Contractor shall have no effect and that neither may attempt to use it in any litigation which may result from the Contract.

If the Contractor intends to assert a claim for an equitable adjustment under this Article, he must, within seven (7) days after receipt of the Authority’s alterations, deviations, additions to, omissions from the Contract Documents, or directed Extra Work and prior to performing the work, submit to the Authority a written statement setting forth the general nature and monetary extent of such claim.

No claim for additional compensation shall be made because of any such alteration, deviation, addition to, or omission from the Work required by the Contract, by reason of any variation between the approximate quantities in the Bid Form and the quantities of Work as done, by reason of Extra Work, by reason of elimination of Pay Items, or by reason of changes in the character of Work except as allowed in this Section. Attention is directed to GENERAL CONDITIONS Articles “BALANCED BIDS.”

No claim for additional compensation or extension of Contract Time within the scope of this Section will be allowed if asserted after Acceptance. No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

36. MINOR CHANGES IN THE WORK

The Resident Engineer has the authority to order minor changes in the Work not involving an adjustment to the unit or lump sum prices, or an adjustment to Pay Items, or an extension of Contract Time, and not inconsistent with the intent of the Contract Documents. Such changes may be effected by Field Order and are binding on the Authority and the Contractor. Additional compensation or extension of Contract Time will not be allowed.

37. PROCEDURE AND PROTEST

A Field Order or Change Order may be issued at any time. Should the Contractor disagree with any terms or conditions set forth in a Field Order or a Change Order, the Contractor shall submit a written protest to the Engineer within seven (7) days after the receipt of such Field Order or Change Order or prior to performing the work. The protest shall state the points of disagreement, and, if possible, the specification references, quantities, and costs involved. The protest shall be a specific, detailed statement of the points of disagreement, and the Engineer reserves the right to reject general protests. Rejected general protests, which are not cured by the submission of a specific, detailed statement within five (5) days of such rejection will not be considered. If a written protest is not submitted, payment will be made as set forth in the Field Order or Change Order and such payment constitutes full compensation for all Work included therein or required

thereby and also is conclusive as to any Contract Time adjustments provided for therein or in establishing that no Contract Time adjustment was warranted.

Protests related to Work ordered by Field Order, but as to which a Change Order is required, shall be made within seven (7) days after receipt of the Field Order or prior to performing the work. Subsequent issuance of the Change Order shall not be the basis for a protest except to the extent that the Change Order differs materially from the Field Order.

Where the protest concerning a Field Order or a Change Order relates to compensation, the compensation payable for all Work specified or required by said Field Order or Change Order to which such protest relates, if later deemed appropriate by the Engineer, will be determined as provided in GENERAL CONDITIONS Articles "PAYMENT FOR MODIFICATIONS," "INCREASED OR DECREASED QUANTITIES," "ELIMINATED ITEMS," "CHANGES IN CHARACTER OF WORK," and "EXTRA WORK." The Contractor shall keep full and complete records of the cost of such Work and shall permit the Engineer to have such access thereto consistent with GENERAL CONDITIONS Article "AUDIT: ACCESS TO RECORDS," as may be necessary to assist in the determination of the compensation payable for such Work.

Where the protest concerning a Change Order relates to the adjustment of Contract Time, the time to be allowed, if later deemed appropriate, will be determined as provided in GENERAL CONDITIONS Articles "TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSIONS," "CLAIMS FOR ADDITIONAL TIME AND/OR COMPENSATION" and "EXTENSION OF TIME."

38. INCREASED OR DECREASED QUANTITIES

Increases or decreases in the quantity of a Pay Item will be determined by comparing the total actual quantity of such item of Work with the quantity contained in the Proposal. In making such a comparison, quantities which are the subject of Supplementary Agreements or Change Orders for Extra Work will not be considered.

Minor Pay Items are not eligible for any adjustment in unit price regardless of how much the total as-built quantity varies from the quantity contained in the Proposal unless eligible for adjustment pursuant to GENERAL CONDITIONS Article "CHANGES IN THE CHARACTER OF THE WORK".

If the total pay quantity of any Major Pay Item varies from the estimate contained in the Proposal by more than 25 percent, payment will be made in accordance with the following categories:

- A. Increases of More Than 25 Percent
 1. Lump-Sum Items - Should the total actual quantity of or actual component quantity for lump sum Items of any Major Pay Item exceed the estimate contained in the Proposal by more than 25 percent, the Work in excess of 125 percent of such estimate will be paid for by adjusting the unit price, as hereinafter provided. Alternatively, the Contractor and Engineer may request in writing to negotiate a Supplementary Agreement for such adjustment.
 2. Unit Price - Such adjustment of the unit price is to be the difference between the unit price and the actual unit cost, which will be determined as hereinafter provided. If the costs applicable to such item of Work include overhead, such overhead will be deemed to have been recovered by the Contractor by the payments made for the 125 percent of the Contract quantity for such item already paid, and in computing the

actual unit cost, such overhead will be excluded. Subject to the above provisions, such actual unit costs will be determined in the same manner as if the Work were to be paid for on a Force Account basis as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATION."

When the compensation payable for the number of units of an item of Work performed in excess of 125 percent of the Engineer's estimate is less than \$1,500 at the applicable unit price, the Engineer reserves the right to make no adjustment in said price if the Engineer so elects, except that an adjustment may be made if requested in writing by the Contractor.

B. Decreases of More than 25 Percent

1. Lump Sum - Should the total actual quantity or component quantity for lump sum Items of any Major Pay Item be less than 75 percent of the estimate contained in the Proposal Form, an adjustment in compensation pursuant to this Article will not be made unless the Contractor so requests in writing. If the Contractor so requests, the quantity of said item performed will be paid for by adjusting the unit price as hereinafter provided, or at the option of the Engineer, payment for the quantity of the Work of such item performed will be made on the basis of Force Account as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATION," provided, however, that in no case shall the payment for such Work be less than that which would be made at the unit price bid. Alternately, the Contractor or Engineer may request in request to negotiate a Supplementary Agreement for such adjustment.
2. Unit Price - Such adjustment of the unit price is to be the difference between the unit price and the actual unit cost, which will be determined as hereinafter provided, of the total actual quantity of the item, including overhead. Such actual unit cost will be determined in the same manner as if the Work were to be paid for on a Force Account basis as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATION."

The payment for the total actual quantity of such item of Work is not to exceed the payment which would be made for the performance of 75 percent of the estimate contained in the Proposal for such item at the original unit price bid or component cost for lump sum items.

39. ELIMINATED ITEMS

Should any Pay Item contained in the Proposal be found unnecessary for the proper completion of the Work, the Engineer may, upon written order to the Contractor, eliminate such item from the Contract. In such case compensation, if any is appropriate, will be made as provided in this Article.

If acceptable material is ordered by the Contractor for the eliminated item prior to the date of notification of such elimination and if orders for such material cannot be canceled, material will be paid for at the actual cost to the Contractor. In such case, the material paid for becomes the property of the Authority, and the actual cost of any further handling will be paid for by the Authority. If the material is returnable to the vendor, and if the Engineer so directs, the material shall be returned, and the Contractor will be paid for the actual cost or charges made by the vendor for returning the material. The actual costs of handling returned material will be paid for by the Authority.

The actual costs or charges will be computed in the same manner as if the Work were to be paid for as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS." However, no profit will be allowed.

40. DIFFERING SITE CONDITIONS

- A. The Contractor shall immediately, and before such conditions are disturbed, except in the event of an emergency, notify the Authority by written notice of:
1. Subsurface or latent physical conditions at the site differing materially from those indicated in this Contract; or
 2. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work of the character provided for this Contract.

The Engineer shall promptly investigate the conditions. If he finds that such conditions do materially differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the Contract modified in writing accordingly.

- B. No claim of the Contractor under this Article shall be allowed unless the Contractor has given the notice required in Paragraph A of this Article, except that the Authority may extend the prescribed time.
- C. No claim of the Contractor shall be allowed if filed later than thirty (30) days after the differing site condition has been overcome unless such period is extended by the Authority.
- D. No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

41. CHANGES IN CHARACTER OF WORK

If the Engineer determines that an ordered change in the Work materially changes the character of the Work of a Pay Item, or a portion thereof, and if the change substantially increases or decreases the actual unit cost of such changed item as compared to the actual or estimated cost of performing the Work of said item in accordance with the Contract Documents originally applicable thereto, in the absence of a Supplementary Agreement or unprotested Change Order specifying the compensation payable, an adjustment in compensation will be made in accordance with the following:

- A. The basis of such adjustment in compensation will be the difference between the actual unit cost to perform the Work of said item or portion thereof involved in the change as originally planned and the actual unit cost of performing the Work of said item or portion thereof involved in the change, as changed. Actual unit costs will be determined in the same manner as if the Work were to be paid for as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS," or such adjustment is as agreed to in a Supplementary Agreement. Any such adjustment is to apply only to the portion of the Work of said item actually changed in character.

- B. At the option of the Engineer, the Work on said item or portion of item which is changed in character will be paid for as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS."
- C. If the compensation for an item of Work is adjusted under this Article, the costs recognized in determining such adjustment and quantity involved will be excluded from consideration in making an adjustment for such item of Work under the provision in GENERAL CONDITIONS Article "INCREASED OR DECREASED QUANTITIES."

Failure of the Engineer to recognize a change in character of the Work at the time a Field Order or Change Order is issued does not relieve the Contractor of the duty and responsibility of filing a written protest within the five (5) day limit as provided in GENERAL CONDITIONS Article "NOTIFICATION OF CHANGES."

An adjustment in compensation will be made if there is an increase or decrease in excess of five percent (5%) in solid waste disposal costs incurred as a result of lawful increases or decreases in the rates, fees, or charges of the solid waste facility to be used or due to an order issued by the NJDEP in conjunction with the Bureau of Public Utilities directing the solid waste to be disposed at a solid waste facility other than the disposal facility previously used. Adjustments in compensation will be made in accordance with the provisions above. Adjustments in compensation will not be made if actual disposal costs have changed by less than five percent (5%) of the fee structure provided in accordance with the requirements of GENERAL CONDITIONS Article "PROSECUTION OF THE WORK."

42. EXTRA WORK

The Authority reserves the right to require Extra Work as needed for the satisfactory completion of the Project. Such Work will be designated as Extra Work when it is determined by the Engineer that such Work is not covered by any of the various items for which there is a bid price or combinations of such items. In the event portions of such Work are determined to be covered by some of the various items for which there is a bid price or combinations of such items, the remaining portion of such Work will be designated as Extra Work. Extra Work also includes Work specifically designated as Extra Work in the Contract Documents.

The Contractor shall do such Extra Work and furnish labor, material, and equipment therefor upon receipt of a Change Order, Field Order, or Supplementary Agreement. In the absence of such, the Contractor shall not perform, nor be entitled to payment for, such Extra Work.

Payment for Extra Work required pursuant to the provisions in this Article will be made as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS, or as agreed to in a Supplementary Agreement.

If the Contractor and the Engineer cannot agree on a Supplementary Agreement for Extra Work and the Engineer deems it inadvisable to have such Work completed on a Force Account basis as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS," the Authority may elect to have such Work completed by others, and the Contractor shall not interfere therewith nor have any claim for additional compensation as the result of such election.

43. NOTIFICATION OF CHANGES

The Contractor shall promptly report Authority conduct which the Contractor believes to constitute a change to the Contract. Except for changes identified as such pursuant to GENERAL CONDITIONS Articles "CHANGES" and "MINOR CHANGES IN THE WORK," the Contractor shall promptly notify the Engineer in writing within 14 calendar days from the date that the

Contractor identifies any Authority conduct including actions, inactions, and written or oral communications, which the Contractor regards as a change to the Contract terms and conditions. In no event shall the Contractor begin Work nor incur any expenses with relation to the claimed change prior to giving notice. The notice shall state the following on the basis of the most accurate information available to the Contractor:

- A. The date, nature, and circumstances of the conduct regarded as a change.
- B. The name, function, and activity of each Authority individual and official or employee involved in or knowledgeable about such conduct.
- C. The identification of any documents and the substance of any oral communication involved in such conduct.
- D. In the instance of alleged acceleration of scheduled performance or delivery, the basis for the Contractor's claim of accelerations.
- E. In the instance of alleged Extra Work, the basis for the Contractor's claim that the Work is extra.
- F. The particular elements of Contract performance for which the Contractor may seek additional compensation under this Section including:
 - (1) What Pay Items have been or may be affected by the alleged change.
 - (2) What labor or materials or both have been or may be added, deleted, or wasted by the alleged change and equipment idled, added, or required for additional time.
 - (3) To the extent practicable, what delay and disruption in the manner and sequence of performance and effect on continued performance have been or may be caused by the alleged change.
 - (4) What adjustments to Contract price, delivery schedule, and other provisions affected by the alleged change are estimated.

Following submission of the notice, the Contractor shall diligently continue performance of the Contract to the maximum extent possible in accordance with the Contract Documents, unless such notice results in a direction by the Engineer, in which event the Contractor shall continue performance in compliance therewith, provided, however, that if the Contractor regards such direction itself as a change, notice shall be given as provided above. All directions, orders, and similar actions of the Engineer will be reduced to writing and copies thereof furnished to the Contractor. The Resident Engineer will promptly, and in any event within ten days after receipt of notice, respond thereto in writing. In such response, the Resident Engineer will do one of the following:

- A. Confirm that the conduct of which the Contractor gave notice constitutes a change, and when necessary direct the mode of further performance.
- B. Revise or rescind any communication regarded as a change.
- C. Deny that the conduct of which the Contractor gave notice constitutes a change, and when necessary direct the mode of further performance; or
- D. In the event the Contractor's notice information is inadequate to make a decision under Items A, B, or C of this paragraph, advise the Contractor as to what additional information is required, and establish the date by which it should be furnished and the date thereafter by which the Authority will respond.

If the Engineer confirms that Authority conduct effected a change as alleged by the Contractor, and such conduct causes an increase or decrease in the cost of, or the time required for performance of any part of the Work under the Contract, whether changed or not changed by such conduct, an adjustment in compensation will be made in accordance with the provisions of this Section, and the Contract will be modified in writing accordingly. In the case of drawings, designs, or specifications which are defective and for which the Authority is responsible, the adjustment will be made to include the cost and extension of Contract Time for delay reasonably

incurred by the Contractor in attempting to comply with such defective drawings, designs, or specifications before the Contractor identified, or reasonably should have identified, such defect. When the cost of property made obsolete or excess as a result of a change confirmed by the Engineer pursuant to this Article is included in the adjustment in compensation, the Engineer has the right to prescribe the manner of disposition of such property. Adjustments will not be made which include increased costs or extensions of Contract Time for delay resulting from the Contractor's failure to provide adequate notice or to continue performance as provided above. Any adjustments of Contract Time will be made pursuant to GENERAL CONDITIONS Articles "TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSIONS," "CLAIMS FOR ADDITIONAL TIME AND/OR COMPENSATION" and "EXTENSION OF TIME."

The failure of the Contractor to give notice pursuant to the provisions of this Article shall constitute a waiver of any and all claims and damages which could have been avoided or mitigated had such timely notice been given. Moreover, no action or inaction of any person shall constitute a waiver of the Authority's absolute right to receive written notice of an alleged claim pursuant to this Article.

44. RIGHTS IN AND USE OF MATERIALS FOUND ON THE WORK

The Contractor, with the approval of the Engineer, may use on the Project such stone, gravel, sand, or other material determined suitable by the Engineer, as may be found in the excavation and will be paid both for the excavation of such materials at the corresponding unit price and for the Pay Item for which the excavated material is used except for the provisions for roadway excavation as provided by the contract. The Contractor shall replace at his own expense with other acceptable material all of that portion of the excavated material which was needed in the embankments, bankfills, approaches, or otherwise. Charge for the materials so used will not be made against the Contractor. The Contractor shall not excavate or remove any material from within the highway or airport location which is outside the grading limits, as indicated by the slope and grade lines, without written authorization. The Contractor will not be paid for the excavation so authorized and shall replace the excavated material at no cost to the Authority.

45. MAINTENANCE OF TRAFFIC

When the contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall furnish erect, and maintain barricades, warning signs, flagmen, and other traffic control devices in conformity the requirements of the New Jersey Department of Transportation, unless otherwise specified herein. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

On Airport projects it is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the Air Operations Areas of the airport with respect to its own operations and the operations of all his Subcontractors as specified in the Article titled "LIMITATION OF OPERATIONS." It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport.

With respect to his/her own operations and the operations of all his/her Subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying: personnel;

equipment; vehicles; storage areas; and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport.

The Contractor shall make his/her own estimate of all labor, materials, equipment, and incidentals necessary for providing the maintenance of aircraft and vehicular traffic as specified in this subsection.

The cost of maintaining the aircraft and vehicular traffic specified in this subsection shall not be measured or paid for directly, but shall be included in the various contract items.

46. VALUE ENGINEERING

The term proposal as used in this Article is construed to mean a Value Engineering proposal submitted by the Contractor for changing the Plans, Specifications, or other requirements of the Contract. The Value Engineering proposal shall conform to the following:

- A. Purpose and Scope - The intent of Value Engineering is to share with the Contractor any cost savings generated on the Contract as a result of a proposal or proposals offered by the Contractor and approved by the Authority. The purpose is to encourage the use of Contractor's ingenuity and experience in arriving at alternative, lower cost or time-saving construction methods other than those reflected in the Contract Documents, by the sharing of savings resulting therefrom. The proposals contemplated are those that could produce a savings to the Authority without, in the sole judgement of the Engineer, impairing essential functions and characteristics of the Project or a portion of the Work involved. They include but are not limited to safety, service life, stage construction, economy of operation, ease of maintenance, and desired appearance.
- B. Submittal of Initial Proposal - An initial proposal is required for all Value Engineering proposals and shall outline the general technical concepts associated with the proposal and the estimated savings which will result.

The initial proposal will be reviewed by the Authority and, if found to be conceptually acceptable, approval to submit a final proposal will be granted by the Authority. A finding of conceptual acceptability of the initial proposal in no way obligates the Authority to approve the final proposal. The Contractor shall have no claim against the Authority as a result of the rejection of any such final proposal.

- C. Submittal of Final Proposal - Final proposals will be considered only after Authority approval of the initial proposal in accordance with Subheading B above. Final proposals will not be considered if submitted after 50 percent completion of the Work has occurred, based on monthly estimates amounting to more than 50 percent of the total adjusted Contract price, unless the remaining Contract Time is one (1) year or more. As a minimum, the following materials and information shall be submitted with each final proposal plus any additional information requested by the Authority:

- (1) A statement that the final proposal is submitted as a Value Engineering proposal.
- (2) A description of the difference between the existing Contract requirements and the proposed change, and the comparative advantages and disadvantages of each, including considerations of

- safety, service life, economy of operations, ease of maintenance, and desired appearance.
- (3) Complete plans, specifications, and calculations showing the proposed revisions relative to the original Contract features and requirements. All plans and engineering calculations shall bear the signature of a Professional Engineer licensed to practice in the State of New Jersey.
 - (4) A complete cost analysis indicating the final estimate costs and quantities to be replaced by the proposal, the new costs and quantities generated by the final proposal, and the cost effects of the proposed changes on operational, maintenance, and other considerations.
 - (5) A specific date by which a Change Order or Supplementary Agreement adopting the final proposal must be executed so as to obtain the maximum cost reduction during the remainder of the Contract. This date must be selected to allow the Authority ample time, usually a minimum of 60 days, for review and processing a Change Order or Supplementary Agreement. Should the Authority find that insufficient time is available for review and processing, it may reject the final proposal solely on such basis. If the Authority fails to respond to the final proposal by the date specified, the Contractor shall consider the final proposal rejected and shall have no claim against the Authority as a result thereof.
 - (6) A statement as to the effect the final proposal has on the Contract Time.
 - (7) A description of any previous use or testing of the final proposal on another Authority project or elsewhere and the conditions and results therewith. If the final proposal was previously submitted on another Authority project, indicate the date, the project, and the action taken by the Authority.
- D. Conditions - Proposals will be considered only after Award of Contract and only when all of the following conditions are met:
- (1) The Contractor is cautioned not to base any bid prices on the anticipated approval of a proposal and to recognize that such proposal may be rejected. In the event of rejection, the Contractor is required to complete the Contract in accordance with the Plans and Specifications and the prices bid.
 - (2) All proposals, approved or not approved by the Authority for use in the Contract, apply only to the ongoing Contract or Contracts referenced in the proposal. The proposals shall become the property of the Authority and shall contain no restrictions imposed by the Contractor on their use or disclosure. The Authority will have the right to use, duplicate, and disclose in whole or in part any data necessary for the utilization of the proposal. The Authority retains the right to use any accepted proposal or part thereof on any other or subsequent project without any obligation to the Contractor. This provision is not intended to deny rights provided by law with respect to patented materials or processes.
 - (3) If the Authority already has under consideration certain revisions to the Contract which are subsequently incorporated in a proposal, the Authority will reject the Contractor's proposal and may proceed with such revisions without any obligation to the Contractor.
 - (4) The Contractor shall have no claim against the Authority for any costs or delays due to the Authority's rejection of a proposal, including but not limited to development costs, anticipated profits, or increased materials or labor costs resulting from delays in the review of such proposal.
 - (5) The Engineer will determine as to whether a proposal qualifies for consideration and evaluation. The Engineer may reject any proposal that

- requires excessive time or costs for review, evaluation and/or investigations, or which is not consistent with the Authority's design policies and basic design criteria for the Project.
- (6) The Engineer may reject all or any portion of Work performed pursuant to an approved proposal if the Engineer determines that unsatisfactory results are being obtained. The Engineer may direct the removal of such rejected Work and require the Contractor to proceed in accordance with the original Contract requirements without reimbursement for any Work performed under the proposal, or for its removal. Where modifications to the proposal are approved in order to adjust to field or other conditions, reimbursement is limited to the total amount payable for the Work at the Contract prices as if it were constructed in accordance with the original Contract requirements. Such rejection or limitation of reimbursement does not constitute the basis of any claim against the Authority for delay or for any other costs.
 - (7) The proposal shall not be experimental in nature but shall have been proven to the Authority's satisfaction under similar or acceptable conditions on another Authority project or at another location acceptable to the Authority.
 - (8) Proposals will be considered only if equivalent options are not already provided in the Contract Documents.
 - (9) The proposal shall be made based on items of Work scheduled to be done by the Contractor. Anticipated cost savings based on revisions of utility relocations or other similar items to be done by others will not be considered. Proposals which may increase the cost of Work done by others will not be considered.
 - (10) The savings generated by the proposal must be of sufficient significance to warrant review and processing.
 - (11) If additional information is needed to evaluate proposals, this information must be provided in a timely manner, otherwise the proposal will be rejected. Such additional information could include, where design changes are proposed, results of field investigations and surveys, design computations, and field change sheets.

If the proposal is approved, the Contractor shall submit drawings, in ink, on polyester film such as Mylar or Herculene, 100 micrometers thick, matted on both sides except as follows:

- a. Structural drawings may be submitted in pencil.
- b. Electrical drawings may be matted on one side and may be submitted in pencil.
- c. Cross-section sheets may be 80 micrometers thick and may be matted on one side.

All plans and engineering calculations shall bear the signature of a Professional Engineer licensed to practice in the State of New Jersey. Proposals will not be considered that change the following:

- a. The types, thicknesses, or joint designs of a concrete, a bituminous, or a stabilized surface or base course.
- b. The thicknesses of the unbound material immediately underlying a concrete, a bituminous, or a stabilized surface or base course.

- c. The basic design of bridges, defined as the type of superstructure and substructure, span length type and thickness of deck, type of beam and arrangement, geometrics, width, and underclearance.
 - d. The basic design of retaining walls.
 - e. The basic design of overhead sign supports or breakaway sign supports.
 - f. The type of noise barriers.
- E. Payment - If the proposal is accepted, the changes and payment therefor will be authorized by Supplementary Agreement. Payment will be made as follows:
- (1) The changes will be incorporated into the Contract by adjustments in the quantities of Pay Items, agreed upon Extra Work Items or by Force Account, as appropriate, in accordance with the Specifications.
 - (2) The cost of the revised Work as determined from the aforementioned changes will be paid in accordance with GENERAL CONDITIONS Article "MEASUREMENT AND PAYMENT." In addition to such payment, upon Completion, the Authority will pay to the Contractor, under a separate Pay Item, 50 percent of the actual savings as reflected by the difference between the above as-built payment and the cost of the related construction required by the original Contract Documents computed at Contract bid prices. However, the Authority may disregard the Contract bid prices if such prices do not represent the value of the Work to be performed or to be deleted.
 - (3) The Authority's costs for review and processing of the proposal will not be deducted from the savings.
 - (4) The Contractor's costs for development, design, and implementation of the proposal are not eligible for reimbursement.
 - (5) The Contractor may submit proposals for an approved Subcontractor, provided that reimbursement is made by the Authority to the Contractor and that the terms of the remuneration to the Subcontractor are satisfactorily negotiated and accepted before the proposal is submitted to the Authority. Subcontractors may not submit a proposal except through the Contractor.

47. FINAL CLEANUP

Before final inspection and Completion, borrow and local material sources and all areas occupied by the Contractor in connection with the Work shall be cleaned of all rubbish, excess materials, temporary structures, and equipment, and all parts of the Work shall be left in an acceptable condition. If the Contractor fails to complete final cleanup within the time stated in the Specifications for the completion of the Contract or within such further time as may have been granted in accordance with the provisions of the Contract, the Contractor shall pay the Authority liquidated damages pursuant to GENERAL CONDITIONS Article "LIQUIDATED DAMAGES OR ACTUAL DAMAGES FOR DELAY."

48. RESERVED

49. RESERVED

CONTROL OF WORK

50. COMMUNICATIONS

Unless otherwise directed, all communications with the Authority shall be sent to the Engineer. Where communications are directed to persons other than the Engineer, a clear copy shall be sent to the Engineer.

51. THE AUTHORITY'S PROJECT ADMINISTRATION

Information or services under the Authority's control shall be furnished by the Authority through the Engineer with reasonable promptness so as to avoid delay in the orderly progress of the work. All instructions to the Contractor shall be issued through the Engineer.

52. AUTHORITY OF THE ENGINEER

The Engineer shall be the Authority's representative during the construction period. His authority and responsibility shall be limited to the provisions set forth in these Contract Documents. The Engineer will decide all questions which may arise as to the quality and acceptability of the Work and shall have the authority to reject defective work and materials whenever such rejection may be necessary to assure execution of the Contract in accordance with the intent of the Contract Documents. The Engineer will further decide all questions, which may arise as to the rate of progress of the Work as related to crews, equipment and work hours, interpretation of the Contract Documents, the acceptable fulfillment of the Contract on the part of the Contractor, and all questions as to compensation. All questions as to the interpretation of the Contract Documents shall be submitted to the Engineer in writing.

The Engineer shall have the authority to interpret project schedule requirements and to establish the necessary priorities for resolving conflicts between Contractors, and to enforce such measures as may be necessary to maintain overall project schedules. It is the intent of this Article that there shall be no delays in the progress of the critical elements of the project work, and the decision of the Engineer as rendered shall be promptly observed. The Engineer has the authority to suspend the Work wholly or in part pursuant to GENERAL CONDITIONS Article "SUSPENSION OF WORK" or "TEMPORARY SUSPENSION OF WORK" and to suspend partial payments under GENERAL CONDITIONS Article "PARTIAL PAYMENTS" due to the failure of the Contractor to correct conditions unsafe for the workers or the general public, for failure to carry out provisions of the Contract, or for failure to carry out orders. The Engineer may also suspend the Work wholly or in part for such periods as deemed necessary due to unsuitable weather, for conditions considered unsuitable for the prosecution of the Work, or for any other condition or reason deemed to be in the public interest.

53. DUTIES AND RESPONSIBILITIES OF THE ENGINEER

The Engineer is responsible for the administration of the Contract. This responsibility includes the authority to reject defective material and to suspend any and all the Work in accordance with GENERAL CONDITIONS Articles "SUSPENSION OF WORK" and "TEMPORARY SUSPENSION OF WORK." The Engineer will make periodic observations at the site of the project to determine the progress, quantity, and quality of the work and to determine, in general, if the work is proceeding in accordance with the intent of the Contract Documents. He shall not be required to make comprehensive or continuous inspections to check quality or quantity of the work. He shall not be responsible for construction means, methods, techniques, or procedures, or for safety precautions and programs in connection with the work. He shall not be responsible for the Contractor's failure to execute the work in accordance with Contract Documents. Observations made by the Engineer shall not relieve the Contractor of his obligation to conduct comprehensive inspections of the work and to furnish materials, to perform acceptable work, and to provide adequate safety precautions in conformance with the intent of the Contract Documents.

The Engineer will not be responsible for the acts or omissions of the Contractor, or any Subcontractor, or of the agents or employees of any Contractor or Subcontractor, or any other persons at the site or otherwise executing any of the work.

All claims by the Contractor arising from interpretation of or performance under the Contract Documents shall, in the first instance, be submitted to the Engineer, who shall issue his determination in writing within a reasonable period of time. If the Contractor considers that a determination made by the Engineer hereunder is not in accord with the meaning and intent of the Contract, the Contractor may, within fifteen (15) days from the receipt of the Engineer's determination, file with the Engineer a written objection to the Engineer's initial determination. The Contractor's written objection shall contain detailed arguments and all documentation necessary to support the objection. The Engineer shall consider and review the Contractor's written objection to the initial determination, with detailed supporting documentation, and render a final determination on the issue within a reasonable period of time. Failure to provide such detailed arguments and documentation shall be considered acceptance of the determination, and the determination shall become final and conclusive. Failure to file a written objection to the final determination, which requests a hearing before the Authority's Executive Director, within fifteen (15) days, shall be considered acceptance of final determination.

The Engineer's initial determination, the filing of the written objection thereto, and the Engineer's determination of such objection shall be a condition precedent to the right to request a hearing before the Authority's Executive Director, as provided for in Article "DISPUTES" of these GENERAL CONDITIONS. Thereafter, unless the Contractor and the Authority amicably resolve the matter, it shall be subject to the provisions of the Article "DISPUTES" of the GENERAL CONDITIONS.

54. INSPECTORS

The Authority may appoint (either directly or through the Engineer) such inspectors as the Authority deems proper, to inspect the materials furnished and the work performed for compliance with the Contract Documents. The Inspectors are authorized to inspect all Work. Such inspection may extend to all or any part of the Work and to the preparation, fabrication, or manufacture of the materials to be used. The Inspector is not authorized to alter or waive the provisions of the Contract. The Inspector is not authorized to issue instructions contrary to the Contract Documents or to act as foreman for the Contractor; however, the Inspector has the authority to reject Work subject to confirmation with the Engineer. The Contractor shall allow access and furnish all reasonable assistance required by the Engineer or Inspectors for the proper inspection of the work.

55. INSPECTION BY CONTRACTOR

The Contractor shall observe and inspect the quality and accuracy of his own work and work executed by his Subcontractors. Deficiencies found in the work shall be corrected prior to requesting inspection by the Engineer.

Inspection by the Engineer shall not relieve the Contractor from any obligation to perform his work strictly in accordance with the Contract Documents. Defective work performed shall be removed and replaced by the Contractor at his own expense.

56. INSPECTION OF WORK

Each part or detail of the Work is subject to inspection by the Engineer. The Engineer shall be allowed access to all parts of the Work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection. When the Engineer is in or about the site of the Work in the course of his employment, the Engineer is deemed conclusively to be an invitee of the Contractor. If the Contractor is not the authority of the place where fabrication, preparation, or manufacture is in progress, the authority thereof shall be deemed to be the agent of the Contractor with respect to the obligation assumed hereunder. The

Contractor or his agent shall be responsible for the payment of claims for injuries to the Engineer due to negligence on the part of the said Contractor or his agent.

The Engineer may order any Work done without the Engineer's inspection to be removed and replaced at the Contractor's expense. Payment for the Work will be made and the uncovering, or removing, and the replacing of the covering, or making good of the parts removed, of the uninspected Work will be paid for as Extra Work only if all of the following conditions are met:

1. The Work removed, uncovered, and/or replaced proves to have been acceptable in accordance with the Contract Documents; and
2. The Contractor gave reasonable notice in writing to the Authority that the uninspected work was to be performed; and
3. The Contractor, in performing the uninspected work, did not do so in the face of a directive from the Authority that such work not be performed.

Projects financed in whole or in part with Federal funds are subject to inspection at all times by the Federal agency involved, or such other Federal agencies as the United States requires. Such inspection does not make the Federal Government a party to this Contract. When any unit of government or political subdivision or any railroad is to pay a portion of cost of the Work covered by the Contract, its respective representatives shall have the right to inspect the Work. Such inspection does not make any such unit of government or political subdivision or any such railroad a party to the Contract and shall in no way interfere with the rights of either party hereunder.

The Contractor is responsible for carrying out the provisions of the Contract at all times and for control of the quality of the Work regardless of whether an authorized Inspector is present or not. This obligation to perform the Work in accordance with the Contract Documents is not relieved by the observations of the Engineer in the administration of the Contract, nor by inspections, tests, or approvals by others. Work not meeting the Contract requirements shall be made good, and unsuitable Work may be rejected, notwithstanding that such Work had been previously inspected and approved by the Authority or that payment therefor has been included in an estimate.

57. QUALITY CONTROL & QUALITY ASSURANCE TESTING

Quality control testing: The Contractor shall be responsible for all quality control testing as required and as specified in the technical sections of the Project Manual. All testing shall be performed by an Independent Testing Laboratory hired by the Contractor and approved by the Engineer. The Independent Testing Laboratory shall not be subject to control, restriction, modification or limitation from the Contractor and/or the project sub-Contractors. The Independent Testing Laboratory shall be certified to perform the testing by the appropriate certifying agency where said certification is either a requirement of the technical specifications or is considered industry standard. All cost associated with quality control testing shall be borne by the Contractor, and no separate payment will be made to the Contractor for this testing. The Contractor shall include the cost of quality control testing in either his lump sum bid or in the various items of work to which the quality control testing applies.

Quality assurance testing: The Engineer, in his discretion, may choose to perform quality assurance testing to verify that the construction or components thereof are in accordance with the contract documents. Said quality assurance testing is not obligatory on the part of the Engineer nor does performance of said quality assurance testing in any way obviate the performance of quality control testing on the part of the Contractor. The Contractor shall provide the Engineer, unhindered access to the Project for the performance of said quality assurance testing and shall assist the Engineer when necessary in the retrieval of samples for quality assurance testing of materials.

Should quality assurance testing indicate that the Work or portions of the Work do(es) not meet the specifications, the defective portion of the Work shall be removed and reinstalled correctly without cost to the Authority. Costs associated with quality assurance testing when Work is deemed to be deficient shall be borne by the Contractor. The Authority shall deduct these costs from payments due the Contractor. Otherwise, all costs associated with quality assurance testing shall be borne by the Authority.

58. SPECIAL INSPECTION, TESTING, OR APPROVAL

Whenever the Engineer considers it necessary or advisable to ensure the proper implementation of the Contract Documents, the Engineer has authority to require special inspection or testing of the Work in addition to that required elsewhere in the Contract Documents, whether or not such Work be then fabricated, installed, or completed. However, neither the Engineer's authority to act under this Article, nor any decision made by the Engineer either to exercise or not to exercise such authority, creates a duty or responsibility of the Engineer to the Contractor, any Subcontractor, or any of their agents or employees performing any of the Work.

If after commencement of the Work the Engineer determines that any Work requires special inspection, testing, or approval not provided for elsewhere in the Contract Documents, the Engineer will perform such inspection, testing, or approval using Authority facilities, by contracting with others for such services, or by instructing the Contractor by Field Order to order special inspection, testing, or approval. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Contract Documents or, with respect to the performance of the Work, with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, the Contractor shall bear all costs thereof, including the Engineer's additional services made necessary by such failure. If tests reveal no such failure, the Authority will bear such costs, and a Supplementary Agreement will be negotiated.

59. CONFORMITY WITH CONTRACT DOCUMENTS

All Work performed shall be in conformity with the lines, grades, cross-sections, dimensions, and material requirements, including tolerances shown in the Contract Documents. The purpose of tolerances is to accommodate occasional minor variations from the middle portion of the tolerance range that are unavoidable for practical reasons. When a maximum or minimum value is specified, the production and processing of the material and the performance of the Work shall be so controlled that the Work shall not be preponderantly of borderline quality or dimension. Although measurement, sampling, and testing may be considered evidence of conformity, the Engineer will determine whether the Work deviates from the Contract Documents.

In the event the Engineer finds the Work not in conformance with the Contract Documents but that reasonably acceptable Work has been produced, the Engineer will determine if the Work is to be accepted and remain in place. In this event, the Engineer will document the basis of the acceptability of the Work and provide for an appropriate adjustment in the contract price for such Work as deemed necessary. If an appropriate adjustment cannot be negotiated, the Work shall be removed and replaced or otherwise corrected at no cost to the Authority.

In the event the Engineer finds the Work not in conformance with the Contract Documents, including tolerances resulting in an inferior or unsatisfactory product, the Work shall be removed and replaced or otherwise corrected at no cost to the Authority.

Neither the observations of the Engineer in the administration of the Contract, nor inspections, tests, or approvals by persons other than the Contractor relieves the Contractor from his obligation to perform the Work in accordance with the Contract Documents.

60. EXAMINATION OF QUESTIONED WORK

At the direction of the Engineer, the Contractor, at any time before Acceptance, shall remove or uncover specified portions of the finished Work, which the Engineer had previously inspected. If such work is found to be in accordance with the Contract Documents, the Authority will issue a Modification Order authorizing payment for the cost of examination and replacement. The Contractor shall restore said portions of the Work to the standard required by the Contract Documents. If such work is found to be not in accordance with the Contract Documents, the Contractor shall correct the defective work, and the cost of examination and correction of the defective work shall be borne by the Contractor. If any work should be covered up without approval or consent of the Engineer, it shall, if examination is required by the Engineer, be uncovered at the Contractor's expense.

61. UNNOTICED DEFECTS

Any defective work that may be discovered by the Engineer before Contract Completion, or before final payment has been made, or during the guarantee period, shall be removed and replaced by work which shall conform to the provisions of the Contract Documents. Failure on the part of the Engineer to condemn or reject unacceptable work shall not be construed to imply acceptance of such work.

62. REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

All Work that does not conform to the requirements of the Contract is unacceptable unless otherwise determined acceptable under the provisions in GENERAL CONDITIONS Article "CONFORMITY WITH CONTRACT DOCUMENTS." Unacceptable Work, whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause, found to exist prior to Acceptance, shall be removed immediately and replaced in an acceptable manner at no cost to the Authority. Work shall not be done without lines and grades having been given by the Engineer or the Contractor as provided under GENERAL CONDITIONS Article "CONSTRUCTION STAKES, LINES, AND GRADES." Work done contrary to the instructions of the Engineer, Work done beyond the lines shown on the Plans, except as herein specified, or any Extra Work done without authority is considered as unauthorized and will not be paid for under the provisions of the Contract. Work so done may be ordered removed or replaced at no cost to the Authority. If the Contractor fails to comply promptly with any order of the Engineer made under the provisions of this Article, the Engineer will have authority to cause unacceptable Work to be removed or replaced by others and to deduct the costs thereof from any monies due or that may become due the Contractor.

63. RIGHT TO RETAIN DEFECTIVE WORK

If any part or portion of the work executed under this Contract shall prove defective, and if the defect in the same shall not be of sufficient magnitude or importance as to make the work dangerous or unsuitable, or if the removal of such work will create conditions which are dangerous or undesirable, the Authority has the right and authority to retain such work and the Authority may make such deductions in the final payment therefor as may be just and reasonable. Acceptance of such work shall in no way negate the guarantee on such work as set forth in the Article "GUARANTEE" of these GENERAL CONDITIONS.

64. LATENT DEFECTS

The Authority reserves and retains all of his rights and remedies at law against the Contractor and his Surety for the correction of any and all latent defects discovered after the guarantee period.

65. PROJECT MEETINGS

The Engineer will conduct project meetings for the purpose of discussing and resolving matters concerning the various elements of the work. Time and place for these meetings and the names of persons required to be present will be as directed by the Engineer. The Contractor shall comply with these attendance requirements and shall also require, if needed, his Subcontractors to comply.

66. INDEPENDENT CONTRACTOR

The Contractor shall execute all work under this Contract as an independent Contractor and neither he nor his Subcontractors at any time shall be considered as an agent of the Authority or Engineer.

67. SUPERINTENDENCE

The Contractor shall designate in writing before starting Work, a competent, English-speaking Superintendent capable of reading and thoroughly understanding the Contract Documents, and thoroughly experienced in the type of construction being performed. The Contractor shall inform the Engineer in writing of the name, address, and the telephone number (day and night) of such representative and shall submit the representative's resume of qualifications, years of experience, and names of previous projects on which he has worked in a supervisory capacity. The Superintendent shall have the authority to represent and act for the Contractor. The Contractor shall not remove or replace his authorized representative without notifying the Engineer. In the event the Contractor's representative ceases to be in his employ, the name and qualifications of an alternate representative shall be submitted to the Engineer. An alternate to the Superintendent, with equal authority and qualifications, may also be designated. The Superintendent or the alternate shall be present at the site of the Project at all times while Work is actually in progress on the Contract irrespective of the amount of Work subcontracted.

The Superintendent or the alternate shall have full authority to execute orders or direction from the Engineer, without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. When Work is not in progress and during periods when Work is suspended, arrangements acceptable to the Engineer shall be made for any emergency Work, which may be required.

Whenever the Superintendent or the alternate is not present on the site or at the location of any particular part of the Work where it may be desired to give direction, the Engineer may suspend all of the Work or the particular Work in reference until the superintendent or the alternate is present. Such suspension shall not be the basis of any claim against the Authority.

68. RECEPTION OF ENGINEER'S DIRECTIONS

The Superintendent, or other duly authorized representative of the Contractor, shall represent the Contractor in all directions given to him by the Engineer, and such directions, instructions, and other communications given shall be as binding as if given to the Contractor. Directions of major importance will be confirmed in writing, as will all directions, if requested by the Contractor.

69. ACCESS TO WORK

The Contractor shall provide to the Authority, Engineer, other Contractors working on the project, authorized government agents, and their representatives, at all times, safe access to the work wherever it is in preparation or progress. Such persons shall inform the Contractor of their visits

and the Contractor shall provide facilities for such access and for such inspection in keeping with his responsibility for construction site control, including maintenance of temporary and permanent access.

70. AUTOMATICALLY CONTROLLED EQUIPMENT

Whenever equipment is required to be operated automatically under the Contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods only for the remainder of the working day on which the breakdown or malfunction occurs, provided this method of operation produces results which otherwise meet the Specifications.

71. LOAD RESTRICTIONS

Within the limits of the Project, the operation of equipment of such weight or so loaded as to cause damage to structures, the roadway, airport facilities, or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete surface course, base course, or structure before the expiration of the curing period. In no case shall legal load limits be exceeded when equipment is used for hauling to and from the Project site unless permitted in writing by the Director of Motor Vehicles and the South Jersey Transportation Authority. The Contractor shall be responsible for all damage done by his hauling equipment.

The Authority will monitor the Contractor's observance of the legal load limits in accordance with the following:

1. For trucks with weigh tickets, a certified weigh ticket shall be furnished with each load.
2. For trucks without weigh tickets that are hauling material for items of 5,000 cubic yards or more, a list of trucks and their motor vehicle classifications shall be furnished prior to the start of work and shall be updated at the start of each construction season thereafter. A certified weigh ticket showing the gross weight shall be furnished with the first load for each truck for each item. The Engineer shall be notified in advance so that the first load can be documented by measurements and photographs.
3. For trucks hauling bituminous concrete from automated batch plants, a list of trucks including the certified tare weights and maximum allowable load for each shall be furnished prior to the start of work. This list shall be kept current and include all trucks to be used throughout the duration of the Project. Failure to provide this information will be cause for rejection of material.
4. For Portland cement concrete delivery trucks, a list of trucks including the certified tare weight and the maximum cubic yard load for each shall be furnished prior to the start of work and shall be updated at the start of each construction season thereafter.

Any truck found to be in excess of the legal load limit may have that load of material rejected for use on the Project. Repeated violations may be cause for suspension of operations until the condition is remedied to the satisfaction of the Engineer. No payment will be made for any material in excess of the legal truck load limit.

72. MAINTENANCE DURING CONSTRUCTION

Except as provided for below, the Contractor shall be responsible for maintenance within the Project limits until Acceptance pursuant to GENERAL CONDITIONS Article "COMPLETION AND

ACCEPTANCE." This maintenance shall consist of continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the roadway or airport facility is kept in satisfactory condition at all times.

In the case of a Contract requiring the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

On any section opened to traffic, whether provided for in the Contract Documents or opened as directed, any damage to the roadway due to the Contractor's operations shall be repaired at no cost to the Authority.

The Contractor shall not be responsible for removal of ice or snow from sections of roadways or airport facility opened to traffic or for damage to the Project caused by the operation of snow plows or other snow removal or de-icing operations carried on by others under the supervision or direction of the Authority or of the various counties and municipalities.

The Contractor shall not be responsible for mowing unless an item for mowing is scheduled in the Bid Form or an item directs the Contractor to perform mowing.

All costs for maintenance during construction shall be included in the various Pay Items scheduled in the BID FORM.

73. FAILURE TO MAINTAIN ROADWAY

If the Contractor at any time fails to comply with the provisions of GENERAL CONDITIONS Article "MAINTENANCE DURING CONSTRUCTION," the Engineer will immediately notify the Contractor of such noncompliance. If the Contractor fails to remedy unsatisfactory maintenance within 24 hours after receipt of such notice, the Engineer may proceed to maintain the Project and deduct the entire cost of this maintenance from any monies due or that may become due the Contractor.

74. CONSTRUCTION STAKES, LINES, AND GRADES

The Authority shall only furnish benchmarks for vertical control and monuments for horizontal control.

The Contractor shall provide all survey services required in connection with the layout for construction of the Project, using the control points and data furnished by the Authority. The Contractor shall furnish all necessary qualified personnel, registered in the State of New Jersey, and adequate equipment to preserve such controls throughout the duration of the Contract and shall lay out all of the lines and grades necessary for the complete construction of the Project. Also, furnish the Engineer with any assistance required for checking lines, grades, and measurements established (other than the Authority established survey points) and necessary for the performance of the work. The Authority does not assume responsibility for the performance of the work as a consequence of this checking.

The Contractor shall make all necessary computations to establish the exact position of all the Work from the control points, which are shown on the Plans or furnished by the Authority. All the Work shall be referenced to baselines which the Contractor shall establish from the control points, re-establish when necessary, and maintain throughout the life of the Contract so as not to delay the Engineer from making necessary preliminary, interim, and final measurements and from checking the Contractor's layout if the Engineer so desires.

The Authority will lay out the work to be done by utility companies using the baselines established by the Contractor. The Engineer will notify the Contractor, in writing, not less than five (5) days in advance of when the baselines shall be established.

The Contractor shall be responsible for the preservation of all control points furnished by the Authority for its use in staking out the Work. If such control points are damaged, lost, displaced, or removed, they shall be reset at no cost to the Authority.

The Contractor shall provide and maintain offset stakes from each main roadway baseline, from each ramp, jughandle, or turnaround baseline, and from each local road baseline, at each station, and outside the limits of grading and construction.

Each stake shall be identified and marked to show the offset distance from the baseline, and the Contractor shall furnish grade sheets showing the cut or fill to the finished profile lines with reference to the offset stakes. Grade sheets for construction of subbase and underlayer preparation shall also include calculations to establish the typical cross-section from the profile grade stake. The Contractor shall provide adequate and accurate offset lines during such construction that require occupation of the baseline points by construction operations.

The Contractor shall be responsible for maintaining the points it has established. Any error or apparent discrepancies found in the Plans or Specifications shall be called to the Engineer's attention in writing for interpretation prior to proceeding with the Work. The Contractor shall be responsible for the finished Work conforming to the lines and grades called for on the Plans, and the Contractor shall correct all errors caused by his personnel at no cost to the Authority.

Attention is directed to the need for caution in laying out and constructing storm drains or headwalls to ascertain that these items do not encroach on private property where easements have not been obtained.

Prior to the beginning of any construction work which requires accurate elevations, rough grading and clearing not included, the vertical control network shall be verified in the field by the Contractor's survey crew. The Contractor shall be responsible for the verification work. In most cases, some vertical control is provided for the Project as shown on the Plans. This control must be verified in the field using, at a minimum, third-order, Class I, procedural standards and equipment. In addition, supplemental bench marks may be required to provide a denser network for efficient construction surveys. Any discrepancies or errors shall be brought to the attention of the Engineer for resolution prior to proceeding with the Work. The Contractor shall provide the Authority with the field notes and calculations of the field verification of the vertical control. The Contractor, in addition, shall provide to the Engineer a list of the existing and new bench mark elevations which will be used on the Project.

The Contractor's survey crew shall be responsible to recover, verify, and check the horizontal control shown on the Plans. The Contractor shall be responsible for all the verification work. The field verification shall be performed at the beginning of the Project, as the control line(s) establish(es) a network of control points which are the basis for all subsequent horizontal work on the Project.

The Contractor's survey crew shall use, at a minimum, third-order, Class I, accuracy and procedures to establish and re-establish the horizontal control line. The Project baseline(s) shall be verified and established during the early phases of the Project. This baseline establishes a network of control monuments which are the basis for all subsequent horizontal surveys on the Project. Any discrepancies or errors shall be brought to the attention of the Engineer for resolution prior to proceeding with the Work. The Contractor shall provide the field notes and calculations of the field verification work.

No separate payment will be made for Contractor's Survey. The cost of the construction stakes, lines, and grades shall be absorbed by the Contractor in the prices bid for the various items of work.

75. COOPERATION BY CONTRACTOR

The Contractor shall give the Work the constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, the Authority's Inspectors, and other Contractors in every way possible.

The Contractor shall be solely responsible for all construction means, methods, techniques, and procedures; and he shall provide adequate safety precautions, coordinate all portions of his own work with the work of his Subcontractor, schedule his work to avoid conflict with the Authority's operations, and cooperatively coordinate his work with the work of other prime Contractors performing work for the Authority.

When the Contractor is comprised of two (2) or more persons, firms, partnerships, or corporations functioning on a joint venture basis, said Contractor shall designate in writing, before starting Work, the name of one (1) individual who shall have the authority to represent and act for the joint venture.

76. COOPERATION BETWEEN CONTRACTORS

The Authority reserves the right at any time to contract for and perform other or additional work on or near the Project site. When separate contracts are let within the limits of the Project, or in areas adjacent thereto, the Contractor shall conduct his Work so as not to interfere with or hinder the progress or completion of the work being performed by other Contractors. Moreover, the Contractor assumes the positive obligation of cooperating with such other Contractors and coordinating his activities with theirs. If there is a difference of opinion as to the respective rights of the Contractor and others doing work within the limits of or adjacent to the Project, the Engineer will decide as to the respective rights of the various parties involved in order to secure the completion of the Authority's Work in general harmony and in a satisfactory manner. The decision of the Engineer is final and binding and is not cause for claims by the Contractor for additional compensation.

The Contractor shall assume all liability, financial or otherwise, in connection with his Contract, and hereby waives any and all claims against the Authority for additional compensation that may arise because of inconvenience, delay, or loss experienced by it because of the presence and operations of other Contractors working within the limits of or adjacent to the Project.

The Contractor shall arrange his Work and shall place and dispose of the materials being used so as not to interfere with the operation of the other Contractors within the limits of the Project or adjacent thereto. The Contractor shall join his Work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

The Contractor is not responsible for damage to Work performed on the Contract or on other contracts within or adjacent to the site of the Project that may be caused by or on account of the work of other Contractors. The Contractor is responsible for any damage done or caused by his Work or forces to the work performed by other Contractors within or adjacent to the site of the Project, and the Contractor shall repair or make good any such damage in a manner satisfactory to the Engineer and at no cost to the Authority.

The provisions of this Article also apply to utilities and their Contractors working on the Project site or adjacent thereto.

77. COOPERATION WITH UTILITIES

The Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Authority to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control his/her operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans.

It is understood and agreed that the Authority does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of his/her responsibility to protect such existing features from damage or unscheduled interruption of service. Any damage shall be immediately repaired on a continuous basis until service is restored.

Within the site of the Project there may be public utility structures, and notwithstanding any other clause or clauses of the Contract, the Contractor shall not proceed with his Work until it has made inquiry at the offices of the Engineer, the utility owners and municipal authorities, or other owners to determine their exact location. The Contractor shall notify, in writing, the utility owners and municipalities or other owners involved of the nature and scope of the Project, and of his operations that may affect their facilities or property. Two (2) copies of such notices shall be sent to the Engineer. The Contractor shall also comply with the State's Underground Facility Protection Act and notify the State's One Call System and identify itself as the Authority's Contractor and specify the route and section number of the Project before performing Work on the Project. The One Call System can be reached by calling 1-800-272-1000.

The Contractor shall make a written request to the Engineer ten (10) working days in advance of the notice called for in the schedule to notify utility owners to proceed with each utility item. The Contractor's failure to give the ten (10) working day's notice hereinabove provided shall be cause for the Engineer to suspend the Contractor's operations in the general vicinity of a utility service or facility. The Contractor shall guarantee the site availability for utility operations. The Engineer will notify the utility owners to proceed if in the Engineer's opinion the site will be available for a particular item of utility work. In addition to the general written notification hereinbefore provided, it shall be the responsibility of the Contractor to keep such individual owners advised of changes in his/her plan of operations that would affect such owners.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use excavation methods acceptable to the Engineer within 3 feet of such outside limits at such points as may be required to ensure protection from damage due to the Contractor's operations.

Utility items constructed or installed by the Contractor for a utility owner must meet the owner's specifications. The owner shall be given the opportunity to inspect the actual material to be installed as well as the installation. The Contractor shall notify the utility owner ten (10) days in advance of the beginning of construction of the utility items.

Electrical installations of the Authority constructed either before or as part of the Contract shall be considered a utility, and all provisions of this Article shall be applicable. The Contractor shall protect, support, and secure all in place utility facilities so as to avoid damage to them and their interruption of service. The Contractor shall satisfactorily maintain the flow in drains and sewers at all times.

The Contractor shall not move utility facilities without the owner's written consent, and the facilities shall be as safe and permanent at Completion as they were before the Contractor's involvement. In the event the Contractor damages a utility facility, the Contractor shall notify the owner immediately and the owner may require the damage to be repaired at the Contractor's expense. The Contractor shall pay for the repair of utility facilities damaged by the Contractor within 30 days of the completed repair or the Authority may retain sufficient monies due or about to be due the Contractor to reimburse the owner for the repair of its facility. The Contractor shall be responsible to repair house services damaged by the Contractor's operation and must have the repair performed by competent mechanics.

The Contractor shall permit the utility owners or their agents access to their facilities at all times and shall cooperate with them in performing their work. The Contractor shall be cognizant that where joint use poles or duct banks are used the time frames for work performed by each user are cumulative.

Should the Contractor, solely for his own convenience, cause the utility company to incur costs not covered by the utility agreement, or delay the utility company, or incur costs without prior written approval of the Resident Engineer, the Contractor shall be responsible for these costs.

The Contractor shall cooperate with the utility owners concerned and shall notify them, through the Engineer, not less than ten (10) days in advance of the time it proposes to perform any Work that may endanger or affect their facilities. The Contractor assumes the obligation of coordinating his activities with those of the utilities.

For the purpose of establishing the exact location of subsurface utilities, the Engineer may direct the excavation of test pits. Failure of the Engineer to direct the digging of test pits does not relieve the Contractor of his responsibilities regarding the protection and preservation of utilities.

It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility facilities in their present or relocated positions as may be shown on Plans, as described in Specifications and as revealed by his site investigation; is aware that utility company service demands, adverse field conditions and emergencies may affect the Authority's ability to comply with the proposed schedules for utility work; and is cognizant of the limited ability of the Authority to control the actions of the utilities, including the actions of railroads, and has made allowances in his bid that no further compensation or extensions of Contract Time will be granted for delays, inconvenience or damage sustained by the Contractor due to any interference from utility facilities or the operation of moving them.

In addition to the foregoing provisions, the following specific provisions relate to railroads only:

- A. Railroad Traffic and Property - Where the Project includes Work across, over, under, or adjacent to railroad tracks or railroad right-of-way, the Contractor shall safeguard the traffic, tracks, and appurtenances, and other property of the railroad which may be affected by his work. The Contractor shall obtain the railroad's approval of the method of construction and timing of the Work. The Contractor shall comply with the regulations of the railroad relating to the Work, shall keep tracks clear of obstructions, and shall provide barricades, warning

signs, lights, or other safety devices as required by the railroad. Payment for such safety devices will be made in accordance with Traffic Control Item(s).

All Work done within the railroad right-of-way is subject to the approval of the railroad company in matters affecting operations, railroad property, safety and train operation. The safety and continuity of railroad operation shall be the first priority when working in proximity to the railroad. The Contractor and Subcontractors shall protect and safeguard railroad interest at all times and arrange their work to avoid interruption of train movements and damage to facilities of the railroad. Railroad approval does not release the Contractor from responsibility or liability for any damage which the railroad may suffer, or for which the Contractor may be held liable, by the acts of the Contractor or those of his Subcontractors or employees.

The Contractor shall develop a schedule with the railroad for his work within the railroad right-of-way and submit a copy of the schedule to the Resident Engineer.

The Contractor shall give written notice to the railroad and the Resident Engineer not less than 14 days in advance of when he or his Subcontractors shall start Work within the railroad right-of-way, or other Work which may affect railroad property, in order that necessary arrangements may be promptly made to protect railroad property. In the event the Contractor does not start work on the scheduled date, through no fault of the railroad, and the railroad incurs costs resulting from the Contractor's request for the railroad services, the Authority will reimburse the railroad, and these costs will be deducted from partial or final payments to be made to the Contractor. If the Contractor does not submit to the Resident Engineer a copy of the notice to the railroad and the Contractor performs the Work within the railroad right-of-way for which the railroad incurs costs, the Authority will reimburse the railroad and these costs will be deducted from partial or final payments to be made to the Contractor.

Fouling of railroad facilities track, power lines, and signal systems occur when the railroad parameters for normal operation are jeopardized because of obstructions in close proximity to the facilities. The Contractor shall obtain from the railroad its fouling parameters for the Work site and observe the railroad's regulations concerning fouling. Construction equipment or material shall not be stored or operated within the fouling distance of the railroad facilities without written permission of the operating railroad.

Equipment used on and adjacent to the railroad right-of-way shall be in first class condition so as to fully prevent any failure that might cause delay in the operation of trains or damage to railroad facilities. Contractor equipment is subject to railroad inspection at all times and shall not stand or be put in operation adjacent to the track without first obtaining permission from the railroad.

The railroad company may assign inspectors or engineers during the time the Contractor is engaged in Work on railroad property for the general supervision of construction operations, to ensure adherence to the Contract documents and applicable railroad requirements, and to ensure the use of approved construction methods. The salary and expense of said inspectors or engineers and the cost of any other engineering services furnished by the railroad will be paid directly to the railroad by the Authority in accordance with the Railroad Utility Agreement. The Authority will also reimburse the railroad for Project related costs to be incurred by the railroad as set forth in the Railroad Utility Agreement.

Should the Contractor, solely for its own convenience, cause the railroad to incur costs not covered by the railroad agreement or delay the railroad, or incur costs without prior written approval by the Resident Engineer, the Contractor shall be responsible for these costs. The Authority will reimburse the railroad for the Contractor generated costs and deduct these expenses from partial or final payment due the Contractor.

- B. Railroad Insurance - The applicable insurance provisions are as specified in the Specifications for Railroad Insurance.

78. SAFETY

The Contractor shall be solely and completely responsible for conditions at the jobsite, including safety of all persons (including employees) and property during execution of the work. This requirement shall apply continuously and not be limited to normal working hours. Project safety provisions shall conform to U.S. Department of Labor (OSHA), the New Jersey Occupational Safety and Health Act, and all other applicable laws including those that may be specified in other parts of these Contract Documents, and shall in any event comply with the common law standards of due care. Where any of these are in conflict, the more stringent shall apply. The Contractor's failure to thoroughly familiarize himself with these safety provisions shall not relieve him of responsibility.

AIRPORT SAFETY REQUIREMENTS

The Contractor shall adhere to the following airport safety requirements for airport projects.

The Contractor shall take all precautions necessary to insure the safety of the public as well as his own equipment and personnel. The Contractor shall obey all instructions as to routes to be taken by equipment traveling within the Airport area and keep all such equipment marked with a three foot (3') checkered orange and white flag. Equipment not actually in operation shall be kept clear of aircraft movement areas and designated restricted areas. The Engineer must approve all equipment storage locations.

The Contractor will not be permitted to leave any trenches or other excavations open overnight, on weekends, or at other times when the Contractor's workmen are not on the site. If it is absolutely necessary to leave a trench or excavation open when approved by the Engineer, the Contractor shall barricade and cover the opening to the complete satisfaction of the Engineer. The Contractor may be required to use covers over such open excavation, which will withstand the wheel load of the heaviest vehicle using the Airport facilities.

The Contractor shall take all necessary precautions to prevent fires adjacent to the work, and he shall prevent the spread of fires to areas outside the limits of the work. He shall provide adequate facilities for extinguishing fires and shall safely dispose of combustible materials off airport property.

Any signs, lights, signals, temporary walkways, traffic control, portable flashing lights, airport breakaway barriers, and other devices which may be required for safe traffic control shall be provided and maintained by the Contractor during the course of the work, subject to the approval of the Engineer.

Air traffic will continue to use existing runways and taxiways of the Airport during the work under this Contract is being performed. The Contractor shall at all times conduct his work so as to create no hindrance, hazard, or obstacle to air traffic using such portions of the Airport as are not

officially closed to air traffic, and must, at all times, conduct the work in conformance with the requirements of the Airport Manager. The Contractor is cautioned that he should not have any men or equipment within 280' of either runway centerline when the runway is open for operations. Any inconvenience occurring is assumed to be a subsidiary obligation of the Contractor and the cost shall be absorbed in the unit prices bid for the various items of work.

Airport hazard marking shall be furnished, installed and maintained by the Contractor, in accordance with "Safety on Airports During Construction Activities" contained in an Appendix in the Specifications.

The Contractor shall hold harmless the Authority, the Engineer, and their respective agents or representatives from any and all claims for damages, costs, expenses, judgement or decrees resulting from negligence on the part of the Contractor, or his, or their, or its agent or employees in conducting the work as required by this Contract.

The cost of the Airport Safety Requirements shall be absorbed by the Contractor in the prices bid for the various items of work.

79. PROTECTION OF WORK AND PROPERTY AND SECURITY

The Contractor shall, at all times, safely guard all property from injury or loss in connection with work performed under this Contract. All passageways, guard fences, lights, and other facilities required for protection by Federal, State or local laws shall be provided and maintained.

The Contractor shall protect his work and materials from damage due to the nature of the work, the elements, adjacent construction operations, or from any cause whatsoever until the completion and acceptance of the work. All loss or damages arising out of the nature of the work to be done under these Contract Documents shall be borne by the Contractor.

Contractor shall be responsible for maintaining lane closures through which to access the work site. The Contractor shall provide the Engineer with a minimum of 72 hours' notice for all lane closures. The Contractor must have New Jersey State Police (NJSP) on duty at all times during lane closures. Costs associated with providing NJSP will be paid by the South Jersey Transportation Authority except for work involving punch-list items or rework due to non-conformance to contract requirements as these NJSP costs will be paid by the Contractor.

A "Special Employment Voucher" is provided in the Appendix of these specifications for documentation of NJSP hours. The Contractor shall be responsible for completing the form for all lane closures in a given day and submitting the form to the Authority.

80. RESPONSIBILITY OF CONTRACTOR TO ACT IN EMERGENCY

In case of an emergency that threatens loss or injury of property or safety of life, the Contractor shall act, without previous instructions from the Authority or Engineer, as the situation may warrant. The Contractor shall immediately inform the Engineer of the emergency action taken. Any claim for compensation by the Contractor, together with substantiating documents in regard to expense, shall be submitted to the Engineer and the amount of compensation, if any, shall be determined by agreement prior to the issuance of a Modification Order. However, if the emergency is created or aggravated by the Contractor, he shall be liable for the resulting

damages. If the Contractor fails to take the necessary action as required by such an emergency, the Authority may assign another Contractor or use his own forces to perform the emergency work.

81. PARTIAL ACCEPTANCE

If at any time during the prosecution of the Project the Contractor completes a unit or portion of the Project, such as a structure, an interchange, or a section of road, or pavement, or runway, or taxiway, the Contractor may request the Engineer to make final inspection of that unit. If the Engineer finds upon inspection that the unit has been satisfactorily completed in compliance with the Contract, the Engineer may accept that unit as being completed, and the Contractor may be relieved of the responsibility of doing further Work on or maintaining that unit or portion of the Project. The Engineer reserves the right to reject the request made by the Contractor, if the Engineer determines that the unit or portion of the Project should not be the subject of a partial acceptance. Such partial acceptance shall in no way void or alter any of the terms of the Contract, including GENERAL CONDITIONS Articles "RISKS ASSUMED BY THE CONTRACTOR", nor shall it be construed as relieving the Contractor of full responsibility for making good defective work or materials found at any time before Acceptance pursuant to GENERAL CONDITIONS Article "COMPLETION AND ACCEPTANCE."

82. SUBSTANTIAL COMPLETION DATE

When the Contractor considers that the work, or a designated portion thereof which is acceptable to the Authority, is substantially complete, the Contractor shall prepare and submit to the Engineer a list of items to be completed or corrected and request an inspection for Substantial Completion. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all work in accordance with the Contractor Documents.

If, however, the inspection discloses that the Work is not substantially completed to the Engineer's satisfaction, the Engineer will give the Contractor the necessary instructions for completion and correction of same, and the Contractor shall immediately comply with and execute such instructions. Upon completion and correction of the Work, the Contractor shall re-notify the Engineer and another inspection will be made.

When the Engineer on the basis of the inspection determines that the work or that designated portion of the work is substantially complete the Engineer; shall state the responsibilities of the Authority and the Contractor for security, maintenance, heat utilities, damage to the work, and insurance; and shall fix the time within which the Contractor shall complete the items listed therein.

Guarantees required by the Contract Documents shall commence on the date of the Substantial Completion of the Work or designated portion thereof, unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Authority and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.

The issuance of a Certificate of Substantial Completion for any part of the work shall not relieve the Contractor of his obligation to promptly remedy any omissions and latent or unnoticed defects in the work covered by the Certificate of Substantial Completion.

Upon substantial completion of the work, an amount retained may be paid to the Contractor. When the work has been substantially completed, except for work which cannot be completed because of weather conditions, lack of materials, or other reasons which in the judgment of the Authority are valid reasons for non-completion, the Authority may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the work still to be completed or, in the alternative, may pay out the entire amount retained and receive from the Contractor guarantees in the form of a bond or other collateral sufficient to ensure completion of the work. The application for payment at substantial completion shall be accompanied by all

documentation called for in the Contract Documents and such other data and schedules as the Authority may reasonably require, together with complete and legally effective releases or waivers (satisfactory to the Authority) of all liens arising out of or filed in connection with the work. In lieu thereof and as approved by the Authority, the Contractor shall furnish receipts or releases in full; an affidavit of the Contractor that the releases and receipts, including all labor, services, material and equipment for which a lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the work for which the Authority or his property might in any way be responsible, have been paid or otherwise satisfied; and consent of the Surety, if any, to this payment.

The Authority shall have the right to restrict the Contractor's use of the occupied portion of the work after the date of Substantial Completion, but the Authority shall allow the Contractor reasonable access to complete or correct items required by the Contract Documents.

83. COMPLETION AND ACCEPTANCE

Upon receipt by the Engineer of written notice from the Contractor that the Work has reached Completion and is ready for final inspection and Acceptance, the Engineer will promptly make such inspection. When such inspection indicates that the Work is to be in compliance with the Contract, the Engineer will promptly issue a Certificate of Completion stating that, to the best of his knowledge, information, and belief, and on the basis of observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract. If, however, the final inspection discloses that the Work has not reached Completion, the Engineer will give the Contractor the necessary instructions for the correction of deficiencies, and the Contractor shall immediately comply with and execute such instructions. Upon correction of the deficiencies, the Contractor shall re-notify the Engineer, and another inspection will be made. This procedure is to be repeated until a Certificate of Completion is issued.

At the request of the Contractor, the Engineer may issue a Certificate of Completion without receiving all required documents, certificates, or proofs of compliance. The Contractor's request must satisfactorily establish that the Contractor could not reasonably and in good faith provide some of the required documents, certificates, or proofs of compliance at a time contemporaneous with Completion and with the Project being ready for use by the Authority to the degree contemplated by the Contract. In such instances where a Certificate of Completion is issued, the Contractor shall expeditiously attempt to provide the exempted document, certificate, or proofs of compliance. Final payment will not be made, however, until all such documents, certificates, and proofs of compliance have been satisfactorily executed and delivered to the Engineer.

The Certificate of Completion is issued establishing Completion as of the date of the notice or re-notice from the Contractor. If the Executive Director concurs in the Certificate of Completion, the Contractor will be notified of Acceptance and the date thereof.

After Acceptance, the Contractor is relieved of the duty of maintaining and protecting the Work as a whole, and is not required to perform any further Work thereon. In addition, the Contractor is relieved of his responsibility for damage to the Work, which may occur after Acceptance. However, nothing herein shall be construed to limit the provisions of GENERAL CONDITIONS Articles "RISKS ASSUMED BY THE CONTRACTOR," "INSURANCE AND LIABILITY," and "NO WAIVER OF RIGHTS."

84. RESERVED

85. RESERVED

CONTRACT DOCUMENTS

86. PLANS AND SPECIFICATIONS

The Plans consist of general drawings and show such details as are necessary to give a comprehensive idea of the construction contemplated. The Plans show details of all structures, lines, grades, typical cross-sections and/or roadway, runway or taxiway location and design of all structures, and a summary of items appearing on the Proposal Form. The Contractor shall keep one (1) set of Plans available on the Project site at all times. All alterations affecting the requirements and information given on the Plans will be authorized in writing.

Omissions from the Plans or Specifications of details of Work which are manifestly necessary to carry out the intent of the Contract Documents, or which are customarily included, shall not relieve the Contractor from including such omitted details of Work, but they shall be included as if fully and correctly set forth and described.

87. ADDITIONAL CONTRACT DOCUMENTS

The Engineer will furnish to the Contractor on request and free of charge, three (3) copies of the Contract Documents. Additional copies of Contract Documents may be obtained on request by paying the actual cost of supplying the additional Contract Documents.

88. SUPPLEMENTING DRAWINGS, INSTRUCTIONS, WORKING DRAWINGS AND CATALOG CUTS

Upon request, the Engineer may furnish, with reasonable promptness, additional instructions by means of supplementing drawings or otherwise if, in the Engineer's opinion, such are required for the proper execution of the work and are in accordance with the requirements of the Contract Documents. All such instructions will be consistent with the terms and become a part of the Contract Documents. The purpose of these instructions is to provide further explanation of the work. If, in the opinion of the Engineer, additions or deletions to the work are identified in these instructions, such additions or deletions shall be made to the Contract by a Change Order as defined in Article "CHANGES" of these GENERAL CONDITIONS.

The Contractor shall make all working drawings, which may be required in addition to the Contract Drawings or in addition to any other drawings, which the Engineer may issue in supplementing the Contract Drawings.

The specific requirements elsewhere set forth in the Specifications for furnishing working drawings for any particular portion of the Contract shall not limit the obligation of the Contractor to furnish working drawings for any other portion when so required by the Engineer.

In preparing the working drawings, the Contractor may adopt a sheet of any reasonable size which best suits his needs, but having adopted such size, all sheets thereafter of a similar nature shall be of the same size as the adopted. Each drawing shall have a margin on the top, bottom and right-hand side of one-half inch (.5") and on the left-hand side a margin of one and one-half inch (1.5").

Before using any working drawings, the Contractor shall submit nine (9) blueprints thereof (or more if requested) for the approval of the Engineer. Within fourteen (14) calendar days after receipt of the prints, the Engineer shall approve the same or require corrections or additions to be made thereon. If additions or corrections are required, the Engineer shall return within the fourteen (14) calendar day period three (3) of the nine (9) blueprints submitted and the Contractor shall make the corrections or additions shown thereon to be made. He shall resubmit nine (9)

blueprints showing the drawing corrected as required. Each drawing shall be corrected as required until the approval of the Engineer is obtained. After each re-submission, the Engineer shall have a similar period of fourteen (14) calendar days in which to approve corrections.

As soon as approval has been given to any working drawing or shop bill, the Contractor shall within five (5) days send to the Engineer nine (9) prints, except that when the Engineer specifically so directs twelve (12) prints shall be sent. After approval thereof, no change will be permitted thereon unless approved in writing by the Engineer.

Before final payment for the Work is made, the Contractor shall furnish to the Engineer one (1) set of working drawings, all clearly revised, completed and brought up to date showing the permanent construction as actually made. These working drawings shall be either drawn in ink, drafting lead, or similar writing material on 80 micrometers minimum thickness, polyester film, such as Mylar or Herculene, from any of which so as to produce clear and legible prints.

The Contractor shall prepare and furnish to the Engineer, in duplicate, prints showing in detail all plant and equipment which he intends to use at the construction site.

The Contractor shall furnish catalog cuts where specifically required by the Specifications, and for other items where the Engineer may deem them necessary. Nine (9) copies of catalog cuts shall be submitted for approval and the Engineer shall return five (5) copies to the Contractor within fourteen (14) calendar days indicating appropriate action.

Approval of drawings or catalog cuts which are inconsistent with the requirements of the Contract Drawings and Specifications shall not be deemed to waive or change such requirements or to relieve the Contractor of his obligation to perform such requirements, unless the Engineer shall expressly and specifically state that he is waiving or changing such requirements.

The Contractor shall fill in the dates on which he will furnish such working drawings and catalog cuts in a schedule furnished by the Contractor to the Authority. The completed schedule shall be delivered to the Engineer for his approval within ten (10) days after execution of the Contract.

All drawings, data, and other papers of any type whatsoever, whether in the form of writing, figures or delineations, which are prepared in connection with this Contract and submitted to the Authority shall become the property of the Authority. Except to the extent that rights are reserved to others under valid patents for which the Authority is not given a license under the provisions of the Article entitled "ROYALTIES, PATENTED DEVICES, MATERIALS, AND PROCESSES", the Authority shall have the non-exclusive right to use or permit the use of all such drawings, data and other papers and any ideas or methods represented thereby for any purpose at any time without additional compensation. No such papers shall be deemed to have been given in confidence. Any statement or legend to the contrary in connection with such drawings, data or other papers and in conflict with the provisions of this paragraph shall be void and of no effect.

89. DISCREPANCIES AND OMISSIONS

Should anything which is necessary for a clear understanding of the work be omitted from the Contract Documents, or should it appear that various instructions are in conflict, the Contractor shall secure written instructions from the Engineer before proceeding with the work affected by such omissions or discrepancies.

In resolving inconsistencies among two (2) or more sections for the Contract Documents, precedence shall be given in the following order:

First Executed Construction Agreement

Second	Proposal Section
Third	Plans
Fourth	Special Provisions
Fifth	General Conditions
Sixth	NJDOT Supplemental Specifications
Seventh	NJDOT Specifications
Eighth	Cited Standards for Materials or Testing

Figured dimensions on Plans and calculated dimensions shall take precedence over scale dimensions. Detailed Plans in the Contract Documents shall take precedence over general plans.

As the Work progresses, it is anticipated that the Contractor shall frequently apply to the Engineer relative to the interpretation and coordination of the Contract Documents. Such applications shall be in writing. Should it appear that the Work to be done or any of the matters relative thereto are not sufficiently detailed or explained in the Contract Documents, the Contractor shall apply to the Engineer for such further explanations as may be necessary and shall conform to them as part of the Contract.

Both parties realize that in performing the Work, field conditions may require modifications in the Plans and quantities of Work involved. Work under all Pay Items must be carried out to meet these field conditions to the satisfaction of the Engineer and in accordance with its directions and the Contract Documents.

The Contractor shall not take advantage of any apparent error or omission in the Contract Documents. In the event the Contractor discovers any discrepancy, error, or omission in the Plans, Specifications, or other Contract Documents, or if there is any doubt or question as to the intent or meaning of the Plans, Specifications, or other Contract Documents, the Contractor shall immediately notify the Engineer in writing. The Engineer will promptly make, in writing, such corrections and interpretations as deemed necessary.

90. VERIFICATION AND WARRANTY

The Contractor shall thoroughly examine and become familiar with all of the various parts of the Contract Documents and determine the nature and location of the work, the general and local conditions, and all other matters, which can in any way affect the work under this Contract. Failure to make an examination necessary for this determination shall not release the Contractor from the obligations of this Contract. The Contractor warrants that no verbal agreement or conversation with any officer, agent, or employee of the Authority, or Engineer, either before or after the execution of this Contract, has affected or modified any of the terms or obligations herein contained.

91. DOCUMENTS TO BE KEPT ON THE JOBSITE

The Contractor shall keep one (1) copy of the Contract Documents on the jobsite, in good order, available to the Engineer. The Contractor shall maintain on a daily basis at the jobsite, and make available to the Engineer on request, one (1) current record set of the Plans which have been accurately marked up to indicate all approved changes in the completed work that differ from the information shown on the Plans. Upon substantial completion of the work, the Contractor shall give the Engineer one (1) complete set of marked-up record Plans.

92. OWNERSHIP OF CONTRACT DOCUMENTS

The Contract Documents, and copies of parts thereof, furnished by the Engineer are the property of the Authority. They are not to be used on other work and, with the exception of the signed Contract set, are to be returned to him at his request. Any reuse of these materials without authorization by the Engineer will be at the risk of the user and without liability or legal expense to the Engineer or to the Authority. Any such authorization will entitle the Engineer to compensation at rates to be agreed upon by the user and the Engineer.

93. RESERVED

94. RESERVED

CONTROL OF MATERIAL

95. SOURCE OF SUPPLY AND QUALITY REQUIREMENTS

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, utility services, tools, equipment, and all appliances, machinery, transportation, and appurtenances necessary for the execution and completion of the work and such additional items not specifically indicated or described that can be reasonably inferred as belonging to the item described or indicated and as required by good practice to provide a complete and satisfactory system or structure.

All materials for the Project shall be furnished by the Contractor and shall be new, unless otherwise specifically prescribed in the Contract Documents and both workmanship and materials shall be of good quality, and fit for the particular purpose for which used. The materials shall conform to the requirements of the Contract Documents and shall be from approved sources. Only materials which have been approved by the Engineer shall be used.

Within 12 hours after receiving a shipment of materials, the Engineer shall be notified of the kind, size, quantity, and location thereof.

In any item of construction, the sources, brands, or types of materials shall not be changed without the consent of the Engineer. Request for such changes shall be filed with the Engineer 30 days prior to shipment or 30 days prior to the date needed, whichever is earlier, of such changes as required above. The request shall state the name and address of the owner, the location of the proposed source, the method of shipment, and the intended use of the material.

The foregoing provisions shall apply with regard to requests by Subcontractors for the sources of the materials they propose to use, such requests to be submitted through the Contractor.

The notice provisions of this Article shall not be so construed as to relieve the Contractor of his obligation to ensure that all materials required for the construction of the Project shall be available at the time and place necessary for their incorporation into the Work in order that the completion date set forth in the Information to Bidders is met. If any doubt exists as to the timely availability of any material, the Engineer shall be immediately informed, in writing, of the potential problem and of the action to be taken to guarantee the availability of such material. Stockpiles of materials whose availability is or may be problematical shall be established at an early date.

On Airport projects the Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is listed in FAA Advisory Circular (AC) 150/5345-1, Approved Airport Equipment that is in effect on the date of advertisement.

96. LOCAL MATERIAL SOURCES

Possible sources of local materials may be designated on the Plans or in the Specifications. The quality of material in such deposits may be acceptable in general, but the Contractor shall determine for itself the amount of equipment and Work required to produce a material meeting the requirements of the Contract Documents. It shall be understood that it is not feasible to ascertain from samples the limits or quantity for an entire deposit, and that variations shall be considered as usual and are to be expected. The Engineer may order procurement of material from any portion of a deposit and may reject portions of the deposit as unacceptable.

The Authority may acquire, and make available to the Contractor, the right to take materials from the sources designated on the Plans or described in the Specifications, together with the right to use such property as may be specified, for plant site, stockpiles, and hauling roads.

If the Contractor desires to use material from sources other than those designated, the Contractor shall acquire the necessary rights to take materials from the sources and shall pay all costs related thereto, including any which may result from an increase in length of haul. All costs of exploring and developing such other sources shall be borne by the Contractor. The use of material from other than designated sources is not permitted until such preliminary samples as may be required by the Engineer have been obtained and tested at the expense of the Contractor. Additional samples may be required of the Contractor for inspection and testing by the Engineer prior to approval of and authorization to use the source.

When material sources are not described in the Specifications or where those designated provide insufficient material, the Contractor shall provide sources of acceptable material. When these sources are provided by the Contractor, the Authority assumes the cost of processing samples to determine the suitability of the material except as in GENERAL CONDITIONS Article "MATERIALS, INSPECTIONS, TESTS, AND SAMPLES".

Unless otherwise permitted, borrow pits and quarries occupied by the Contractor, or his Subcontractor, or suppliers exclusively for the Project shall be so excavated that water does not collect and stand therein. Sites from which material has been removed shall be left in a neat and presentable condition before Completion. Where practicable, all pits and quarry sites shall be located so that they are not visible from the highway.

97. SUBMITTALS

Submittal requirements for shop drawings and other items to be submitted by the Contractor are, if applicable, set forth in GENERAL CONDITIONS Article "SUPPLEMENTING DRAWINGS, INSTRUCTIONS, WORKING DRAWINGS AND CATALOG CUTS" and the Specifications and/or Technical Provision.

98. RELEASE OF BITUMINOUS AND CEMENT CONCRETE

Material will be released from the plant when the Inspector notifies the plant that conditions at the job site are acceptable for incorporation of the material into the work. The Engineer shall be notified at least 24 hours in advance of any anticipated releases.

99. MATERIALS, INSPECTIONS, TESTS, AND SAMPLES

The Contractor shall furnish, without extra charge, the necessary test pieces and samples, including facilities and labor for obtaining the same, as requested by the Engineer. When required, the Contractor shall furnish certificates of tests of materials and equipment made at the point of manufacture by a recognized testing laboratory approved by the Engineer. All materials

will be inspected, tested, and approved before incorporation in the Work. Unapproved materials may be used only with written permission of the Engineer. In the absence of such written permission, unapproved materials will not be paid for and shall be removed at no cost to the Authority.

All materials being used are subject to inspection, testing, or rejection at any time prior to Acceptance.

Samples will be taken by a representative of the Contractor in the presence of the Engineer. Results of tests, made with the Contractor's laboratory apparatus and conforming to the requirements specified in the prescribed methods of tests will be furnished to the Engineer. Testing will be performed in accordance with AASHTO or ASTM methods of tests or in accordance with specified New Jersey Department of Transportation test methods.

Nothing in this Article shall be construed to limit the right of the Engineer to order special inspection or tests as provided in GENERAL CONDITIONS Article "SPECIAL INSPECTION, TESTING, OR APPROVAL". If the Specifications, the Engineer's instructions, laws, or any public authority require any work to be specially tested or approved, the Contractor shall give timely notice of his readiness for testing or inspection. Inspections to be conducted by the Engineer will be promptly made, and where practicable, at the source of supply.

The required number of samples and rate of sampling, or Certifications of Compliance for the various materials are as specified in the respective methods of test or in the Articles applicable to that particular material or Pay Item. Additional samples shall be required whenever, in the opinion of the Engineer, additional tests are required to determine the quality and suitability of materials for their respective uses.

The sampling and field testing of soil aggregates shall conform to the general requirements for sampling and testing specified in the Articles applicable to that particular material/Pay Item or the New Jersey Department of Transportation's Standard Specification Section 901, and with the following requirements, provided, however, that the following requirements shall govern where there is any conflict or inconsistency between them.

The Contractor shall determine initially, by means of proper sampling and laboratory tests that soil aggregate materials from proposed sources conform to the requirements of the Specifications. Written notice of the proposed sources of soil aggregate materials, as well as the results of the sampling and testing, shall be given to the Engineer by the Contractor after the initial determination as specified above, and not less than ten (10) days prior to the time of their intended use. The Engineer may request the Contractor to sample and test materials representative of that portion of the source intended to be used.

Approval by the Engineer of a proposed source of any aggregate materials does not constitute approval of materials delivered to the site of the Work from that source, but shall be deemed as permission to select and use materials from that source only so long as they conform to the Specifications. The Contractor shall progressively determine for itself by proper sampling and laboratory tests, while the sources are in use, that materials selected from approved sources conform to the Specifications. Should the source contain oversize material, the Engineer may require the Contractor to eliminate such oversize material.

The final and governing determination of conformance or nonconformance with the Contract Documents will be made based on sampling and testing of the materials after they have been placed in accordance with the Contract Documents. All materials in place in the Work which do not conform to the Contract Documents shall be removed and replaced with materials which do conform thereto, or their deficiencies shall be corrected. For those materials subject to density

testing, conformance shall include compliance with the density requirement. After the initial corrective action has been taken, the Contractor will take an additional sample, and if necessary, one (1) check sample. If the materials still do not conform to the requirements of the Contract Documents after additional corrective action, the Contractor shall supply the Engineer with a gradation of the in-place material showing the size of sample, all calculations, final gradation, name of person performing the test, date, and location of sample taken. Further testing will not be performed by the Contractor until the Contractor certifies that the rejected material has been corrected. After this certification, the Engineer will analyze one (1) additional sample supplied by the Contractor, and if this sample does not meet the Contract Documents, the material shall be removed.

The Contractor shall excavate test pits and provide such facilities as the Engineer may require in order to properly sample the source and shall, if the source is approved, remove any overburden which would contaminate the material intended for use on the Project. If soil aggregate materials are obtained by dredging, the Contractor shall provide safe and adequate water transportation for the Engineer to and from the dredges or other boats and shall cooperate with the Engineer in every reasonable way to expedite inspection and sampling of the materials. The cost of such work, facilities, and transportation, in connection with sampling by the Engineer at the proposed source of soil aggregate materials, and the initial and progressive sampling and testing of materials at their sources, performed by the Contractor, shall be included in the prices bid for the various Pay Items scheduled in the Proposal as well as the sampling and testing of aggregates which meet the Specifications and are used in the Work.

The cost of sampling and testing by the Contractor of soil aggregates which do not conform to the Specifications for gradation and density and the cost of sampling and testing of soil aggregates which do conform to the Specifications but are not used in the Work shall be paid by the Contractor.

100. PERFORMANCE TESTING

Operating equipment and systems shall be performance tested in the presence of the Engineer to demonstrate compliance with the Specifications. Performance testing shall be conducted under the specified design operating conditions or under such simulated operating conditions as recommended or approved by the Engineer. Such testing shall be scheduled with the Engineer at least one (1) week in advance of the planned date of testing. Detailed test requirements are set forth in the Specifications.

101. CERTIFICATION OF COMPLIANCE

Materials or assemblies, as specified, will be accepted on the basis of Certificates of Compliance stating that such materials or assemblies fully comply with the requirements of the Contract. The form of Certificates of Compliance must be approved by the Engineer.

Materials or assemblies, used on the basis of Certificates of Compliance, may be sampled and tested at any time. If found not to be in conformance with the Contract requirements, materials and assemblies will be rejected whether in place or not. The Contractor shall require the manufacturer or supplier to furnish four (4) copies of Certificates of Compliance with each delivery of materials, components, and manufactured items that are acceptable by certification. The Engineer will be provided with three (3) copies and one (1) copy shall be retained by the Contractor.

Certificates of Compliance are to contain the following information:

- A. Project to which the material is consigned.

- B. Name of the Contractor to which the material is supplied.
- C. Kind of material supplied.
- D. Quantity of material represented by the certificate.
- E. Means of identifying the consignment, such as label marking, seal number, etc.
- F. Date and method of shipment.
- G. Statement that the material has been tested and found in conformity with the pertinent Contract requirements stated in the certificate.
- H. Signature of a person having legal authority to bind the supplier.
- I. Signature attested to by a notary public or other properly authorized person.

Payments will not be made for materials specified to be accepted on the basis of Certificates of Compliance until the Engineer has received the required Certificate of Compliance.

102. PLANT INSPECTION

The Engineer may undertake the inspection of materials at the source. Manufacturing plants may be inspected periodically for compliance with specified manufacturing methods. Material samples may be obtained for laboratory testing for compliance with materials quality requirements. Plant inspection may be the basis for the acceptability of manufactured lots as to quality.

In the event plant inspection is undertaken, the following conditions shall be met:

- A. The Engineer will have the cooperation and assistance of the Contractor and the producer with whom the Contractor contracted for materials.
- B. The Engineer will have full entry at all times to such parts of the plant as may concern the manufacture or production of the materials being furnished.
- C. If required by the Engineer, the Contractor shall arrange for approved office space for the use of the inspector. Such space shall be located conveniently in or near the plant.
- D. Adequate safety measures shall be provided and maintained. It is understood that the Authority reserves the right to retest all materials that have been tested and accepted at the source of supply after the same have been delivered and to reject all materials which, when retested, do not meet the requirements of the Contract Documents.

103. CONTRACTORS' AND MANUFACTURERS' COMPLIANCE WITH STATE SAFETY, OSHA, AND OTHER CODE REQUIREMENTS

The completed Work shall include all necessary permanent safety devices, such as machinery guards and similar ordinary safety items required by laws. Further, any features of the work (including Owner-selected equipment) subject to such safety regulations shall be fabricated, furnished, and installed in compliance with these requirements. The Contract shall include the provisions of this Article in his agreements with Subcontractors, suppliers, and manufacturers of equipment.

In selecting and/or accepting equipment for installation in the project, the Authority and Engineer assume no responsibility for any personal injury, property damage, or any other damages or claims resulting from failure of the equipment to comply with applicable safety codes or requirements, or the safety requirements of a recognized agency, or failure due to manufacturer's faulty design concepts, or defective workmanship and materials. The Contractor shall indemnify and hold the Authority and Engineer harmless against any and all liability, claims, suits, damages, costs or expenses without limitation arising out of the installation or use of such equipment.

104. STORAGE AND HANDLING OF MATERIALS

Materials shall be stored to ensure the preservation of their quality and fitness. Stored materials, even though approved before storage, may again be inspected prior to their use on the Project. Stored materials shall be located so as to facilitate their prompt inspection. With the approval of the Engineer, portions of the right-of-way may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space must be provided by the Contractor at the Contractor's expense. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the Engineer. No materials shall be stored within 4 yards, plus the extended boom length of the largest crane on site, of overhead high voltage power lines. The high voltage power line is defined as an aerial power line having a voltage differential in excess of 750 volts between any pairs of conductors or between any conductor and ground. The Contractor shall be responsible for any power outage or de-energization associated with the Contractor's activity in the vicinity of the power lines. Private property shall not be used for storage purposes without written permission of the owner or lessee. Copies of such written permission shall be furnished to the Engineer prior to storage. Storage sites shall be restored to their original condition at no cost to the Authority.

Materials shall be handled to ensure the preservation of their quality and fitness. Aggregates shall be transported from the storage site to the Project site in tight vehicles constructed to prevent loss or segregation of materials after loading and measuring in order that there shall be no inconsistencies in the quantities of materials intended for incorporation in the Project as loaded, and the quantities actually received at the place of operations.

105. UNACCEPTABLE MATERIALS

All materials, whether in place or not, which do not conform to the requirements of the Contract Documents shall be considered as unacceptable, and such materials will be rejected and shall be removed immediately from the site of the Work unless otherwise directed. Rejected material, the defects of which have been corrected, shall not be used until approval has been given.

106. AUTHORITY FURNISHED MATERIAL

The Contractor shall furnish all materials required to complete the Work, except those specified to be furnished by the Authority. Material furnished by the Authority will be delivered or made available at the points specified in the Specifications.

The cost of handling and placing the materials after they are delivered or made available shall be considered as included in the Work for the Pay Item in connection with which they are used.

The Contractor is to be responsible for all material delivered to it, and deductions will be made from any monies due or that may become due the Contractor to make good any shortages and deficiencies, from any cause whatsoever, and for any damage which may occur after such delivery, and for any demurrage charges.

107. SUBSTITUTES OR "OR EQUAL" ITEMS

Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function, and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other suppliers may be accepted if sufficient information is submitted by the Contractor to allow the Engineer to

determine that the material or equipment proposed is equivalent or equal to that named. Requests for review of substitute items of material or equipment will not be accepted from anyone other than the Contractor. If the Contractor wishes to furnish or use a substitute item of material or equipment, the Contractor shall make written application to the Engineer for approval thereof, certifying that the proposed substitute performs adequately the functions and achieves the results called for by the general design, is similar and of equal substance to that specified, and is suited to the same use as that specified. The application shall state that the evaluation and approval of the proposed substitute does not prejudice the Contractor's achievement of Completion on time. It shall also state whether or not approval of the proposed substitute for use in the Work requires a change in any of the Contract Documents (or in the provisions of any other direct Contract with the Authority for Work on the Project) to adapt the design to the proposed substitute, and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified shall be identified in the application, and available maintenance, repair, and replacement service shall be indicated. The application shall also contain an itemized estimate of all costs that result directly or indirectly from approval of such substitute, including costs of redesign, all of which will be considered in evaluating the proposed substitute. The Engineer may require the Contractor to furnish additional data about the proposed substitute.

If a specific means, method, technique, sequence, or procedure of construction is indicated in or required by the Contract Documents, the Contractor may furnish or use a substitute means, method, technique, sequence, or procedure of construction which is acceptable, if the Contractor submits sufficient information to allow the Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedure for review by the Engineer is to be similar to that described in the previous paragraph.

The Engineer is to be allowed a reasonable time within which to evaluate each proposed substitute. The Engineer will be the sole judge of acceptability, and no substitute shall be ordered, installed, or used without either a Construction Order or an approved working drawing. If approval is given, it is on the condition that the Contractor is fully responsible for producing Work in conformity with Contract requirements. If, after trial use of the substituted materials, equipment, means, method, technique, sequence, or procedure of construction, the Engineer determines that the Work produced does not meet Contract requirements, the Contractor shall discontinue the use of the substitute and shall complete the remaining Work with the specified materials, equipment, means, method, technique, sequence, or procedure of construction. The Contractor shall remove the deficient Work and replace it as specified, or take such other corrective action as the Engineer may direct. Changes will not be made in the basis of payment for the Pay Items involved, nor in the Contract Time as a result of authorized substitutes. The Engineer may require the Contractor to furnish at no cost to the Authority a special performance guarantee or other surety with respect to any substitute. The Engineer will document the time required by the Authority in evaluating proposed substitutions and in making changes in the Contract Documents.

If the Engineer shall disallow the requested substitute, for just cause, the Contractor shall abide by the Engineer's decision. The Contractor shall have no claim of economic impact due to his reliance upon the substitute price as a basis for his bid. The Authority makes no guarantee of substitute approval by the Engineer and, therefore, will not entertain a claim for additional compensation due to rejection of any substitution request.

When the Contract Documents permit the use of more than one type of material, equipment, or product, only one type is to be used throughout the Project.

108. GUARANTEE

Unless specifically stated otherwise in the Contract Documents, all work provided under this contract by the Contractor or any of his Subcontractors shall be warranted to the Authority as follows:

All work shall be fit for the particular purpose for which used, and be guaranteed by the Contractor against all defects in workmanship and material for a period of one (1) year following contract completion or, if specifically called for in these Contract Documents and enumerated in the SUPPLEMENTAL CONDITIONS, for a period of one (1) year following the date of Substantial Completion as established by the Engineer for specified items of equipment or other designate parts of the work, as enumerated in each Certificate of Substantial Completion issued by the Engineer.

The Contractor shall make, at his own expense, all repairs and/or replacements necessitated by defects in materials or workmanship in work provided by him or any of his Subcontractors that become evident within the guarantee period.

The Contractor also agrees to hold the Authority and Engineer harmless from liability of any kind arising from damage due to said defects. The Contractor shall make all repairs and replacements promptly upon receipt of written orders for same from the Authority. If within ten (10) days (or such longer period as the Authority may allow) after the Authority has notified the Contractor of a defect, the Contractor has not started to make the necessary corrections, the Authority is hereby authorized to make the corrections or to order the work to be done by a third party, and the cost of the corrections shall be paid by the Contractor.

Repetitive malfunction of equipment shall be cause for equipment replacement and an extension of the guarantee period to a date one (1) year following acceptable replacement.

The Authority's rights under this Article shall be in addition to, and not a limitation of, any other rights and remedies available at law or in equity.

109. CORRECTION OF DEFECTIVE WORK AFTER CONTRACT COMPLETION

The Contractor hereby agrees to make, at his own expense, all repairs and replacements necessitated by defects in materials or workmanship in work provided by him or any of his Subcontractors, equipment manufacturers and suppliers, and pay for any damage to other works resulting from such defects, which become evidence within one (1) year after Contract Completion or within one (1) year after the date of Substantial Completion established by the Engineer for specified items of equipment, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents.

The Contractor also agrees to hold the Authority and the Engineer harmless from liability of any kind arising from damage due to said defects. The Contractor shall make all repairs and replacements in the time specified in Article "AUTHORITY'S RIGHT TO CORRECT DEFECTIVE WORK" of these GENERAL CONDITIONS upon receipt of written order for same from the Authority. If the Contractor fails to make the repairs and replacements promptly, the Authority may do the work and the Contractor and his Surety shall be liable for the cost thereof.

110. RESERVED

111. RESERVED

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

112. GOVERNING LAW

The terms and conditions of this Contract shall be construed and interpreted under, and all respective rights and duties shall be governed by, the laws of the State of New Jersey, to the extent not superseded by federal law. The Contractor's attention is called to the Federal Requirements provisions contained in the "Instructions to Bidders" portion of the bidding requirements comprising a portion of the Contract Documents.

Whenever applicable each provision of these Contract Documents shall be interpreted in such a manner as to be effective and valid under applicable law, but if any provision of these Contract Documents shall be prohibited by or invalid under applicable law, such provision shall be ineffective to the extent of such prohibition or invalidity, without invalidating the remainder of such provision or the remaining provisions of these Contract documents.

113. APPLICABLE LAWS

The Contractor shall keep fully informed of all Federal, State, and local laws, ordinances, and regulations, and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the Work, or which in any way affect the conduct of the Work. The Contractor shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such laws, ordinances, regulations, orders, and decrees and shall protect and indemnify the Authority, Engineer, and their officers, employees, agent, and representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's agents or employees, Subcontractors of any tier, suppliers, or materialmen. If any discrepancy or inconsistency is discovered between the Contract Documents and any such law, ordinance, regulation, order, or decree, the Contractor shall immediately report the same to the Engineer in writing.

114. PERMITS AND LICENSES

The Contractor shall procure all permits, grants, and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful prosecution of the Work except where the Authority has procured such permits, grants, or licenses for temporary or permanent construction. The Contractor shall advise the issuing agency or party of its proposed operations and obtain their cooperation and such supplemental permission as may be necessary. Before submitting his bid, the Contractor should obtain from the Authority all available information on the permits, grants, and licenses the Authority has obtained. Charges incurred by the Contractor for permits, grants, and licenses in connection with the Work shall be paid by the Contractor and shall be included in the prices bid for the various Pay Items scheduled in the Proposal.

Before the Contractor performs dredging or channel excavation within tidal waterways for the procurement of materials, or performs therein other work of his own, when such work is not part of the permanent or temporary Work provided for in the Contract, the Contractor shall advise USACE, USCG, and NJDEP, Division of Marine Services and Division of Water Quality of its intended work. If the waterway is not navigable, the Contractor shall notify the Division of Water Quality only. The Contractor shall procure all necessary permits for such work from the above

named agencies having jurisdiction and interest and shall comply with their rules and regulations in the performance of the above mentioned work.

The Department of the Army, acting through the Corps of Engineers, is charged with the responsibility for the administration of laws for the protection and preservation of navigation and the navigable waters of the United States. Section 10 (33 USC 403) of the River and Harbor Act of 3 March 1899 specified that: "The creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is prohibited; and it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of the Army; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of, any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or enclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army prior to beginning the same" (30 Stat 1151; 33 USC 403). Failure to obtain a Department of Army Permit is a violation of Section 10 cited above, and penalties therefor may be adjudged. In addition, the owners of such non-authorized structures are considered legally responsible and liable for damages attributable thereto or occasioned thereby.

A pamphlet describing the procedures for applying for a permit together with a list of applicable waterways may be obtained free of charge from the various district offices of the Corps of Engineers.

Section 21 PL 91-224, The Water Quality Improvement Act 1970, requires a certification in connection with any permit application to conduct any activity, including but not limited to the construction or operation of facilities which may result in any discharge into the navigable waters of the United States. This certification must be made by the State or interstate agency responsible for water quality or by the Secretary of the Interior as the case may be to the effect that there is reasonable assurance that the permitted activity will not violate water quality standards.

Upon receipt of any application for such permit, a public notice is issued to all known interested parties and to the news media to provide an opportunity for individuals and Federal, State, and local governmental agencies to comment on the proposed work being considered. In known controversial cases, a public hearing will be held in order that all views may be presented for consideration. The period normally allowed for receipt of comments is 30 days. If the proposed work is not considered to adversely affect navigation, fish and wildlife, water quality, conservation, aesthetics, recreation, ecology, and other aspects of the public interest, and if no objections are received, the Department of the Army Permit is then issued. If objections to the proposed work are received, an attempt is made to resolve the differences between the objector and the applicant. If this attempt is unsuccessful, the application, objections, and all pertinent information, including the minutes of the public hearing if held, with the District Engineer's recommendations, are forwarded to the office of the Chief of Engineers for an ultimate decision, all of which requires additional time for final action.

Prior to submitting a bid based on utilizing hydraulically procured soil aggregate materials, Bidders shall assure themselves that the NJDEP will issue a permit to dredge such materials.

115. RESTORATION OF SURFACES OPENED BY PERMIT

The right to construct or reconstruct, or maintain any public or private utility service, FAA or NOAA facility or a utility service of another government agency in the highway, street or Airport Facility, or to grant permits for same, at any time, is hereby expressly reserved by the Authority for the public utilities and proper authorities of the municipality in which the Work is done, and the Contractor shall not be entitled to any damages either for the digging up of the street or for any delay occasioned thereby.

When an individual, firm, or corporation is authorized through a duly executed permit from the Authority, the Contractor shall allow parties bearing such permits, and only those parties, to make openings in the highway. When ordered by the Engineer, the Contractor shall make all necessary repairs due to such openings, and such necessary work will be paid for as Extra Work or as specifically provided elsewhere in the Contract Documents.

116. FEDERAL AID PARTICIPATION

For AIP contracts, the United States Government has agreed to reimburse the Authority for some portion of the contract costs. Such reimbursement is made from time to time upon the Authority's (sponsor's) request to the FAA. In consideration of the United States Government's (FAA's) agreement with the Authority, the Authority has included provisions in this contract pursuant to the requirements of the Airport Improvement Act of 1982, as amended by the Airport and Airway Safety and Capacity Expansion Act of 1987, and the Rules and Regulations of the FAA that pertain to the work.

As required by the Act, the contract work is subject to the inspection and approval of duly authorized representatives of the Administrator, FAA, and is further subject to those provisions of the rules and regulations that are cited in the contract, plans, or specifications.

No requirement of the Act, the rules and regulations implementing the Act, or this contract shall be construed as making the Federal Government a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

117. ENVIRONMENTAL PROTECTION

The Contractor shall comply with all applicable Federal, State, and local laws and regulations, and all conditions of permits controlling pollution of the environment. Necessary precautions shall be taken to prevent pollution of streams, lakes, ponds, wetlands, groundwater, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

All modifications to permits that are proposed by the Contractor shall be submitted to the Authority for approval prior to submitting them to the regulatory agencies having jurisdiction and interest. After receiving the Authority's approval, the Contractor shall obtain all other necessary approvals from the appropriate regulatory agencies. Any time required to obtain the approvals will not warrant extensions of contract time. The Contractor shall perform the Work in compliance with the terms and conditions of all permits procured for the Project. If the Contractor is not in compliance with permit provisions, corrective actions shall be taken immediately. The Engineer may suspend the Work, wholly or in part, in accordance with GENERAL CONDITIONS Article "TEMPORARY SUSPENSION OF WORK," until such time as the Contractor is fully in compliance with all permits. All corrective and remedial work required to bring the Contractor into compliance shall be performed at no cost to the Authority.

The Contractor shall pay all fees and violation charges that arise out of or are alleged to arise out of its noncompliance or the noncompliance of its agents, employees, and Subcontractors with permit requirements. In its sole discretion, the Authority may determine to hold the Contractor

responsible for all engineering, inspection, and administration costs (including overhead) incurred as a result of its noncompliance. If it so determines, the Authority will deduct the amount of such costs from the monthly estimate and payment due in accordance with GENERAL CONDITIONS Article "PARTIAL PAYMENTS."

The Contractor shall provide to the Engineer, whenever requested, all documentation pertaining to the noncompliance and related corrective actions taken.

The Contractor shall also comply with the following:

- A. Control of Soil Erosion and Water Pollution - The Contractor shall employ soil erosion and sediment control measures during the life of the Project to control erosion and minimize the sedimentation of rivers, streams, lakes, reservoirs, wetlands, floodplains, bays, and coastal waters in accordance with the current version of the "Standards for Soil Erosion and Sediment Control in New Jersey."

The Contractor is responsible to provide the Engineer with documentation that a soil erosion and sediment control plan has been approved by the appropriate soil conservation district for off-Project borrow pits or storage areas that the Contractor uses or establishes to accomplish the Work of the Project.

- B. Control of Noise and Air Pollution - The Contractor shall employ all possible methods to minimize noise and dust pollution caused by drilling, blasting, excavation, and hauling operations. These shall include, but shall not necessarily be limited to, use of dust collection devices or water injectors on drilling units.

All construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler. Air-powered equipment shall be fitted with pneumatic exhaust silencers. Air compressors shall meet EPA noise emission standards.

Stationary equipment powered by an internal combustion engine shall not be operated within 50 yards of noise sensitive sites without portable noise barriers placed between the equipment and the noise sensitive sites. Noise sensitive sites include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries, and public recreation areas. Portable noise barriers shall be constructed of plywood or tongue and groove boards with a noise absorbent treatment on the interior surface (facing the equipment).

All methods and devices employed to minimize noise and dust pollution are subject to the daily approval of the Engineer.

- C. Historic Places - The Contractor will not be permitted to use as a disposal site or obtain borrow excavation from locations eligible for or listed on the State or National Registers of Historic Places. Copies of the State and National Registers of Historic Places are available from the New Jersey Department of Transportation's Bureau of Environmental Services.
- D. Disposal Sites Beyond Project Limits - Material shall not be disposed of beyond the Project limits until the Engineer has approved the location of the disposal site and received a copy of the soil and sediment control plan certified by the soil conservation district in accordance with NJSA 4:24-39 *et seq.*
- E. Borrow Pits - Material shall not be excavated from a borrow pit beyond the Project's limits until the Engineer has received a copy of the soil and sediment

control plan certified by the soil conservation district in accordance with NJSA 4:24-39 *et seq.*

118. ARCHAEOLOGICAL AND HISTORICAL FINDINGS

Unless otherwise specified in this Article, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

When excavating operations encounter prehistoric remains or artifacts of historical or archaeological significance, the operations shall be temporarily discontinued in that area and the Engineer shall immediately be notified. The Engineer will consult archaeological authorities and determine the disposition of the remains or artifacts.

The Contractor agrees to make no claim for additional payment or for an extension of Contract Time because of any delays in the progress or alteration of the prosecution of the Work due to such discontinuance of the work or removal of any such remains or artifacts for the first ten (10) days of such delay. Thereafter and beginning on the eleventh (11th) day, compensation for such delay and an extension of Contract Time will be considered in accordance with the provisions of GENERAL CONDITIONS Article "SUSPENSION OF WORK".

119. TAXES AND CHARGES

The Contractor shall withhold and pay all withholding taxes, whether State or Federal, and pay all Social Security taxes and also all State Unemployment Compensation taxes for his employees, and pay or cause to be withheld, as the case may be, any and all taxes, charges, or fees or sums whatsoever, which are now or may hereafter be required to be paid or withheld under any laws.

Pursuant to L. 1966, c. 30, §9, as amended (C.54:32B-9), the Authority is not subject to the sales and use taxes imposed under New Jersey's Sales and Use Tax Act. A Certificate to this effect can be obtained from the Authority. NJSA 54:32B-9 provides that any sale or service to the State of New Jersey, or any of its agencies, instrumentalities, public authorities, public corporations (including a public corporation created pursuant to agreement or compact with another State), or political subdivisions where the State is the purchaser, user, or consumer, is not subject to the sales and use taxes imposed under the Sales and Use Tax Act. NJSA 54:32B-8 provides that sales of materials, supplies, or services made to Contractors, Subcontractors, or repairmen for exclusive use in erecting structures, or building on, or otherwise improving, altering, or repairing real property of the above listed bodies are exempt from the tax on retail sales imposed by the Sales and Use Tax Act. The sales tax exemption does not apply for equipment used for Contract work or for force account work whether the equipment is to be purchased or rented. The exemption provided under NJSA 54:32B-8 is conditioned on the person seeking such exemption qualifying therefor pursuant to the rules and regulations and upon the forms prescribed by the New Jersey Division of Taxation. The required form, "Contractor's Exemption Purchase Certificate" (Form No. ST-13), can be obtained by writing or calling the New Jersey Division of Taxation, Tax Information Services (TIS), CN 269, Trenton, New Jersey 08625, or any New Jersey Division of Taxation Regional Office.

120. COMPLIANCE WITH LABOR STANDARDS AND RATE OF WAGE REQUIREMENTS

The requirements of the State of New Jersey relative to the payment of prevailing wages and, if this Contract is Federally funded, the Federal requirements for compliance with the wage determination of the U.S. Secretary of Labor, shall apply. In case of discrepancies between the two (2) lists of wage rates, the Contractor shall pay not less than the higher rate for the respective

crafts. The minimum prevailing wage rates, current as of the date of assembly of these Documents are available from the State of New Jersey and, if applicable, from the U.S. Secretary of Labor.

There is no guarantee that labor can be obtained at these wages, or that the Federal and State minimum wage rates will remain the same for any specified period. Unless specific agreement is made otherwise, Contractors will not be allowed additional compensation under this Contract for any wage escalation that may become effective.

121. ROYALTIES, PATENTED DEVICES, MATERIALS, AND PROCESSES

The Contractor shall pay all royalty and license fees unless otherwise specified. The Contractor shall indemnify and hold harmless the Authority and the Engineer against any and all liability, claims, royalties, suits, damages, costs or expenses, without limitation arising out of any alleged use of patented or unpatented processes, products, materials or appliances used in the performance of this Contract.

If any design, device, material, or process covered by letters of patent or copyright is used in the Work, the Contractor shall provide for such use by suitable legal agreement with the patentee or owner. The Contractor shall assume all costs arising from the use of patented materials, equipment, devices, or processes used on or incorporated in the Work. The Contractor shall defend, indemnify, and save harmless the Authority, any affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material, or process, or any trademark or copyright, and shall indemnify the Authority for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the performance of the Work or after Acceptance.

122. SANITARY, HEALTH, AND SAFETY PROVISIONS

The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of its employees and for Authority field offices as may be necessary to comply with the requirements of the State and local health departments, or of other bodies or tribunals having jurisdiction.

The Contractor shall ensure privacy to all employees and Authority personnel assigned to the Project by providing on site separate toilet facilities for male and female employees. These facilities shall be portable toilets and clearly marked MEN and WOMEN. They are in addition to the facilities provided in the field office.

The total number of facilities shall be determined by the chart listed below. A facility is defined as one (1) unit. A facility site is defined as a location that provides at least one (1) facility for each sex. The maximum distance between the location of facility sites and workers shall be no more than half a mile.

All toilet facilities shall be in compliance with OSHA Regulation 1926.51(c) with the exception that the Authority will require that separate toilet facilities be provided for males and females. The sewage disposal method shall not endanger the health of employees and shall be in compliance with all State and Federal regulations.

Toilet facilities shall be cleaned and sanitized a minimum of once per week except from May 15 through September 15 in which these facilities shall be cleaned and sanitized a minimum of twice per week.

Number	Minimum	Number	Minimum No. of
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of Male Employees	No. of Facilities for Male Use	Of Female Employees	Facilities for Female Use
1 - 15	1	1 - 15	1
16 - 35	2	16 - 35	2
36 - 55	3	36 - 55	3
56 - 80	4	56 - 80	4
81 - 110	5	81 - 110	5
111 - 150	6	111 - 150	6
Over 150	6+(1)	Over 150	6+(1)

(1) - One (1) additional facility for each additional 40 employees or part thereof of each sex.

The Contractor shall observe all rules and regulations of the Federal, State, and local health officials. Attention is directed to Federal, State, and local laws, rules, and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to the worker's health or safety.

The Contractor shall admit, without delay and without the presentation of an inspection warrant, any inspector of OSHA or other legally responsible agency involved in safety and health administration upon presentation of proper credentials.

The Contractor shall make available to the Contractor's employees, Subcontractors, the Engineer, and the public, all information pursuant to OSHA 29 CFR Part 1926.59 of The Hazard Communication Standard 29 CFR 1910.1200, and shall also maintain a file on each job site containing all Material Safety Data Sheets (MSDS) for products in use at the Project. These Material Safety Data Sheets shall be made available to the Engineer upon request.

123. PUBLIC CONVENIENCE AND SAFETY

The Contractor shall at all times so conduct the Work as to ensure the least possible obstruction to traffic. The safety and convenience of the general public and the residents along the highway or airport facility and the protection of persons and property shall be provided for by the Contractor in accordance with the contract documents.

Precaution shall be exercised at all times for the protection of persons and property. The safety provisions of applicable laws, OSHA regulations, building and construction codes, and the rules and regulations of the New Jersey Department of Labor shall be observed.

The Contractor shall maintain the free and unobstructed movement of aircraft, pedestrian and vehicular traffic with respect to his own operations and those of his Subcontractors and all suppliers in accordance with the Article titled "MAINTENANCE OF TRAFFIC" and shall limit such operations for the convenience and safety of the traveling public as specified in the Article titled "LIMITATION OF OPERATIONS".

124. RAILWAY HIGHWAY PROVISIONS

If the Contract Documents require that materials be hauled across the tracks of any railway, the Authority will arrange with the railway for any new crossings required or for the use of any existing crossings. If the Contractor elects to use crossings other than those designated, it shall make arrangements for the use of such crossings. Construction work performed on or near railroad

right-of-way shall be performed in accordance with GENERAL CONDITIONS Articles "COOPERATION WITH UTILITIES" and "COOPERATION BETWEEN CONTRACTORS."

125. CONSTRUCTION OVER OR ADJACENT TO NAVIGABLE WATERS

All Work over, on, or adjacent to navigable waters shall be so conducted that free navigation of the waterways is not interfered with, and that the existing navigable depths are not impaired except as allowed by permit issued by USCG or USACE, as applicable.

126. BARRICADES, WARNING SIGNS AND HAZARD MARKINGS

The Contractor shall provide, erect, and maintain all necessary barricades, marking for hazards, suitable and sufficient lights, danger signals, signs, and other traffic control devices in accordance with the New Jersey Department of Transportation Standard Specifications Section 617, and shall take all necessary precautions for the protection of the Work and safety of the public.

On Airport projects when the work requires closing an air operations area of the airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of AC 150/5340-1, Marking of Paved Areas on Airports. The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and his/her parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to AC 150/5370-2, Operational Safety on Airports During Construction Activity. The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2. The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work which requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their dismantling is directed by the Engineer. Open-flame type lights shall not be permitted within the air operations areas of the airport.

127. USE OF EXPLOSIVES

When the use of explosives is necessary and approved by the Engineer for the prosecution of the Work, the Contractor shall exercise the utmost care not to endanger life or property, including new Work. The Contractor shall be responsible for all damage resulting from the use of explosives. A pre-blasting meeting will be scheduled by the Engineer with the Office of Safety Compliance. The Contractor shall attend the pre-blasting meeting. No blasting will be permitted prior to the pre-blasting meeting.

All Explosives shall be stored safely under lock and key. The storage places shall be marked plainly DANGEROUS EXPLOSIVES. The storing and handling of explosives and highly inflammable materials shall conform to the regulations of the New Jersey Department of Transportation Office of Safety Compliance, Mine Safety and Explosives, New Jersey Department of Labor, and to local regulations relating thereto. Proper means shall be used to avoid blasting damage to public and private property. Flaggers shall be provided, when necessary, who shall warn and keep traffic from the danger area, and all persons within the danger area shall be warned and given time to withdraw.

The Contractor shall notify each property owner and public utility company having structures or facilities in proximity to the site of the work of his/her intention to use explosives. Such notice shall be given sufficiently in advance to enable them to take such steps as they may deem necessary to protect their property from injury.

The use of electrical blasting caps shall not be permitted on or within 1,000 feet of the airport property.

128. PROTECTION AND RESTORATION OF PROPERTY MARKERS AND LAND MONUMENTS

The Contractor shall be responsible for the preservation of all public and private property markers and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer has referenced their location. Monuments and markers shall not be moved until directed. All Geodetic Control Markers such as monuments, disks, and benchmarks within the Project site shall be carefully protected and shall not be disturbed by construction activity. Where such markers are located within the Project and are in danger of destruction or disturbance, the Contractor shall retain qualified surveying personnel and shall ensure the markers' relocation prior to disturbing the original markers. All survey work shall be in accordance with the Geodetic Mark Preservation Guidebook as prepared by National Geodetic Survey. Copies of the guidebook are available from the Geodetic Control Survey Unit, New Jersey Department of Transportation, CN 600, Trenton, New Jersey 08625.

129. FOREST PROTECTION

In carrying out work within or adjacent to State or National Forests or Parks, the Contractor shall comply with all regulations of the State Fire Warden, State Division of Parks and Forestry, or other authority having jurisdiction, governing the protection of forests and the carrying out of work within forests, and shall observe all sanitary laws and regulations with respect to the performance of work in forest areas. The Contractor shall keep the areas in an orderly condition, dispose of all refuse, obtain permits for the construction and maintenance of all construction camps, stores, warehouses, residences, latrines, cesspools, septic tanks, and other structures in accordance with the requirements of the Division or such other authority.

The Contractor shall take all reasonable precautions to prevent forest fires and shall require its employees and Subcontractors, both independently and at the request of Forestry officials, to do all reasonably within their power to prevent and assist in preventing forest fires, and to make every possible effort to notify a Forestry official at the earliest possible moment of the location and extent of any fire seen by them.

130. OPENING SECTIONS OF PROJECT TO TRAFFIC

Opening sections of the Project to traffic prior to Completion may be desirable or may be necessary due to conditions inherent in the Work, changes in the Contractor's work schedule, or conditions or events unforeseen at the time the Project was bid. Such openings shall be made only when so directed by the Engineer. Under no condition shall such openings constitute Acceptance or a part thereof, or a waiver of any provisions of the Contract.

The Contract Documents indicate, insofar as possible, which sections are to be opened prior to Completion. The Contractor shall make no claim for and shall have no right to additional compensation or extension of Contract Time for opening sections of the Project to traffic as indicated in the Contract Documents, or resulting from partial acceptance or changes in the Contractor's work schedule, or for reasons that are due to the fault of the Contractor or any other party, including utilities.

Additional compensation or extension of Contract Time for completion of other items of Work on sections of the Project opened to traffic for reasons other than those indicated in the preceding paragraph will be made as provided in GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS" or in a Supplementary Agreement.

If the Contractor is dilatory in completing shoulders, drainage structures, or other features of the Work, the Engineer may so notify the Contractor in writing and establish therein a reasonable period of time in which the Work is to be completed. If the Contractor is dilatory, or fails to make a

reasonable effort toward completion in this period of time, the Engineer may then order all or a portion of the Project opened to traffic. On such sections which are so ordered to be opened, the Contractor shall conduct the remainder of its construction operations so as to cause the least obstruction to traffic, and shall make no claim for and shall have no right to additional compensation or extension of Contract Time.

On sections of the Project opened to traffic whether indicated in the Contract Documents or not, maintenance of the roadway, runway or taxiway shall be in accordance with GENERAL CONDITIONS Article "MAINTENANCE DURING CONSTRUCTION".

131. INDEPENDENT CONTRACTOR

The relationship of the Contractor to the Authority is that of an independent Contractor, and said Contractor, in accordance with his status as an independent Contractor, covenants and agrees that he shall conduct himself consistent with such status, that he shall neither hold himself out as nor claim to be an officer or employee of the Authority by reason hereof. The Contractor shall not, by reason hereof, make any claim, demand, or application to or for any right or privilege applicable to an officer or employee of the Authority, including, but not limited to, workers compensation coverage, unemployment insurance benefits, social security coverage, or retirement membership or credit.

132. THIRD PARTY BENEFICIARY CLAUSE

It is specifically agreed between the parties executing the Contract that no provision of the Contract is intended to make the public or any member thereof a third party beneficiary hereunder, or to authorize anyone not a party to the Contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the Contract.

It is the further intent of the Executive Director and the Contractor in executing the Contract that no individual, firm, corporation, or any combination thereof, that supplies materials, labor, services, or equipment to the Contractor for the performance of the Work becomes thereby a third party beneficiary of the Contract.

133. LIMITATIONS OF LIABILITY

In any event, whether under the provisions of the Contract, as a result of breach of Contract, tort (including negligence), or otherwise, the Authority will not be liable to the Contractor for any special, consequential, incidental, or penal damages including, but not limited to, loss of profit or revenues, loss of rental value for Contractor-owned equipment, damages to associated equipment, cost of capital, or interest of any nature.

134. ASSIGNMENT OF CONTRACT FUNDS AND CLAIMS

The Contractor shall not transfer or assign to any party any contract funds, due or to become due, or claims of any nature he has against the Authority, without the written approval of the Engineer having first been obtained. The Engineer, by sole discretion, considering primarily the interests of the Authority, may grant or deny such approval.

135. RISK ASSUMED BY THE CONTRACTOR

The Contractor assumes the following distinct and several risks, whether they arise from acts or omissions, whether negligent or not, of the Contractor, his Subcontractors, suppliers, materialmen, employees, agents, and all others working for the Contractor on the Project, of the Authority, or of third persons, or from any other cause, and whether such risks are within or

beyond the control of the Contractor described in Subheadings A through C below. Excepted from this assumption of risks are only those risks which arise from solely affirmative acts done by the Authority subsequent to the execution of the Contract with actual and willful intent to cause loss, damage, and injury. The risks are as follows:

- A. Risks of Loss or Damage to the Permanent Construction - Until Acceptance, the Contractor shall bear the risk of loss or damage to the permanent construction, temporary construction, and to materials, whether or not the Contractor has received payment for such construction or materials under GENERAL CONDITIONS Article "PARTIAL PAYMENTS," or "FINAL PAYMENT." The Contractor shall take every precaution against injury or damage to any part of the construction or to materials by the action of the elements or from any other cause, whether arising from the execution or the non-execution of the Work. The Contractor shall promptly repair, replace, and make good any such loss or damage without cost to the Authority. However, the Contractor shall not bear such risk of loss or damage which arises from acts of war or floods, tidal waves, earthquakes, cyclones, tornadoes, hurricanes, or other cataclysmic natural phenomenon unless such loss or damage is covered by insurance.

The Contractor shall, in furtherance of the above paragraph, but not by way of limitation, at the Contractor's expense, provide suitable drainage for the Project and erect such temporary structures where necessary to protect the Work from damage. The risks for failure to take such actions shall be assumed by the Contractor.

In case of suspension of the Work from any cause whatever, the Contractor shall continue to be responsible for the Project as provided above and shall take such precautions as may be necessary to prevent damage to the Project, provide for drainage, and shall erect any necessary temporary structures, signs, or other facilities. During such period of suspension of the Work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under the Contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury. If ordered by the Engineer, the Contractor shall properly store, during such suspension of the Work, materials which have been partially paid for or furnished by the Authority. The Authority will be entitled to the possession of such materials, and the Contractor shall promptly return the same to the Project site when requested. The Contractor shall not dispose of any of the materials so stored except on written authorization. The Contractor shall be responsible for the loss of or damage to such materials.

- B. Risks of Claims on Account of Injury, Loss, or Damage - The Contractor shall bear the risk of claims, just or unjust, by third persons made against the Contractor or the Authority, on account of injuries (including wrongful death), loss, or damage of any kind whatsoever arising or alleged to arise out of or in connection with the performance of the Work. The risk of claims, whether or not actually caused by or resulting from the performance of the Work or out of or in connection with the Contractor's operations or presence at or in the vicinity of the construction site or Authority premises, whether such claims are made and whether such injuries, loss, and damages are sustained, applies at any time both before and after Acceptance.
- C. Risk of Loss to Property of Those Performing the Work - The Contractor shall bear the risk of loss or damage to any property of the Contractor, and of claims

made against the Contractor or the Authority for loss or damage to any property of Subcontractors, materialmen, workers, and others performing the Work, and to lessors. Said risk occurs at any time prior to completion of removal of such property from the construction site or the Authority's premises, or the vicinity thereof.

The Contractor shall indemnify and save harmless the Authority against all claims described in Subheadings B and C above, and for all expense incurred by the Authority in the defense, settlement, or satisfaction thereof including expenses of attorneys. If so directed, the Contractor shall at its own expense defend against such claims, in which event it shall not, without obtaining express advance permission from the Authority, raise any defense involving in any way jurisdiction of the tribunal, immunity of the Authority, governmental nature of the Authority, or the provisions of any statutes respecting suits against the Authority.

The provisions of this Article are also for the benefit of all officers, agents, and employees of the Authority so that they have all the rights which they would have under this Article if they were named at each place above at which the Authority is named, including a direct right of action against the Contractor to enforce the foregoing indemnity except, however, that the Authority may at any time in its sole discretion and without liability on its part cancel the benefit conferred on any of them by this Article, whether or not the occasion for invoking such benefit has already arisen at the time of such cancellation.

Neither Acceptance nor the making of final payment releases the Contractor from his obligations under this Article. Moreover, neither the enumeration in this Article nor the enumeration elsewhere in this Contract of particular risks assumed by the Contractor or of particular claims for which he is responsible shall be deemed:

- A. To limit the effect of the provisions of this Article or of any other provision of the Contract relating to such risks or claims, or
- B. To imply that the Contractor assumes or is responsible for risks or claims only of the type enumerated in this Article or in any Contract, or
- C. To limit the risks which the Contractor would assume or the claims for which the Contractor would be responsible in the absence of such enumerations.

The Contractor expressly understands and agrees that any insurance protection required by the Contract, or otherwise provided by the Contractor, in no way limits the Contractor's responsibility to defend, indemnify, and save harmless the Authority as herein provided. Such insurance requirements are designed to provide greater assurance to the Authority that the Contractor is financially able to discharge his obligations under this Article and as to the risks assumed elsewhere in the Contract, and are not in any way construed as a limitation on the nature and extent of such obligations.

136. DISPUTES

Except for specific provisions otherwise set forth in the Contract Documents, any dispute concerning questions of fact or circumstance arising out of this Contract shall be mutually resolved through good faith mediation between the Contractor and the Authority. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the Contractor and the Authority may otherwise agree in writing.

Any dispute arising under or relating to this Contract, which is not disposed by mutual agreement, may be submitted by the Contractor, for a hearing, before the Authority's Executive Director. The Contractor's right to request such a hearing is conditioned upon compliance with the requirements of Article "DUTIES AND RESPONSIBILITIES OF THE ENGINEER," of these

GENERAL CONDITIONS. If the Contractor is not satisfied with the decision of the Engineer, the Contractor may, within fifteen (15) days from the receipt of the Engineer's final determination based upon the Contractor's written objection, file a request before the Authority's Executive Director.

The Authority's Executive Director, or his designee, shall hold a hearing of the dispute, and his decision shall be reduced to writing and a copy thereof mailed or otherwise furnished to the Contractor. The decision of the Executive Director or his designee, shall be considered final and conclusive unless, within fifteen (15) days of receipt of a copy of the decision, the Contractor notifies the Authority of his objections to such decision. Failure to file a written objection within the allotted time, shall be considered acceptance of the decision, and the decision shall become final and conclusive.

The request for such a hearing before the Authority's Executive Director, or his designee, the holding of the hearing, and the receipt of the decision shall be a condition precedent to the right to request arbitration or initiate court action.

137. **ARBITRATION**

If agreed upon in writing by the Contractor and Authority in an unsettled dispute, any controversy arising out of or relating to this Contract, or the breach thereof, may be settled by arbitration in accordance with Construction Industry Arbitration Rules of the American Arbitration Association and judgement upon the award rendered by the arbitrator or arbitrators may be entered in any court having jurisdiction thereof.

The Contractor shall not delay the work because arbitration proceedings are pending, unless he shall have written permission from the Authority to do so. Such delay shall not extend beyond the time when the arbitrators shall have opportunity to determine whether the work shall continue or be suspended pending decision by the arbitrators of such a dispute. Any request for arbitration shall be in writing and shall be delivered to the Engineer and any adverse party either by personal delivery or by registered mail addressed to the last known address of the parties in dispute.

138. **HEADINGS**

The headings of the various Articles contained herein are inserted for convenience of reference only and shall not constitute a part hereof, nor limit or define the terms and conditions hereof.

139. **RESERVED**

140. **RESERVED**

MAINTENANCE BOND, INSURANCE, AND INDEMNIFICATION

141. **MAINTENANCE BOND**

Upon completion of all required work and prior to final payment the Contractor shall provide a two (2) year Maintenance Bond to the Authority for 100% of the final contract price.

142. **DEFAULT OF SURETY**

If the Surety on any bond furnished by the Contractor is placed under any Federal or State rehabilitation, liquidation, receivership or bankruptcy proceedings, of any kind, the Authority, at his discretion, shall have the right to require the Contractor to take immediate steps to secure a replacement bond and Surety, both of which shall be acceptable to the Authority, at the sole

expense of the Contractor. Failure by the Contractor to provide a replacement bond and Surety as required by the Authority within ten (10) days thereafter shall be cause for the Authority to exercise his rights under Article "SUSPENSION OF WORK" of these GENERAL CONDITIONS or terminate the Contract for material breach. In addition, no further progress payments under the Contract shall be made by the Authority until the Contractor complies with the provisions of this Article.

143. INSURANCE AND LIABILITY

1. Prior to the commencement of any work or services and until completion / final acceptance of the work as described in the Scope of Services in this Contract, the Contractor will provide and maintain the following minimum levels of insurance at Contractor's own expense. The cost of the required insurance shall be included in the Contractor's bid price and no adjustment shall be made to the contract price on account of such costs unless such approval is provided. The term Contractor shall include "Professional Service Contractors" as well as Subcontractors and Sub-Subcontractors of every tier. Contractor shall furnish Certificates of Insurance evidencing and reflecting the effective date of coverage as outlined below. The Services shall not commence until the Contractor has obtained, at their own expense, all of the insurance as required hereunder and such insurance has been approved by the South Jersey Transportation Authority (the "Authority"). Approval of insurance required of the Contractor will be granted only after submission to the Authority of original certificates of insurance signed by the representatives of the insurers or, at the Authority's request, certified copies of the required insurance policies. If found to be non-compliant at any point during the Contract Term, the Authority may purchase the required insurance coverage(s) and the cost will be borne by the Contractor through direct payment/reimbursement to the Authority or the Authority may withhold payment to the Contractor for amounts owed to them. The required insurance shall not contain any exclusions or endorsements which are not acceptable to the Authority. Failure of the Authority to demand such certificate or other evidence of full compliance with these insurance requirements or failure of the Authority to identify a deficiency from evidence that is provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance. With respect to insurance maintained after final payment in compliance with a requirement below, an additional certificate(s) evidencing such coverage shall be provided to the Authority with final application for payment and thereafter upon renewal or replacement of such insurance until the expiration of the time period for which such insurance must be maintained.
2. The Contractor shall require all Subcontractors to maintain during the term of the Contract Insurance of the type and in the minimum amounts as described below and required of the Contractor. Any obligations imposed upon the Contractor as part of this contract shall be so imposed upon any and all Subcontractors as well.
3. All insurance required herein, with the exception of the Professional Liability Insurance, shall be written on an "occurrence" basis and not a "claims-made" basis. For Professional Liability "claims-made" coverage:
 - a. The retroactive date must be on or prior to the start of work under this contract; and
 - b. The Contractor must purchase "tail coverage/an extended reporting period" or maintain coverage for a period of two (2) years subsequent to the completion of their work / final payment.
4. The South Jersey Transportation Authority, its commissioners, agents, servants, employees and representatives shall be named as additional insured on the Contractor's liability insurance program (except Workers Compensation and Professional Liability policies) for ongoing operations and completed operations on a primary noncontributory basis. Coverage to include ongoing and completed operations using ISO Endorsements CG 2010 and CG 2037, or their

equivalents. Each of the Additional Insured's respective members, employees, agents and representatives shall also be afforded coverage as an Additional Insured. Coverage should be provided for a period of two years subsequent to the completion of work/final payment. The Authority reserves the right to require the Contractor to name other parties as additional insureds as required by the Authority. There shall be no "Insured versus Insured Exclusion" on any policies; all policies will provide for "cross liability coverage".

5. All insurance policies required hereunder shall be endorsed to provide that the policy is not subject to cancellation, non-renewal, or material reduction in coverage until thirty (30) days prior written notice has been given to the Authority. In the event of cancellation or non-renewal of coverage(s), it is the Contractor's responsibility to replace coverage to comply with the Contract requirements so there is no lapse of coverage for any time period. In the event the insurance carriers will not issue or endorse their policy(s) to comply with the above it is the responsibility of the Contractor to report any notice of cancellation or non-renewal at least thirty (30) days prior to the effective date of this notice.
6. No acceptance and/or approval of any insurance by the Authority shall be construed as relieving or excusing the Contractor or the Contractor's Surety from any liability or obligation imposed upon either or both of them by provisions of this Contract.
7. Any deductibles or self insured retention's (SIR) of \$10,000 or greater shall be disclosed by the Contractor, and are subject to the Authority's written approval. Any deductible or retention amounts elected by the Contractor or imposed by the Contractor's insurer(s) shall be the sole responsibility of the Contractor. In the event any policy includes an SIR, the Contractor is responsible for payment within the SIR of their policy(ies) and the Additional Insured requirements specified herein shall be offered within the SIR amount(s).
8. All insurance companies shall have an AM Best's rating of at least "A-, Class VIII" or better and be permitted to do business in the State of New Jersey.
9. There shall be no liability upon the Authority, public officials, their employees, their authorized representatives, or agents either personally or as officials of the Authority in carrying out any of the provisions of the Contract nor in exercising any power or authority granted to them by or within the scope of the Contract, it being understood that in all such matters they act solely as agents and representatives of the Authority.
10. Waiver of Rights of Recovery and Waiver of Rights of Subrogation:
 - a. The Contractor waives all rights of recovery against the Authority and all the additional insured's for loss or damage covered by any of the insurance maintained by the Contractor.
 - b. If any of the policies of insurance required under this contract require an endorsement to provide for the waiver of subrogation, then the named insured of such policies will cause them to be so endorsed.
11. Any type of insurance or any increase in limits of liability not described above which the Contractor requires for its own protection or on account of statute shall be its own responsibility and at its own expense.
12. The amount of insurance provided in the aforementioned insurance coverages, shall not be construed to be a limitation of the liability on the part of the Contractor.

13. Contractor shall promptly notify the Authority and the appropriate insurance company(ies) in writing of any accident(s) as well as any claim, suit or process received by the insured Contractor arising in the course of operations under the Contract. The Contractor shall forward such documents received to his/her insurance company(ies), as soon as practicable, or as required by his/her insurance policy(ies).
14. No Aviation or Aircraft related exclusions are permitted on any of the Contractor's insurance policies.

REQUIRED COVERAGE: the following may be provided through a combination of primary and excess policies in order to meet the minimum limits set forth below:

B. CONTRACTOR'S LIABILITY INSURANCE REQUIREMENTS:

1. Commercial General Liability insurance for bodily injury, personal injury, and property damage including loss of use, etc. with minimum limits of:

\$1,000,000	each occurrence;
\$1,000,000	personal and advertising injury;
\$2,000,000	general aggregate; and
\$2,000,000	products/completed operation aggregate.

This insurance shall include coverage for all of the following

- Coverage is to be provided on ISO CG 00 01 12 07 or an equivalent form ("Occurrence Form") including Premises/Operations, Independent Contractors, Products/Completed Operations, Broad Form Property Damage, Contractual Liability, and Personal Injury and Advertising Injury;
 - General aggregate limit applying on a per project basis;
 - Products/Completed Operations Coverage must be maintained for a period of at least two (2) years after final payment (including coverage for the Additional Insureds as set forth in these Insurance Requirements);
 - No exclusions for development, construction, building conversion, etc. with respect to the project's location and/or where the work is to be completed by the Contractor;
 - Coverage for "Resulting Damage";
 - No sexual abuse or molestation exclusion;
 - No amendment to the definition of an "Insured Contract".
2. Business Auto Liability insurance with a minimum combined single limit of \$1,000,000 per accident and including, but not limited to, coverage for all of the following:
 - Liability arising out of the ownership, maintenance or use of any auto;
 - Auto non-ownership and hired car coverage
 - Contractual Liability Coverage (including Liability for Employee Injury assumed under a Contract as provided in the standard ISO policy form)
 - For Contractors involved in the transportation of hazardous material, include the following endorsements: MCS-90 and ISO-9948
 3. Workers' Compensation insurance with statutory benefits as required by any state or federal law, including standard "other states" coverage; employer's liability insurance with minimum limits of:

\$1,000,000	each accident for bodily injury by accident;
\$1,000,000	each employee for bodily injury by disease; and
\$1,000,000	policy limit for bodily injury by disease.

1. United States Longshore & Harbor Workers Act Coverage, where applicable.
2. Includes Sole Proprietorships and Officers of a Corporation who will be performing the work.
3. Where applicable, if the Contractor is lending or leasing its employees to the Authority for the work under this contract (e.g. crane rental with operator), it is the Contractor's responsibility to provide the Workers Compensation and Employer's Liability coverage and to have their policy endorsed with the proper Alternate Employer Endorsement.
4. Professional Liability (If Designated by Contractor's Scope of Work): Contractors (such as, but not limited to Architects, Engineers, Attorneys, Financial Advisors, Marketing, Physicians and Risk Management Consultants) shall provide liability and/or malpractice insurance with minimum limits of \$3,000,000. The definition of "covered services" shall include the services required in the scope of this contract.
5. Umbrella Liability or Excess Liability insurance with minimum limits of:
 - \$10,000,000 per occurrence;
 - \$10,000,000 aggregate for other than products/completed operations and auto liability; and
 - \$10,000,000 products/completed operations aggregate.

Policy to apply on a Following Form basis of the Commercial General Liability, Commercial Automobile Liability and Employers Liability Coverage.

6. Pollution Liability Insurance:

- Covering losses caused by pollution incidents that arise from the operations of the Contractor described under the scope of services of this contract. This is to include all work completed by the Contractor, including testing and / or removal of any and all pollutants.
 - Occurrence/Claims Made Limit: \$1,000,000 per project
 - Insurance to be maintained for the duration of the work and for a period of two (2) years after completion of work / final payment.
 - No Exclusions for Silica, Asbestos, Lead, or Lead Based Paint Testing.
 - Include Mold Coverage for full policy limit of liability.
 - Shall include coverage for all pollutants as defined under the Resource Conservation and Recovery Act, as amended, 42 U.S.C. Section 6901 et. Seq. ("RCRA") or any related state or city environmental statute or the removal of any petroleum contaminated material.
 - All owned and / or 3rd Party disposal facilities must be licensed and maintain pollution liability insurance of not less than \$1,000,000, if applicable.
7. Watercraft Liability (If Designated by Contractor's Scope of Work): If Contractor utilizes any owned, used, leased, hired or borrowed watercraft to complete their work in accordance with this Contract, the coverage shall be maintained.

Minimum Limits of Liability:
\$2,000,000 Per Occurrence
\$2,000,000 Aggregate

8. Aircraft Liability and/or Unmanned Aircraft Systems (UAS, aka Drones) **(If Designated by Contractor's Scope of Work)**: If Contractor utilizes any owned, leased, hired, or borrowed aircraft or UAS, coverage for bodily injury, property damage, personal and advertising injury arising out of the above shall be maintained.

Minimum Limits of Liability:

\$10,000,000 Per Occurrence

\$10,000,000 Aggregate

NOTE: If UAS are covered by the General Liability policy instead of an Aviation Policy, coverage must be provided by CG 24 50 (or its equivalent) for "any aircraft used in the Insured's operations" for "any operations or projects of the Insured".

9. Crime **(If Designated by Contractor's Scope of Work)**
- Include the Employee Theft and Theft, Disappearance and Destruction coverage parts.
 - The Employee Theft Coverage part shall include the Clients' Property Endorsement (ISO Form CR 04 01, or its equivalent).
 - Minimum Limits of Liability: \$1,000,000 Per Occurrence
10. Privacy Liability **(If Designated by Contractor's Scope of Work)**
- Contractor shall maintain coverage for third party liability arising out of breach of privacy, inclusive of confidential and proprietary business information, HIPAA violations and other breaches of personally identifiable information and/or protected health information, which may arise from their work with this contract.
 - Minimum Limits of Liability: \$1,000,000 Per Claim / \$1,000,000 Aggregate
 - Privacy Breach Notification and Credit Monitoring: \$250,000 Per Occurrence
11. Property Coverage **(If Designated by Contractor's Scope of Work)**
- Contractor shall provide coverage for damage to their work, materials to be part of the project (on-site and off-site), and in transit.
 - Valuable Papers coverage is to be included with a minimum \$500,000 Limit.
12. Owned, Leased, Rented or Borrowed Equipment **(If Designated by Contractor's Scope of Work)**:
- Contractor shall maintain Property Coverage for their owned, leased, rented or borrowed equipment, tools, trailers, etc.

INDEMNIFICATION

To the extent that state and/or federal laws limit the terms and conditions of this clause, it shall be deemed so limited to comply with such state and/or federal law. This clause shall survive termination of this contract. The Contractor shall protect, defend, indemnify and hold harmless the Authority, its commissioners, agents, servants, employees, and representatives (the "Indemnified Parties") from and against all liability, (including liability for violation of any law or any common law duty) claims, damages, losses, and expenses including attorneys' fees arising in connection with, out of, or resulting from the performance of the work, provided that any such liability, claim, damage, loss or expense (i) is attributable to bodily injury, sickness, disease, or death, or to any statutory or regulatory rule designed to protect against such conditions, or to injury to or destruction of tangible property (other than the work itself), and including the loss of the use resulting there from, and (ii) is caused by or results from, in whole or in part, any act or omission of the Contractor, or any Subcontractor, or anyone direct or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is also caused by or results from any act or omission of any party indemnified hereunder. Such obligation shall

not be construed to negate, abridge, or reduce other rights, obligations or indemnity which would otherwise exist as to a party or person described in this Indemnification.

In any and all claims against the Indemnified Parties by an employee of the Contractor, or Subcontractor, or anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for any Contractor, or Subcontractor under Workmen's Compensation Acts, Disability Benefits Acts, or other Employee Benefit Act.

These Indemnification provisions shall survive the termination of this contract.

PROSECUTION AND PROGRESS OF THE WORK

144. ASSIGNMENT

The Contractor shall not assign, transfer, convey or otherwise dispose of this Contract or any of the proceeds thereunder unless written consent of the Authority has been obtained. No right under this Contract or claim for any proceeds due or to become due hereunder shall be asserted against the Authority, or persons acting for the Authority, by reason of any so-called assignment, transfer or conveyance of this Contract or any part thereof unless such assignment, transfer or conveyance has been authorized by the written consent of the Authority. The instrument of assignment, transfer or conveyance shall contain a clause subordinating the claim of the assignee transferee or conveyee to all prior liens for services rendered for materials supplied for the execution of the work.

145. SUBCONTRACTING

The Contractor shall not employ any Subcontractor who was not named by the Contractor as a proposed Subcontractor as specified in the PROPOSAL SECTION, without written approval or authorization of the Authority.

The Contractor agrees that he is as fully responsible to the Authority for the acts and omissions of his Subcontractors or suppliers at any tier and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.

The Contractor shall include in his agreements with Subcontractors, including suppliers and manufacturers of equipment, the provisions and requirements of these Contract Documents as applicable to their part of the work included under this Contract, together with such provisions as may be required pursuant to applicable laws. Nothing contained in the Contract Documents shall create any contractual relationship between the Authority or the Engineer and any Subcontractor or sub-Subcontractor.

Subject to the provisions of this Article and to the consent of the Executive Director, Work may be subcontracted except that the item of mobilization or any part thereof shall not be subcontracted. It is understood, however, that any consent of the Authority for the subcontracting of any Work of the Contract in no way relieves the Contractor from its full obligations for all Work under the Contract, nor the surety of its obligations under the bond. The Contractor shall at all times give its personal attention to the fulfillment of the Contract and shall keep the Work under control. The Contractor shall be responsible for all work of Subcontractors which work shall conform to the provisions of the Contract Documents. The consent to the subcontracting of any part of the Work shall not be construed as an approval of the said subcontract or of any of its terms, but is to operate only as an approval of the Contractor's request for the making of a subcontract between the Contractor and its chosen Subcontractor.

The Contractor shall perform with his own organization Contract Work amounting to at least 50 percent of the original total contract price except as follows:

- A. If the Contract Documents include Pay Items designated as "Specialty Items," the Contractor may deduct the value of these items from the original total Contract price before computing the amount of work to be performed by his own organization.
- B. The Contractor may deduct from the amount of work to be performed by his own organization the value of all Pay Items subcontracted to certified D/WBE firms indicated on the original DBE Form approved by the Authority.

In no event shall the Contractor perform, with his own organization, work amounting to less than 30 percent of the original total Contract price reduced in accordance with Item A above.

Where an entire item is subcontracted, the value of Work subcontracted will be determined based on the Pay Item Contract price. When part of the quantity of a unit price item is subcontracted, the value of the work subcontracted will be determined by multiplying the Contract unit price by the quantity performed by the Subcontractor. If the Subcontractor performs part of the work of any unit of a unit price item, that entire unit will be considered to be subcontracted and the value of the work subcontracted will be determined by multiplying the Contract unit price by the number of units of the quantity considered to be subcontracted. When a portion of a lump sum item or an item which includes specialty work is subcontracted, the value of Work subcontracted will be determined based on the estimated cost of the Work to be subcontracted as determined from the breakdown of cost submitted by the Contractor. When part of a sign support structure is subcontracted, the provisions for a lump sum item govern.

Application for subcontracting any part of the Work shall be made by the Contractor on forms furnished by the Authority. That form, fully completed in quadruplicate, one (1) original and three (3) copies, shall be furnished to the Engineer. The Contractor shall attach to that form a certified copy of the executed subcontract between the Contractor and the Subcontractor. The copy of the subcontract will be used in the review of the application.

After review of the application, the consent of or rejection by the Authority of the subcontracting will be provided to the Contractor in writing. Prior to the receipt of the written consent from the Authority, Work shall not be performed on the Project under the subcontract.

Subcontracting will not be permitted to firms and individuals suspended or debarred by the State of New Jersey Department of Transportation or included in the Report of Suspensions, Debarments, and Disqualifications of Firms and Individuals as maintained by the New Jersey Department of the Treasury, Division of Building and Construction, Bureau of Contractor Prequalification.

Subcontracting of those electrical items, which require electricians will be permitted only to Subcontractors who are licensed electricians in the State of New Jersey regardless of the value of the subcontract.

The Subcontractor shall look only to the Contractor for the payment of any claims of any nature whatsoever arising out of the subcontract. The Subcontractor agrees, as a condition of the Authority's consent to the making of the subcontract, that the Subcontractor shall make no claims against the Authority or its agents or employees for any Work performed or thing done by reason of the subcontract, or for any other cause that may arise by reason of the relationship created between the Contractor and Subcontractor by the subcontract.

Additionally, the Contractor shall give assurances, prior to the Authority's giving consent, that when minimum wage rates are specified they shall apply to labor performed on all subcontracted Work.

The Authority will not consent to the making of any subcontract unless the proposed Subcontractor furnishes a statement to the effect that the Subcontractor is acquainted with all of the provisions of the Contract.

146. OTHER CONTRACTS

The Authority may let other contracts in connection with the work. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials, and shall cooperate as necessary to provide for the orderly and timely execution of their work, and shall properly connect and coordinate his work with theirs.

If any part of work under this Contract depends on the prior acceptable completion of work under separate contract(s), the Contractor for this Contract shall inspect the existing conditions that are to receive his work and promptly provide a written report to the Engineer describing any defects in such existing conditions that would adversely affect the satisfactory completion of the work under this Contract. The Contractor's failure to so inspect and report shall constitute acceptance of the work under separate contract(s) as being suitable for the proper reception and completion of the work under this Contract, excluding, however, those defects in the work by others that occur after the satisfactory completion of the work specified hereunder:

147. COMMENCEMENT OF WORK

Upon execution of the Contract by the Authority, a fully executed copy together with a Notice to Proceed will be provided to the Contractor. Receipt of the executed Contract and Notice to Proceed shall constitute the Contractor's authority to enter upon the Project site, provided the Contractor has submitted to the Engineer, and the Engineer has accepted, the insurance certificates required under GENERAL CONDITIONS Article "INSURANCE AND LIABILITY" and a pre-construction conference has been held. Construction operations shall not begin until the Contractor has supplied, and the Engineer has accepted, the progress schedule and other certifications, forms, schedules, and any other information required by the Contract Documents, and until the Contractor has established a field office as required by Contract Documents. The Contractor shall begin the work to be performed under the contract within 14 calendar days of the date set by the Engineer in the written notice to proceed, but in any event, the Contractor shall notify the Engineer at least 24 hours in advance of the time actual construction operations will begin. Failure to begin construction operations within 14 calendar days shall constitute a default for which the Authority may take whatever action that is deemed appropriate under the Contract.

148. PROSECUTION OF THE WORK

It is expressly understood and agreed that the time of beginning, rate of progress, and time of completion of the work are the essence of this Contract and are the responsibility of the Contractor. The Contractor should schedule the work and provide proper resources, labor, equipment and material to complete the project within the Time of Completion. The work shall be executed as required in the Contract Documents.

At or prior to the pre-construction meeting, the Contractor shall furnish the name and location of the solid waste facilities to be used as well as the fee structure of each of the facilities. Failure to provide such information will make the Contractor ineligible for adjusted compensation as provided for in GENERAL CONDITIONS Article "CHANGES IN CHARACTER OR WORK."

149. LIMITATION OF OPERATIONS

The Contractor shall conduct the Work at all times in such a manner and in such sequence that shall ensure the least interference with traffic. The Contractor shall have due regard for the location of detours and for the provisions for handling traffic. The Engineer may require the Contractor to finish a section on which Work is in progress before Work is started on any additional sections if the opening of such section is essential to public convenience.

On Airport Projects the Contractor shall control his operations and the operations of his Subcontractors and all suppliers so as to provide for the free and unobstructed movement of aircraft in the AIR OPERATIONS AREAS of the airport.

When the work requires the Contractor to conduct his operations within an AIR OPERATIONS AREA of the airport, the work shall be coordinated with airport management (through the Engineer) at least 48 hours prior to commencement of such work. The Contractor shall not close an AIR OPERATIONS AREA until so authorized by the Engineer and until the necessary temporary marking and associated lighting is in place as provided in the Article titled "BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS."

When the contract work requires the Contractor to work within an AIR OPERATIONS AREA of the airport on an intermittent basis (intermittent opening and closing of the AIR OPERATIONS AREA), the Contractor shall maintain constant communications as hereinafter specified; immediately obey all instructions to vacate the AIR OPERATIONS AREA; immediately obey all instructions to resume work in such AIR OPERATIONS AREA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AIR OPERATIONS AREA until the satisfactory conditions are provided.

150. CHARACTER OF WORKERS

The Contractor shall at all times employ sufficient labor and equipment for prosecuting the several classes of Work to full completion in the manner and time required by the Contract Documents.

All workers shall competent and have sufficient skill and experience to properly perform the Work assigned to them. Workers engaged in special Work or skilled Work shall have sufficient experience in that Work and in the operation of the equipment required to perform the Work satisfactorily. The Contractor shall provide sufficient competent, skillful employees to complete the work in the allotted time by the Time of Completion.

Any person employed by the Contractor or by any Subcontractor who, in the opinion of the Engineer, does not perform Work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be promptly removed by the Contractor or Subcontractor employing the person and shall not be again employed in any portion of the Work without approval. Should the Contractor fail to remove such person or persons as required, or fail to furnish suitable and sufficient personnel for the proper prosecution of the Work, the Engineer may suspend the Work by written notice until compliance with such orders.

Except for regularly retired employees, the Contractor and its Subcontractors shall not, without the written consent of the public employer of such person, engage on a full, part-time, or other basis, during the period of the Contract, any of the professional or technical personnel of the South Jersey Transportation Authority.

151. CONTRACTOR'S METHODS, TOOLS AND EQUIPMENT

The Contractor's tools and equipment used on the work shall be furnished in sufficient quantity and of a capacity and type that will perform the work specified and in the time allotted by the Time of Completion. All equipment which is proposed to be used on the Work shall be of sufficient size and in such mechanical condition as to meet the requirements of the Work and to produce a satisfactory quality of Work.

Tools and Equipment used on any portion of the Project shall not cause damage to the roadway, adjacent property, or other highways. They shall be maintained and used in a manner that will not create a hazard to persons or property or cause a delay in the progress of the work.

When the methods and equipment to be used by the Contractor in accomplishing the construction are not specified, the Contractor is free to use any methods or equipment that accomplishes the Work. When the use of certain methods and equipment is specified, the specified methods and equipment shall be used unless otherwise authorized in accordance with GENERAL CONDITIONS Article "SUBSTITUTES OR "OR EQUAL" ITEMS."

152. AUTHORITY'S RIGHT TO CORRECT DEFECTIVE WORK

If the Contractor should, in the opinion of the Engineer, neglect to execute the Work properly or should neglect or refuse at his own cost to take up and replace defective work that has been rejected by the Engineer, then the Authority will notify his Surety of the condition. After ten (10) days (or such longer period as the Authority may allow) written notice to the Contractor and the Surety, and without prejudice to any other right which the Authority may have under the contract, the Authority may take over that portion of the work that has been improperly executed and make good the deficiencies and deduct the cost thereof from the payments then or thereafter due the Contractor, and if such payments are not sufficient therefor, charge the cost to the Contractor and his Surety.

153. WORKING SITE / USE OF PREMISES

The Contractor shall confine his equipment, the storage of materials, and the operation of his workers to limits indicated in the Contract Documents or required by law, permits, or directions of the Engineer, and shall not unreasonably encumber the premises with his materials. The Contractor shall not use the decks of any completed bridges, or the areas including slopes under any completed bridges, as working sites or storage areas for materials or equipment. The Contractor shall provide, at his own expense, the necessary rights-of-way and access to the work which may be required outside the limits described above and provide evidence of such access rights to the Authority. Except as otherwise provided, any space that the Contractor may require for plant, equipment, storage, or other purposes in addition to that available at the Project site, shall be procured by the Contractor, and the cost thereof shall be included in the prices bid for the various Pay Items scheduled in the Proposal. In the event of default as set forth in GENERAL CONDITIONS Article "TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSIONS," the Authority has the right to take over and occupy such space, or cause it to be occupied, for the purpose of completing the Project, at the Contractor's expense. If the space is leased, the lease shall contain a provision that in event of default by the Contractor the lease may be assigned to the Authority or its nominee at their election. The Contractor agrees in event of said default, that it shall make such assignment.

The Contractor shall use every precaution to prevent injury or damage to all underground structures, such as pipes, wires and conduits; to all paved surfaces and to all turfed areas. He shall be responsible for injury or damage of any character resulting from any act, neglect, misconduct in his manner or method of execution or non-execution of said work, and such responsibility shall not be released until the work shall have been completed and accepted.

Whenever any such damage or injury is done, the Contractor shall restore, at his own expense, the above to a condition similar or equal to that existing before such damage or injury is done.

The Contractor shall take particular care when new cables are being placed through existing duct banks, which contain existing cables. Any damage caused to existing cable by or during the operations of the Contractor must be repaired immediately at the sole expense of the Contractor.

The maintenance of Airport Operations is of the utmost importance and priority on airport projects. The Contractor shall so schedule and conduct his operations and store his materials and equipment so that no unauthorized interference to normal airport operations will result therefrom.

Grading and stockpiling of materials or other construction operations shall not be conducted in a manner to cause malfunction of or interference with the Airport traffic control. The Contractor shall plan and execute his work in such a manner that adequate access will be available for vehicular traffic at all times during the period of construction. No trucking or other heavy equipment will be allowed on the paved runways, and at no time shall the speed exceed the limits of the Airport. It is expressly understood that the Authority will not be responsible for any deduction, interpretations, delays, or conclusions made by the Contractor as to the difficulties, which will be encountered in this regard.

Existing airfield lights shall be maintained in full operation throughout the period of this Contract. Where disconnections of airfield lights are required, such work shall be made at such times and in such manner as approved by Airport Management, the FAA and the Control Tower Chief. The Contractor shall conduct his operations as required to maintain full use of existing lighting circuits, utilizing temporary cables and connections if necessary.

The Contractor shall secure the Airport Operations Area (AOA) with temporary fencing in accordance with the dimensions and locations shown on the drawings.

The cost of maintaining Airport operations shall be absorbed by the Contractor in the prices bid for the various items of work with the exception of items specified in the Schedule of Prices.

154. UNUSUAL SITE CONDITIONS

The Contractor shall promptly, and before such conditions are disturbed, notify the Engineer in writing of previously unknown physical conditions at the site of an unusual nature or differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Contract. The Engineer will promptly investigate the conditions, and if the Engineer determines that such conditions are unusual, that they could not have been discovered by the Contractor through employing the high standard of care required under GENERAL CONDITIONS Article "EXAMINATION OF CONTRACT DOCUMENTS AND SITE OF PROJECT", and that they cause an increase or decrease in the cost of, or the time required for, performance of any part of the Work under the Contract, an adjustment, as appropriate, will be made in the Contract Time pursuant to GENERAL CONDITIONS Articles "CLAIMS FOR ADDITIONAL TIME AND/OR COMPENSATION" and "EXTENSION OF TIME" and in compensation to the Contractor pursuant to GENERAL CONDITIONS Articles "CHANGES", "MINOR CHANGES IN THE WORK", "INCREASED OR DECREASED QUANTITIES", "ELIMINATED ITEMS", "EXTRA WORK", "PAYMENT FOR MODIFICATIONS", and "PAYMENT FOR CONTRACTOR'S EXPENSES DURING DELAY".

Claims arising from unusual site conditions are barred unless the Contractor has given the required notice prior to disturbing such conditions.

155. COMPLAINTS

All complaints received by the Contractor shall be reported to the Engineer no later than the working day following receipt thereof. Such reports shall include the name, address, date, time received, date and time of action complained about, and a brief description of the alleged damages or other circumstances upon which the complaint is predicated. Each complaint shall be assigned a separate number, and all complaints shall be numbered consecutively in order of receipt. In the event more than one complaint is received from the same complainant, each later complaint shall show all previous complainant numbers registered by the same complainant. In addition, a summary report shall be made to the Engineer each month which shall indicate the date, time, and name of the person investigating the complaint and the amount of damages claimed (or estimate thereof), including the amount of settlement, if any. When settlement of a claim is made, the Engineer shall be furnished with a copy of the release of claim by the claimant. The Authority shall be notified immediately, throughout the statutory period of liability, of any formal claims or demands made by attorneys on behalf of claimants; of the serving of any notice, summons, subpoena, or other legal documents incidental to litigation; and for any out-of court settlement or court verdicts resulting from litigation.

156. TEMPORARY SUSPENSION OF WORK

The Engineer has the authority to suspend the Work wholly or in part, for such period as deemed necessary, due to unsuitable weather, or to such other conditions as are considered unfavorable for the suitable prosecution of the Work, or for such time as deemed necessary due to the failure on the part of the Contractor to carry out orders given, or to perform any provision of the Contract. The Contractor shall promptly comply with the written order of the Engineer to suspend the Work wholly or in part. The suspended Work shall be resumed when conditions are favorable and methods are corrected, as ordered or approved in writing.

In the event that a suspension of Work is ordered as provided above, and should such suspension be ordered by reason of the failure of the Contractor to carry out orders or to perform any provision of the Contract; or by reason of weather conditions being unsuitable for performing any item or items of Work, which Work, in the sole opinion of the Engineer, could have been performed prior to the occurrence of such unsuitable weather conditions had the Contractor diligently prosecuted the Work when weather conditions were suitable; the Contractor, at its expense, shall do all the Work necessary to provide a safe, smooth, and unobstructed passageway through the construction area for use by public traffic during the period of such suspension. In the event that the Contractor fails to perform the Work above specified, the Authority will perform such Work and the cost thereof will be deducted from any monies due or that may become due the Contractor.

If the Engineer orders a suspension of all of the Work or a portion of the Work which is the current controlling operation or operations, due to unsuitable weather or to such other conditions as are considered unfavorable to the suitable prosecution of the Work, the days on which the suspension is in effect are not considered working days on working day contracts. If a portion of Work at the time of such suspension is not a current controlling operation or operations, but subsequently does become the current controlling operation or operations, the determination of working days will be made on the basis of the then current controlling operation or operations. Similarly, on calendar day and specified completion date contracts, extensions of Contract Time will be granted only if the suspension affects the overall completion of the Contract and the other requirements of GENERAL CONDITIONS Article "EXTENSION OF TIME" are satisfied.

If a suspension of Work is ordered by the Engineer due to the failure on the part of the Contractor to carry out orders given or to perform any provision of the Contract, the days on which the suspension order is in effect are to be considered working days if such days are working days

within the meaning of the definition set forth in GENERAL CONDITIONS Article titled "DEFINITIONS". On calendar day and specified completion date contracts, extensions of Contract Time will not be granted due to such suspension.

The Contractor shall have no claim for additional compensation as a result of suspension ordered for the reasons set forth in this Article, except as to the costs of providing a smooth and unobstructed passageway consistent with the above provisions.

157. SUSPENSION OF WORK

The Authority may order the Contractor in writing to suspend, delay or interrupt all or any part of the work for such period of time as he may determine to be appropriate for the convenience of the Authority.

If the performance of all or any part of the work is, for any unreasonable period of time, suspended, delayed, or interrupted by an act of the Authority in administration of this Contract or by his failure to act within the times specified in this Contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this Contract (excluding profit) necessarily caused by such unreasonable suspension, delay or interruption, and the Contract modified in writing accordingly. However, no adjustment shall be made under this Article for any suspension, delay or interruption to the extent.

1. that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or
2. for which an equitable adjustment is provided or excluded under any other provision of this Contract.

No claim under this Article shall be allowed:

1. for any costs incurred more than twenty (20) days before the Contractor shall have notified the Authority in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and
2. unless the claim, in an amount stated, is asserted in writing within sixty (60) days after the termination of such suspension, delay, or interruption, but not later than the date of final payment under this Contract.

158. TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSIONS

If the Contractor refuses or fails to prosecute the work, or any separable part of the work, with such diligence as will insure its completion within the time specified in this Contract, or any extension thereof, or fails to complete said work within such time, or in the event of substantial failure to fulfill his obligations under this contract through no fault of the Authority, the Authority may, by written notice to the Contractor, terminate his right to proceed with the work or such part of the work as to which there has been delay. In such event the Authority may take over the work and prosecute the same to completion by contract or otherwise, and may take possession of and use in completing the work such materials, appliances, and plant as may be on the site of the work and necessary therefor. Whether or not the Contractor's right to proceed with the work is terminated, he and his Sureties shall be liable for any damage to the Authority resulting from his refusal or failure to complete the work within the specified time.

If the Contract provides for liquidated damages, and if the Authority terminates the Contractor's right to proceed, the resulting damage will consist of such liquidated damages until the work is completed or accepted.

The Contractor's right to proceed shall not be terminated nor the Contractor charged with resulting damage if:

1. The delay in the completion of the work arises from causes other than normal weather beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, acts of the public enemy, acts of the Authority in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the Authority, fires, floods, epidemics, quarantine restrictions, unusually severe weather, or delays of Subcontractors or suppliers at any tier arising from causes other than normal weather beyond the control and without the fault or negligence of both the Contractor and such Subcontractors or suppliers; and
2. The Contractor within ten (10) days from the beginning of any such delay (unless the Authority grants a further period of time before the date of final payment under the Contract), notifies the Authority in writing of the causes of delay. Any claim for a time extension shall be asserted in writing within sixty (60) days after the termination of the delay and include detailed and documented justification as well as a Time Impact Schedule Analysis. The Authority shall ascertain the facts and the extent of the delay and extend the time for completing the work when, in his judgement, the findings of fact justify such an extension. His findings of fact shall be final and conclusive on the parties, subject only to appeal as Article "DISPUTES" of these GENERAL CONDITIONS provide.

If, after notice of termination of the Contractor's right to proceed under the provisions of this Article, it is determined for any reason that the Contractor was not in default under this Article, or that the delay was excusable under this Article, the rights and obligations of the parties shall be the same as if the Notice of Termination has been issued under Article "TERMINATION FOR CONVENIENCE" of these GENERAL CONDITIONS. The rights and remedies of the Authority provided in this Article are in addition to any other rights and remedies provided by law or under this Contract.

159. CLAIMS FOR ADDITIONAL TIME AND/OR COMPENSATION

When the Contractor deems additional time and/or compensation is or may be due him for work or costs not clearly covered in the Contract Documents, or not ordered by the Authority according to the provisions of Article "CHANGES", of these GENERAL CONDITIONS, the Contractor shall notify the Engineer in writing of his intention to make a claim for such additional time and/or compensation before he begins the work or otherwise incurs costs upon which he intends to base the claim. The Contractor shall clearly state which of the following listed articles of these GENERAL CONDITIONS the claim shall be based upon: Article "SUSPENSION FOR WORK"; Article "TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSIONS," Article "TERMINATION FOR CONVENIENCE" Article "CHANGES"; or, Article "DIFFERING SITE CONDITIONS." Failure to comply in all respects to the notice and other filing provisions of these Articles may cause a rejection of the claim.

The Contractor shall also provide the Engineer with written information for keeping strict account of the actual costs of the work upon which the claim is based. Such costs shall be maintained in accordance with GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS" and "AUDIT: ACCESS TO RECORDS." If such notification or information is not provided by the Contractor, then he shall be deemed to have waived his right to claim for additional time and/or compensation. Such notice by the Contractor and the fact the Engineer has kept account of the

cost shall not in any way be constructed as proving the validity of the claim. Claims for additional time and/or compensation shall be made in itemized detail based on a proper schedule analysis with the supporting documentation and submitted in writing in accordance with the Article of these GENERAL CONDITIONS under which the claim is being filed. The Engineer will carefully consider the claim and render a decision thereon in accordance with Article "DUTIES AND RESPONSIBILITIES OF THE ENGINEER" of these GENERAL CONDITIONS. If the Authority approves the claim, it will be paid for in accordance with Article "PAYMENT FOR MODIFICATIONS."

Claims for additional time and/or compensation for delays resulting from alterations or changes to the work that have been authorized by Modification Order will not be considered. All costs and time impacts for such altered or changed work shall have been included in the amount of compensation or time extension stipulated in the Modification Order prior to the signing of the Modification Order by the Authority and the Contractor.

160. TERMINATION FOR CONVENIENCE

- A. The Authority may terminate the performance of the work under this Contract in accordance with this Article in whole, or from time to time in part, whenever the Authority shall determine that such termination is in the best interest of the Authority. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of the work under the Contract is terminated, and the date upon which such termination becomes effective.
- B. After receipt of a Notice of Termination and except as otherwise directed by the Authority, the Contractor shall:
 - 1. Stop work under the contract on the date and to the extent specified in the Notice of Termination;
 - 2. Place no further orders or subcontracts for materials, services, or facilities except as necessary to complete the portion of the work under the Contract which is not terminated;
 - 3. Terminate all orders and subcontracts to the extent that they relate to the performance of the work terminated by the Notice of Termination;
 - 4. Assign to the Authority, in the manner, at the times, and to the extent directed by the Authority, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated. The Authority shall have the right, in his discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;
 - 5. Settle all outstanding liabilities and claims arising out of such termination of orders and Subcontractors, with the approval or ratification of the Authority to the extent he may require. His approval or ratification shall be final for all the purposes of this Article;
 - 6. Transfer title to the Authority, and deliver in the manner, at the times, and to the extent, if any, directed by the Authority, (i) the fabricated or unfabricated parts, work in process, completed work, supplies and other material produced as a part of, or acquired in connection with the performance of, the work terminated by the Notice of Termination, and (ii) the completed or partially completed Plans,

- drawings, information, and other property which, if the Contract had been completed would have been required to be furnished to the Authority.
7. Use his best efforts to sell, in the manner, at the times to the extent, and at the price or prices that the Authority, directs or authorizes, any property of the types referred to in Paragraph B6 of this Article, but the Contractor (i) shall not be required to extend credit to any purchaser; and (ii) may acquire any such property under the conditions prescribed and at a price or prices approved by the Authority. The proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Authority to the Contractor under this Contract or shall otherwise be credited to the price or cost of the work covered by this Contract or paid in such other manner as the Authority may direct;
 8. Complete performance of such part of the work as shall not have been terminated by the Notice of Termination; and
 9. Take such action as may be necessary, or as the Authority may direct, for the protection and preservation of the property related to this Contract and in which the Authority has or may acquire an interest.
- C. After receipt of a Notice of Termination, the Contractor shall submit to the Authority his termination claim in the form and with the certification the Authority prescribes. Such claim shall be submitted promptly but in no event later than one (1) year from the effective date of termination, unless one (1) or more extensions in writing are granted by the Authority upon request of the Contractor made in writing within such 1-year period or extension. If the Contractor fails to submit his termination claim within the time allowed, the Authority may determine, on the basis of information available to him, the amount, if any due to the Contractor because of termination. The Authority shall then pay to the Contractor the amount so determined.
- D. Subject to the provisions of Paragraph C, the Contractor and the Authority may agree upon the whole or any part of the amount or amounts to be paid to the Contractor because of the total or partial termination of work under this Article. The amount or amounts may include a reasonable allowance for profit on work done. However, such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total Contract price as reduced by the amount of payment otherwise made and as further reduced by the Contract price of work not terminated. The contract shall be amended accordingly, and the Contractor shall be paid the agreed amount. Nothing in Paragraph E of this Article prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the Authority to agree upon the whole amount to be paid to the Contractor because of the termination under this Article, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the Contractor pursuant to this Paragraph D.
- E. If the Contractor and the Authority fail to agree, as Paragraph D provides, on the whole amount to be paid to the Contractor because of the termination of work under this Article, the Authority shall determine, on the basis of information available to him, the amount, if any, due to the Contractor by reason of the termination and shall pay to the Contractor the amounts determined as follows:
1. For all Contract work performed before the effective date of the Notice of Termination, the total (without duplication of any times) of (i) the cost of such work; (ii) the cost of setting and paying claims arising out of the termination of

work under subcontracts or orders as Paragraph B5 of this Article provides. This cost is exclusive of the amounts paid or payable on account of supplies of materials delivered or services furnished by the Subcontractor before the effective date of the Notice of Termination. These amounts shall be included in the cost on account of which payment is made under (i) above; and (iii) a sum, as profit on (i), above, that the Authority determines to be fair and reasonable. But, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, no profit shall be included or allowed under this subdivision (iii) and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

2. The reasonable cost of the preservation and protection of property incurred under Paragraph B9 of this Article, and any other reasonable cost incidental to termination of work under this Contract. The total sum to be paid to the Contractor under Paragraph E1 of this Article shall not exceed the total sum to be paid to the Contractor under Paragraph E1 of this Article shall not exceed the total Contract price as reduced by the amount or payments otherwise made and as further reduced by the Contract price of the work not terminated. Except for the normal spoilage, and except to the extent that the Authority shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor under Paragraph E1 above, the fair value, as determined by the Authority of property which is destroyed, lost stolen, or damaged, to the extent that it is undeliverable to the Authority, or to a buyer under Paragraph B7 of this Article.
- F. The Contractor shall have the right to dispute under Article "DISPUTES" of these GENERAL CONDITIONS from any determination the Authority makes under Paragraph C or E of this Article. But, if the Contractor has failed to submit his claim within the time provided in Paragraph C of this Article and has failed to request extension of such time, he shall have no such right to appeal. In any case where the Authority has determined the amount due under Paragraph C or Paragraph E of this Article, the Authority shall pay to the Contractor the following: (i) if there is no right of appeal hereunder or if no timely appeal has been taken, the amount so determined by the Authority or (ii) if a Disputes proceeding is initiated, the amount finally determined in such Disputes proceeding.
- G. In arriving at the amount due to the Contractor under this Article, there shall be deducted (i) all unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this contract, (ii) any claim which the Authority may have against the Contractor in connection with this Contract, and (iii) the agreed price for, or the proceeds of sale of, any materials, supplies or other things kept by the Contractor or sold, under the provisions of this Article, and not otherwise recovered by or credited to the Authority.
- H. If the termination hereunder be partial, before the settlement of the termination portion of this Contract, the Contractor may file with the Authority a request in writing for an equitable adjustment of the price or prices specified in the Contract related to the continued portion of the Contract the portion not terminated by the Notice of Termination). Such equitable adjustment as may be agreed upon shall be made in the price or prices. Nothing contained herein shall limit the right of the Authority and the Contractor for the completion of the continued portion of the Contract when the Contract does not contain an established Contract price for the continued portion.

161. AUTHORITY'S USE OF PORTIONS OF THE WORK

The Authority at anytime may request the Contractor, in writing, to permit the Authority to use any part of the work which the Authority may require and which may be so used without significant interference with construction of the other parts of the work. Within a reasonable time thereafter, the Authority, the Contractor, and the Engineer shall make an inspection of that part of the work to determine its status of completion. If the Engineer does not consider that part of the work to determine its status of completion. If the Engineer does not consider that part of the work to be substantially complete, the Engineer will notify the Authority and the Contractor in writing, giving his reasons therefore. If the Engineer considers that part of the work to be substantially complete, the Engineer will execute and deliver to the Authority and the Contractor a Certificate of Substantial Completion as set forth in Article "SUBSTANTIAL COMPLETION DATE" of these GENERAL CONDITIONS and fixing the date of Substantial Completion as to that part of the work, attaching thereto a tentative list of items to be completed or corrected before final payment. Such tentative list shall not be considered as a complete listing of Contractor's responsibilities for meeting the requirements for final acceptance of the work. The tentative listing of uncompleted items shall include the time within which the Contractor shall complete the items listed therein. The Authority will allow the Contractor reasonable access to complete or correct items on the tentative list.

In lieu of the issuance of a Certificate of Substantial Completion, the Authority may occupy and operate a facility constituting part of the work, whether or not it is substantially complete, if such facility is functionally and separately usable; provided that prior to any such takeover, the Authority and the Contractor have agreed as to the division of responsibilities between the Authority and the Contractor for security, operation, safety, maintenance, correction period, heat, utilities, and insurance with respect to such facility.

Such use shall not be considered as final acceptance of any portion of the work, nor shall such use be considered as cause for an extension of the Contract completion time unless authorized by a Contract Modification by the Authority.

162. TIME OF COMPLETION

The Contractor shall complete all or any portion of the Project called for under the Contract in all parts and requirements within the time or times for completion of the Contract set forth in the Information for Bidders. All time limits stated in the Contract Documents are of the essence of the Contract.

When the Contract Time is on a working day basis, the Engineer will furnish the Contractor a weekly statement showing the number of days charged to the Contract for the preceding week and the number of days specified for Completion. The Contractor is allowed one (1) week in which to file a written protest setting forth in what respect said weekly statement is incorrect. Otherwise, the statement is deemed to have been accepted by the Contractor as correct.

When the Contract Time is on a calendar day basis, it shall consist of the number of calendar days stated in the Contract counting from the date set forth in the Notice to Proceed in accordance with GENERAL CONDITIONS Article "COMMENCEMENT OF WORK," including all Saturdays, Sundays, holidays, and non-work days.

When the Contract Time is a specified completion date, that is the date on which the Contract shall reach Completion.

163. LIQUIDATED DAMAGES OR ACTUAL DAMAGES FOR DELAY

A. GENERAL

Time is of the essence of this contract, and either, but not both, Liquidated Damages or Actual Damages for Delay will be assessed against the Contractor for failure to complete the work within the time(s) specified in these Contract Documents. The type of damages to be assessed for failure to complete the work on time is set forth in the Information for Bidders.

B. LIQUIDATED DAMAGES

Should the Contractor fail to complete the work, or any part thereof, in the time agreed upon in the Contract or within such extra time as may have been allowed for delay by extensions granted as provided in the Contract, the Contractor shall reimburse the Authority for the additional expense and damage for each calendar day, Sundays and legal holidays included, that the Contract remains uncompleted after the Contract completion date. It is agreed that the amount of such additional expense and damage incurred by reason of failure to complete the work is the actual cost to the Authority, which is estimated at a per-diem rate stipulated in the Information for Bidders. The said amounts are hereby agreed upon as liquidated damages for the loss to the Authority on account of expense due to the employment of Engineers, inspectors, and other employees after the expiration of the time of completion, and as applicable, expenses incurred by the Authority as a result of the impact of the Contractor on other Contractors under this project or other contracts, and on account of the value of the operation of the works dependent thereon. It is expressly understood and agreed that this amount is not to be considered in the nature of a penalty, but as liquidated damages, which have accrued against the Contractor. The Authority shall have the right to deduct such damages from any amount due, or that may become due the Contractor, or the amount of such damages shall be due and collectible from the Contractor or his Surety.

C. ACTUAL DAMAGES FOR DELAY

Failure to meet the Contract Completion Date(s) by the Contractor will subject the Contractor to liability for all damages suffered by the Authority. Damages that might accrue to the Authority include, but are not limited to, the additional costs for project inspection, the Authority's project administration and overhead, the Engineer's project administration and overhead, loss of revenue from the completed facility, delay or impact damages from other Contractors on this Contract or other Contractors on the Contracts resulting from the delay, rental costs incurred by the Authority as a result of delay in completion of this Contract, value and use loss arising from this delay, and all legal costs associated with administration for this General Conditions or with any litigation arising out of this General Conditions. The Authority may, without prejudice to any other remedies that may be available, withhold from any monies due, or which may become due the Contractor, all damages sustained or which may be sustained in accordance with this Article. The rights and remedies of the Authority provided in this Article are in addition to any other remedies provided by law or under this Contract.

164. RESERVED

165. RESERVED

PROGRESS SCHEDULE

166. GENERAL

This work consist of the preparation and maintenance of a project control system using the Critical Path Method (CPM) of scheduling which shall be developed and used by the Contractor

to demonstrate Contractor planning for the performance and progress of all activities, in accordance with this specification and contract documents.

By submitting a bid on the project, the Contractor is representing to the Authority that the project can be completed by the Required Completion Date and in accordance with all Project Milestone Dates, and that included in the Contract Price are any and all costs which may be incurred in order to meet all of the requirements of this Contract and to complete the Contract work by the Required Completion Date, and in accordance with all Project Milestone Dates.

At or prior to the pre-construction conference, the Contractor shall furnish, for approval, a progress schedule showing the order in which the Contractor proposes to prosecute the Work; the dates on which the various work stages, operations, and principal items of Work including procurement of materials and plant will begin; the quantity and kinds of equipment and character of the labor force; and the contemplated dates for completing the same. The progress schedule shall clearly outline the intended maintenance of traffic, the locations where temporary and permanent soil erosion and sediment control measures shall be installed, and such other information as required by the Contract documents or as deemed appropriate for the Project. The progress schedule shall give special consideration to sensitive areas such as wetlands, floodplains, waterways, and parklands to ensure that appropriate staging and seasonal constraints are considered in order to maximize the effectiveness of the soil erosion and sediment controls. The progress schedule shall also indicate any time frames when work is restricted in these sensitive areas as outlined in the permits issued by the regulatory agencies.

Construction operations shall not begin until the progress schedule has been approved. Once the progress schedule has been approved, the Contractor shall not deviate from it without first notifying the Engineer in writing. In scheduling and executing the Work, the following shall be considered:

- A. Staging - The Contractor shall schedule the Work using such procedures and staging as may be specified in the Contract Documents. Work designated as part of separate stages may be performed simultaneously where provided by the Contract Documents or where approved.

When the Contract Documents provide for staging or specific procedures, the Contractor may, prior to submitting a progress schedule, present for written approval of the Engineer, a detailed, written alternate staging plan or procedure which incorporates the requirements of the Authority. As a condition of the Engineer's reviewing the alternate staging plan or procedure, the Contractor agrees that it is not entitled to additional Contract Time or compensation arising from possible delays to construction due to the time spent in reviewing the Contractor's staging plan or procedure, regardless of whether the Authority accepts or rejects it. If such staging plan or procedure is approved in writing, the Contractor may then prepare a progress schedule consistent with the approval.

Bituminous paving operations shall be staged to progress up to the bottom of the surface course. The bituminous concrete surface course for the full width of the traveled way, shoulder, and auxiliary lanes shall be paved as a single stage of construction and as the final paving operation.

- B. Prosecution of the Work - The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the Project in accordance with the Contract Documents and within the time set forth under GENERAL CONDITIONS Article "TIME OF COMPLETION" and in the Information for Bidders.

Should the prosecution of the Work be discontinued by the Contractor for any reason, the Contractor shall notify the Engineer, in writing, prior to discontinuing work and at least 24 hours before resuming operations.

The Contractor shall arrange and prosecute the Work so that each successive construction operation at each location shall follow the preceding operation as closely as the requirements of the various types of construction permit.

The Engineer may revise stage construction and maintenance of traffic, if deemed necessary, due to unforeseen circumstances which may arise during construction.

Compensation for additional expense to the Contractor and allowance of additional time for completion of the Work shall be as set forth in a Change Order or Supplementary Agreement or in accordance with GENERAL CONDITIONS Articles "CLAIMS FOR ADDITIONAL TIME AND/OR COMPENSATION," "EXTENSION OF TIME", "PAYMENT FOR MODIFICATIONS", and "EXTENSION OF TIME".

When possible, the construction of subsurface structures adjacent to traffic shall be performed while traffic is being diverted from such areas. If traffic must be maintained in such areas, the Work shall be performed expeditiously in stages, as approved, and with minimum interference with traffic.

Subsurface structure excavation adjacent to traffic shall not remain open overnight unless adequately protected by approved safety devices.

The Contractor shall proceed with the Work of demolition of the various buildings that are identified with a demolition number as they become available for demolition. If any of the buildings that are to be demolished are not available for demolition at the time the Contractor begins Work on the Project, the Contractor shall temporarily defer its Work in the vicinity of the building and complete the Work when the building is available for demolition.

Operations adjacent to traffic shall be confined to only one (1) side of the traffic at any one (1) time unless otherwise specified in the Contract Documents.

Concrete curbs to be constructed adjacent to flexible base and surface courses shall be completed, cured, and backfilled before the flexible base and surface courses are constructed.

Underground structures for traffic signals, except for pressure detector installations, shall be constructed prior to completion of the intersecting road.

- C. Intent, Responsibility, and Time - Scheduling of construction is the responsibility of the Contractor. Therefore, it is the Contractor's responsibility to determine the most feasible order of Work commensurate with the Contractor's abilities and the Contract Documents. The requirement for the progress schedule is included to ensure adequate planning and execution of the Work, to assist the Engineer in appraising the Contractor's compliance with the Contract Documents, and to evaluate progress of the Work. The progress schedule will be used for determining extensions or reductions of Contract Time pursuant to GENERAL

CONDITIONS Articles "CLAIMS FOR ADDITIONAL TIME AND/OR COMPENSATION" and "EXTENSION OF TIME".

It is not intended that the Engineer, by approving the progress schedule, agrees that it is reasonable in all respects or that following the progress schedule can result in timely completion of the Project. The progress schedule is not a part of the Contract.

If, in the preparation of the progress schedule, the Contractor projects a completion date that is different than that specified under GENERAL CONDITIONS "TIME OF COMPLETION," the progress schedule in no way voids the date set by the Contract. The date as specified in that Article governs. Where the progress schedule reflects a completion date that is earlier than that specified as the Contract Time, the Engineer may approve the schedule with the Contractor specifically understanding that no claim for additional Contract Time or compensation shall be brought against the Authority as the result of failure to complete the Work by the earlier date shown on the progress schedule.

- D. Acceleration and Default - If, in the opinion of the Engineer, the Contractor falls behind his progress schedule, and cannot complete the Work within the time prescribed under GENERAL CONDITIONS Article "TIME OF COMPLETION", as modified pursuant to GENERAL CONDITIONS Articles "CLAIMS FOR ADDITIONAL TIME AND/OR COMPENSATION", and "EXTENSION OF TIME", the Contractor shall take such steps as may be necessary to improve his progress. The Engineer may require the Contractor to increase the number of shifts, begin overtime operations, work extra days including weekends and holidays, or supplement his construction plant and to submit for approval such supplementary schedule or schedules, as may be deemed necessary to demonstrate the manner in which the agreed rate of progress shall be regained, all at no cost to the Authority.

Failure of the Contractor to comply with the requirements of the Engineer under this Subheading is grounds for the determination that the Contractor is not prosecuting the Work with such diligence as to ensure Completion within the time specified. Upon such determination, the Engineer may terminate the Contractor's right to proceed with the Work or any separable part thereof in accordance with GENERAL CONDITIONS Article "TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSIONS."

The following definitions apply:

- (1) Critical Activities: Activities that control the total duration of a Project, by forming a chain making up the longest sum of durations in a Project. This chain of critical activities forms the critical path of a Project.
- (2) Float: The length of time the start or finish of an activity can be delayed without delaying the Project Milestone Date(s). Float is a shared commodity.
- (3) Milestone Dates: Contractual Milestone Dates as defined in the Information to Bidders section titled "Time of Completion."
- (4) Lag: The delay in number of time units, between an activity and its successor or predecessor. The delay period is from the start or finish of an activity to the start or finish of its successor or predecessor. Lag units can be positive or negative values.

The Contractor shall assign a person, with decision-making authority, responsible to manage this work. Refer to the Milestone Dates referenced in the Information for Bidders section of the Contract.

167. PROCEDURES

A. "Scheduling Conference"

1. Attend a Scheduling Conference with the Engineer within seven (7) calendar days after the Award. The purpose of the Scheduling Conference is to review this specification.
2. At the conference, submit a list of all Required Completion Dates and Milestone Dates, as specified in this Contract. Be prepared to discuss concepts and the logic to be used in sequencing work activities for development of the Schedule.
3. In addition, designate a representative to serve as the CPM Scheduler and submit that individual's credentials for acceptance by the Engineer, as described in GENERAL CONDITIONS Article entitled PROCEDURES, Paragraph H of this specification.

B. "Preliminary Ninety-Day CPM Schedule"

Within fourteen (14) calendar days after the Notice of Award of the Contract, or fourteen (14) calendar days prior to the Pre-construction Conference (whichever occurs earlier), submit a "Preliminary Ninety-Day CPM Schedule" which itemizes the work and defines the Contractor's plan for the first ninety (90) days of Contract Time. This "Preliminary Ninety-Day CPM Schedule" will provide detail for the first ninety (90) days of the Contract Time, in full accordance with all requirements of this GENERAL CONDITIONS, PROGRESS SCHEDULE, as well as summary logic for the remainder of the Contract Time. The use of lag lead times in the Preliminary Ninety-Day Schedule and the CPM Schedule is not permitted. All relationships shown are to be Finish to Start relationships. No work on the project will be permitted by the Contractor or any Subcontractors until the Engineer receives, reviews, issues comments and accepts this "Preliminary Ninety-Day CPM Schedule." Maintain and submit monthly a Ninety-Day Look Ahead Schedule until the "CPM Schedule" is accepted by the Engineer. Additionally, no extension of Contract Time will be allowed for any delays associated with the Contractor's preparation and the Engineer's review and acceptance of the "Preliminary Ninety-Day CPM Schedule." Until the "CPM Schedule" for the Contract is accepted, the Ninety-Day Schedule will be the basis for evaluating progress and coordinating the work.

C. "CPM Schedule"

Within fourteen (14) calendar days after Notice to Proceed with the Contract, prepare, complete, and submit to the Engineer for review, a Composite CPM Schedule, incorporating the schedules for all Subcontractors, interfaces with Contractors on adjacent Contracts, utilities, and railroads performing work in full accordance with this Contract. As such, it will comply fully with all Contract Provisions including, but not limited to, the requirements regarding contract time, milestones, coordination and cooperation with utility companies, governmental agencies, maintenance and protection of traffic, erosion and sedimentation control, construction noise restrictions and the requirements specified in Contract Provisions. Current estimate payments will not be released until the schedule is submitted in the format described in this section.

Acceptance of the Schedule does not approve the Contractor's estimate of resources (labor and equipment) or production rates. The Contractor is responsible to perform all work in accordance with the Schedule including all accepted revisions. However, nothing in the Schedule shall supersede the Contract Time requirements including the Required Completion Date, all Project Milestone Dates, and all coordination and cooperation requirements of the Contract.

D. The "CPM Schedule" will conform to the following:

1. The Schedule will be prepared as a Critical Path Method (CPM) schedule utilizing the Precedence Diagramming Method (PDM). The Schedule shall be at level of detail to be useful to field forces and to assure adequate planning, execution, monitoring, and recording of the progress of the work. Activity durations shall be limited to a maximum duration of fifteen (15) working days, as measured in accordance with the calendar applicable to that activity.
2. The Schedule shall be developed and used by the Contractor to: (a) schedule all work activities, (b) provide necessary and required coordination and cooperation logic between Contractors and utilities, (c) show all interdependent work activities, (d) phase construction, (e) stage construction, (f) provide traffic restrictions, (g) provide resource needs, (h) indicate time estimates for transmittal reviews for Contractor designs, shop drawings and other submissions, (is) provide all other controlling and subsequent operations. In addition to construction activities, the Contractor should include on the Schedule as a minimum, the procurement, fabrication and delivery of critical or special materials and equipment, and indicate restraints or relationships, means, method, sequences, and construction logic that may be required by the work, and that may be required by the Engineer. The Contractor's CPM Schedule shall integrate and meet the Milestone Dates as provided in the Contract.
3. The Engineer will be utilizing the most current version of Project Planner by Primavera for Windows or Primavera Suretrak. The Contractor may use one (1) of the following current Windows based versions of the approved scheduling software listed below, when approved by the Engineer. All data shall be submitted on disk(s) that are compatible with the Engineer's system and those disks will be provided to the Engineer by the Contractor.

Approved Scheduling software includes:

Project Planner by Primavera
Suretrak by Primavera
Aldegraf Scheduling System by Aldegraf System, Inc.

Alternative software scheduling may be utilized if approved by the Engineer. Also, the Contractor is to provide training to the Engineer as recommended by the manufacturer for approved alternate software packages, if applicable.

- E. Adjust Contract Time only in accordance with the requirements of Contract, GENERAL CONDITIONS and the Article entitled EXTENSION OF TIME of this Element.
- F. Progress Reports will be required bi-weekly. They shall be subject to comments from the Engineer.

- G. Requirements for initial submittal, review, and updating the CPM Schedule are included in GENERAL CONDITIONS Article of this Element entitled SUBMITTALS. Use the CPM Schedule for planning, organizing, and directing the Contractor's work and for reporting progress.
- H. Designate an individual (or Subconsultant), to be available to the Engineer on an as-needed basis during the duration of the project, as the CPM Scheduler. Submit the CPM Scheduler's experience and credentials to the Engineer for review and acceptance prior to proceeding with any scheduling work under this Contract. Prior experience with resource-loaded CPM scheduling, knowledge of the specific scheduling software being used, and knowledge and experience shall be to administer the elements of this Project Schedule specification section. The Authority reserves the right to rescind such acceptance at any time during the Contract and to require the Contractor to provide a qualified replacement. The delegation of the CPM Scheduler's duties is not permitted, however, the Contractor may engage the services of qualified consultant to advise and provide staff assistance to the Construction Coordinator, if approved by the Authority.
- I. Comply with all requirements of the Contract regarding coordination, cooperation, contract, and schedule.

168. CONTENT AND PROJECT SCHEDULE

- A. The CPM Schedule shall consist of a pure logic CPM network diagram, activity sorts, printed reports, and digital data on disks, all of which will include the Required Completion Date and Milestone Dates. This shall include, but is not limited to, activities describing all work, the sequence of work, and all requirements of coordination and cooperation between Contractors, Subcontractors, Contractors on adjacent Contracts, Authority's work, utilities, governmental agencies, and other parties involved with the Work.
- B. Diagrams shall show the order and interdependence of activities and the sequences in which the Work is to be accomplished. The basic concept of the network analysis diagram shall be followed to show how the start or finish of a given activity is dependent on other activities. Predecessor and successor activity restraints must be documented and provided in all reports to the Authority. The use of leads and lags in the Schedule and Contractor imposed constraint dates are prohibited.
- C. The CPM Schedule shall be prepared in such a manner that the Contractor's Work sequence shall be optimized between early start and late start dates.
- D. Detailed network activities shall include, in addition to construction activities, the submittal of samples, product data, shop drawings, fabrication, procurement and delivery of critical materials and equipment, and the manufacture, installation, and testing of special materials and equipment. Allow sufficient time for review, resubmittal, and/or resubmittal reviews, as required. Allow additional time for review by entities other than the Authority and its design consultants. Allow fourteen (14) calendar days for the review by the Engineer. Obtain concurrence of the Engineer for the duration in the Schedule for submission review activities by other entities. Authority activities, which affect progress, and milestone dates for completion of parts of the work, shall also be shown in accordance with Contract requirements.
- E. The CPM Schedule Logic Diagram shall be based on areas of work and should show a continuous flow of activities from left to right. The CPM Schedule Diagram shall be sufficiently detailed to accurately depict the work. Activity numbers, activity descriptions,

and activity duration in working days shall be shown on the diagram for each activity. The CPM Schedule (both logic diagrams and activity sorts and reports) should be coded by area, pay item, stage, responsibility, type of activity, and other relevant features through the use of activity codes. The following information shall be furnished for each activity:

1. Activity number
2. Activity description
3. Estimated duration of activity, in working days
4. Preceding and succeeding activity numbers

In conjunction with the CPM Schedule Diagram, provide the following information for each activity in the CPM Schedule:

1. Remaining duration of activity, in working days
2. Earliest start date, by calendar date
3. Earliest finish date, by calendar date
4. Actual start date, by calendar date
5. Actual finish date, by calendar date
6. Latest start date, by calendar date
7. Latest finish date, by calendar date
8. Total float
9. Estimated man-hours and shifts by classification
10. Estimated major equipment usage
11. Estimated cost
12. Estimated quantities of work

Be responsible for assuring that Subcontractor work and Contractor work is included in the network diagram, that work sequences are logical, and that the diagram shows a coordinated plan of work between the Contractor and Subcontractors and between Subcontractors.

Contractor imposed dates in the construction schedule do not bind the Authority. Only the Required Completion Date, and Milestone Completion Dates, and any contractually specified sequences shall be binding on the Authority in accordance with the Contract documents.

Consider, and make appropriate schedule and operational allowances, for weather conditions and the influence of high or low ambient temperatures on the completion of all Contract Work within the allotted Contract Time. The Authority assumes no responsibility for the impact of weather on the Contractor's Schedule.

Provide workday calendars, which address the specified and working requirements, which affect the project. Examples of calendars include a normal five (5) day week, weekend only work, holiday restrictions, traffic restrictions, shift requirements, duration of shifts, and seasonal restrictions.

Provide and document the correlation between each schedule activity and its corresponding pay item(s).

Clearly identify in the CPM Schedule network-diagram the activities illustrating accomplishment within the time for completion set forth in the Contract. Should the Schedule indicate an earlier completion than the time for completion set forth in the Contract, the difference between such an Early Completion Date and the Required Completion Date or any Milestone Date shall be defined as float. Show the float for the

various activities on the computer-product printout. Define any float developed between an early completion point (i.e., prior to the contractual completion) and the contractual completion date as part of the project float. Float is the measure of an activity's ability to have its performance extended without affecting the critical path. Float is a commodity available to the Contractor and the Authority.

169. SCHEDULE REVIEW MEETINGS

Attend all Schedule Review Meetings on dates and times specified by the Engineer. Attendees at Schedule Review Meeting must include the CPM Scheduler, and, if requested by the Engineer, the Project Manager, Superintendent, and/or representatives from active, key Subcontractors. Schedule Review Meetings will be held bi-weekly. The attendees of the meeting shall review actual progress, planned progress for the next period, Change Order and any schedule changes since the previous update(s). Attendance is mandatory. Updated Progress Reports must be submitted to the Engineer for review in accordance with GENERAL CONDITIONS Article "SUBMITTALS."

Submit an updated disk and Progress Report three (3) days prior to every bi-weekly Progress Meeting. In the update for the Contractor, provide revised information based on progress to date. The data date will be equal to one (1) week prior to the Progress Meeting date. This information will be updated by the Contractor as described in GENERAL CONDITIONS Article titled UPDATING.

Incorporate all comments discussed at the Schedule Review Meeting into the next scheduled Progress Report submission.

170. UPDATING

The information described in GENERAL CONDITIONS paragraph E of the Article titled CONTENT AND PROJECT SCHEDULE shall be updated as follows. The activity percent complete and remaining duration are to be updated independently of each other.

Updates and Progress Reports shall be submitted bi-weekly. The Update shall provide revised information based on progress to date and logic changes incurred since the previous update. Bi-weekly updated Progress Reports shall show the activities completed during the reporting period. The Reports shall state the percentage of each activity the Contractor completed as of the reporting date, and the progress along each critical path in terms of days ahead or behind the latest allowable dates. The Report shall include a narrative description which includes, but is not limited to, a description of work activities completed, activities completed during this period, activities that are behind schedule, anticipated problems, delaying factors, their impact, and a description of corrective construction actions taken or contemplated. Changed work as a result of Change Orders shall be addressed in bi-weekly Progress Reports in full accordance with the Contract requirements. Change Orders shall be incorporated into the Schedule.

The Schedule will not be revised as long as the Contractor actually performs the work in the order and sequence shown on the Schedule. If the Contractor changes the order of his operations on the Project so that the Schedule no longer indicates reasonable logic for completing the Contract, the Contractor shall submit Schedule revisions to the Engineer for review, comment and acceptance. Comply with all comments issued by the Engineer as a result of such review without additional cost to Authority. Such a revision shall comply with all Contract Time requirements.

If the Authority revises the work and affects the sequence of operations or duration of time on work activities, the Schedule shall be revised promptly by the Contractor in accordance with the contract documents by adding, deleting or revising activities and/or changing restraints on the

Schedule to indicate the Contractor's current plans for completing the work as revised. Submit such changes for the Engineer's review, comment and acceptance, as described above in this Article of the GENERAL CONDITIONS.

Immediately notify the Engineer if a problem arises requiring direction to the Contractor by the Engineer. Identify in writing all changes in activity durations or planned work sequences that impact the Required Completion Date or any Milestone Date and are caused by differing site conditions, changes in quantities, or alterations of the construction drawings. The Contractor shall completely identify the problem and describe "Who, What, When, Where, Why and How" the problem impacts the Schedule. The Engineer will verify the problem in accordance with the Contract and provide direction to the Contractor. Submit a schedule report to the Engineer, outlining the effect that changes, or work directed by the Engineer might have on the Schedule, within seven (7) calendar days after receiving the change or direction. In cases where a Change Order is required, the Contractor shall revise the Schedule to accommodate the proposed change, the preparation of cost or credit estimates, issuance of the Change Order, negotiations, review and approval of samples, drawings, procurement of materials and the performance or deletion of work. Submit proposed Schedule revisions to the engineer for review, comment and acceptance.

Provide a Two (2) Week Look Ahead Schedule Bar Chart produced from the Schedule software on a weekly basis.

171. SUBMITTALS

Submit the Preliminary Ninety-Day CPM Schedule in accordance with the times stated in Article of the GENERAL CONDITIONS entitled PROCEDURES. Provide all information specified in the CONTENT AND PROJECT SCHEDULE of the GENERAL CONDITIONS for the detailed ninety-day portion of the Schedule. The Engineer will review and, if necessary, offer comments. Comply with the Engineer's comments. Update the Preliminary Ninety-Day CPM in accordance with Article titled UPDATING.

Submit the CPM Schedule to the Engineer for review within fourteen (14) days after Notice to Proceed. The initial submission must be made in digital format (3 ½ inch disk) and must be accompanied by three (3) sets of the following hard copy documents:

Pure Logic and Time Scaled Logic Diagram and Bar Chart Tabular Reports, sorted as follows:

- by Activity Number
- by Responsibility and Activity Number
- by Total Float, Early Start
- by Detailed Predecessor – Successor Analysis
- by up to four (4) additional categories which may be requested by the Engineer

The Contractor's Schedule shall consist of the Schedule Diagram and the Tabular Reports. It shall include all comments on the Preliminary Schedule, and the schedules required from other Subcontractors, interfaces with the Contractors on adjacent Contracts, utilities, railroads, and governmental agencies. This Schedule shall become the original Schedule of record for planning, organizing and directing the work and for reporting progress. The Contractor's CPM Schedule and Tabular Reports shall be updated as the need arises and determined by the Engineer, but not less often than bi-weekly. Typically, updates shall be required whenever the work is affected by Change Orders, deviations from previously submitted schedules and development of schedules by Subcontractors, Contractors on adjacent Contracts, utilities, railroads, and governmental agencies. The updates are to be submitted with the Tabular Reports, or as directed by the Engineer in accordance with the Article entitled SCHEDULE REVIEW MEETINGS.

All data required by the Article of the GENERAL CONDITIONS titled CONTENT AND PROJECT SCHEDULES, must be included in this submission.

Submit the Two (2) Week Look Ahead Schedule required in Article titled UPDATING to the Engineer two (2) calendar days prior to the scheduled Progress Meeting.

Failure by the Contractor to submit a project schedule or any required revisions or updates thereto within the time limits specified, shall be sufficient cause for the Engineer to withhold processing of current estimates until such delinquent submittal is made. Should the Contractor fail to submit the schedule information within twenty-eight (28) calendar days, after the project schedule update, material breach of Contract shall result from failure to provide the Engineer with the required schedules and failure to implement such schedules immediately. Consider this material breach of Contract to be the Contractor's default of Contract, and as such, be subject to the provision GENERAL CONDITIONS Article "TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSIONS."

The Engineer's review of a schedule shall in no way waive the requirements of this Contract nor shall it excuse the Contractor of any obligations under this Contract. Should a situation occur, such that an activity required by the Contract is not accurately depicted in the schedule, and its insertion impacts the project completion date, the Contractor must take the necessary action to recover the lost time. These efforts will be made at no additional cost to the Authority.

172. RECOVERY SCHEDULE

The Authority reserves the right to require a Recovery Schedule and implementation of such a Recovery Schedule. All statements regarding progress shall be subject to verification by the Engineer. Revise such statements if necessary, to reflect any changes identified by the Engineer. All changes identified in a schedule revision shall be reviewed by the Engineer and shall be subject to acceptance or rejection on the basis of compliance with the Contract and the GENERAL CONDITIONS. Accept and comply with all comments issued by the Engineer as a result of any review of a schedule.

If the Engineer deems that the Contractor has fallen ten (10) working days behind the project schedule (as measured in relation to the Required Completion Date and the Milestone Dates) upon the Engineer's written request, submit a written and documented Recovery Schedule. This Schedule must be submitted within seven (7) calendar days of the date of the Engineer's request or within such other period as the Engineer may specify in writing. Implement the Recovery Schedule with no additional cost to the Authority and provide for completion of the work in accordance with the Required Completion Date and the Milestone Dates, without a time extension. Document in the Recovery Schedule all additional resources, including materials, equipment and labor, and modifications of operations which will be provided so as to meet the Recovery Schedule while maintaining construction restrictions listed in the Contract unless approved otherwise by the Engineer. Provide all such additional resources and modifications of operations without additional cost to the Authority. Such additional resources and modifications shall include but not be limited to:

1. Required overtime for the Contractor's personnel.
2. Increased construction manpower in such quantities as will substantially eliminate the backlog of work and put the project back on schedule.
3. Increased number of shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing which will put the project back on schedule.
4. Rescheduled activities to achieve the maximum practical concurrence of accomplishment of activities to put the project back on schedule.

Failure to provide the Engineer with the required Recovery Schedules and failure to implement such schedules within fourteen (14) calendar days of the Engineer's request shall be considered noncompliance by the Contractor in accordance with the Article titled SUBMITTALS. Continued failure to provide and implement a required Recovery Schedule for an additional fourteen (14) calendar days shall be the Contractor's default of Contract and, as such, shall be subject to the provision of GENERAL CONDITIONS Article "TERMINATION FOR DEFAULT, DAMAGES FOR DELAY, TIME EXTENSION."

173. EXTENSION OF TIME

The Authority shall have the right, at its discretion, by resolution to extend the time for completion of the Work beyond the time stated in this Contract (or as modified by any Change Order, Contract Modification, or Supplemental Agreement thereto), and may grant such an extension if the Contractor shall be actually and necessarily delayed by reason of any labor strike not caused, instituted, or provoked by the Contractor or any Subcontractor, agent or representative of the Contractor; by an injunction or interference of any public authority; by Suspension of Work by the Authority; by any order, rule or regulation of any federal agency; or by any other cause deemed sufficient to the Authority, and not caused in whole or in part by the Contractor or any of his Subcontractors. Any extension of time shall be for the actual amount of such delay in such case. Such extension may not be allowed unless the Contractor has taken reasonable precautions to prevent such delays. During the occurrence of the cause of delay, within ten (10) calendar days after the commencement thereof, the Contractor shall present in writing to the Chief Engineer and Engineer a detailed claim therefore. Such written claim shall describe the circumstances of the delay. Furthermore, the information provided by such written claim shall be updated in writing, within thirty (30) calendar days after the end of the delay, and shall further specify the number of days actually delayed. Failure to submit both the initial and revised claims required by this Article will be sufficient cause for denying the requested time extensions. The extension of time granted under this Article shall not be the basis for additional compensation for any of the Contractor's costs incurred during the time of delay.

A. Extension of Total Contract Time.

Extension to the Total Contract Time will only be considered for actual, necessary, and justifiable delays impacting the actual critical path. Be responsible for any delays caused by failing to start work activities on the early start dates, inadequate or insufficient application of resources, or inability to complete the work within the Total Contract Time due to Contractor's approach to the work. Such delays shall not form the basis of any extension of time.

The Authority reserves the right, in its best interest, to negotiate the cost required to complete the Milestone work in accordance with the schedule dates, and not extend the Total Contract Time when justifiable delays are encountered.

In requesting an extension of time, furnish as part of the updated written claim specified in Article titled EXTENSION OF TIME, justification and supporting documentation as the Engineer deems necessary to determine whether the Contractor is entitled to an extension of time under the provisions of the Contract. This documentation shall include, but not be limited to, a schedule report illustrating the impact and net effect of the alleged delay on the critical path, diaries, timesheets and correspondence.

After a receipt of request for an extension of time the Engineer will make a decision based on facts and findings. Extensions of time will only be granted for justifiable delays,

including those enumerated in the Article entitled EXTENSION OF TIME, when accepted, in writing, by the Engineer, as applied to the actual critical path of the project.

As specified in this Article, time extension requests accepted by the Engineer will result in extensions of time granted by the Authority upon completion of the work. Upon written notification of acceptance by the Engineer, the Authority will concurrently issue acknowledgement of entitlement to an extension of time. Unless stated otherwise therewith, submit a revised schedule incorporating the revised Contract Time and unless agreed otherwise, the Authority will not be responsible for any additional costs incurred as a result of work accelerated by the Contractor.

B. Adjustment of Interim Milestone Dates

Adjustment of Interim Milestone Dates will only be considered for justifiable delays involving the critical path and impact on Interim Milestone Dates by exceeding the positive float on the accepted Schedule. The Contractor shall be responsible for any delays caused by failing to start work activities on the early start dates, lack of continuous effort, inadequate planning and coordination of the work, inadequate or insufficient application of resources, or inability to meet the Interim Milestone due to Contractor's approach to the work. Such delays shall not form the basis of an extension of time to any of the Interim Milestone Dates. No adjustment of Interim Milestone Dates will be considered if such adjustment impacts the Total Contract Time, unless in addition to meeting the requirements of this Paragraph B, the requirements of Paragraph A, the Article titled Extensions of Total Contract Time, are also met.

The Authority reserves the right, in its best interest, to negotiate the cost required to complete the Interim Milestone work in accordance with the schedule dates, and not extend any Interim Milestone dates or the Contract Completion Date when justifiable delays are encountered.

In requesting an extension on listed elements or activities of an Interim Milestone Date, furnish justification and supporting documentation as the Engineer deems necessary to determine whether the Contractor is entitled to additional Interim Milestone Completion Time under the provisions of the Contract.

Submit, in writing, to the Engineer each request for change in any Interim Milestone Date within ten (10) calendar days after the beginning of the condition for which a time extension is requested.

After receipt of request for time extension to an Interim Milestone Date, the Engineer will make a decision based on facts and findings and will advise the Contractor of the approval or rejection of the Interim Milestone extension request, in writing. The Engineer's decision on the Interim Milestone extension request will be final.

Interim Milestone Time Extension will be granted for justifiable delays when accepted by the Engineer, on the actual critical path to that Interim Milestone.

C. Adjustment of Project Milestone Dates by Contract Modification

The EXTENSION OF TIME Article, Paragraphs A and B notwithstanding, extensions of time may be granted by Change Orders and/or Contract Modifications as defined in GENERAL CONDITIONS Article "CHANGES." The Milestone Dates will be adjusted only if upon the incorporation of activities for the work defined in the Change Order into the

accepted Schedule, these activities impact the critical path by exceeding the projected milestone completion date at the start of the delay.

The Change Order procedure is modified as follows: the Contractor will be issued a draft Change Order for review. Within five (5) days, submit for review by the Engineer a schedule report incorporating all elements of the proposed Change Order, and its effect, if any, on the milestone dates. Upon acceptance of the report, the Contractor will be issued the Change Order indicating any additions or reductions to the Contract Time, which justifiably impacts the Milestone's critical path.

The Authority reserves the right, in its best interest, to negotiate the cost required to complete the work defined in the Change Order within the Project Milestone Dates, when that Change Order work justifiably impacts the Milestone's critical path.

174. DRAWINGS

The Contractor and Engineer shall maintain and monitor separate submission logs of all shop/work drawings, Contractor design drawings, and other drawing submissions affecting the work. In addition, the Contractor shall submit a copy of the transmittal for each submitted drawing to the Engineer. The Contractor and Engineer shall enter these submittal transactions into their respective submission logs.

In order to effectively use the submission log, include as a minimum the following information for each drawing and transmittal submitted, unless otherwise approved:

- Project Name
- Section Name
- Authority Contract Number
- Contractor
- Engineer
- Contractor's Shop Drawing Number
- Submittal Number (1st submission, 2nd submission, etc.)
- Specification Section
- Item Number(s) Associated with the Submission
- Shop Drawing Description
- Date of Contractor's Submittal
- The Schedule activity affected by the drawings

If the Contractor's drawing and/or his transmittal does not have this information, the drawing and/or its transmittal will be returned without review. Incomplete drawings, as determined by the reviewing party, will also be returned marked "Incomplete." The Contractor shall be responsible for any delays caused by incomplete drawing submissions.

After a drawing has been submitted once and has been reviewed, except as required to satisfy the review comments, do not add new information or details to that same drawing without the approval of the Engineer.

175. SUBMISSION LOG

The purpose of the submission log is to schedule and monitor the date of each shop/work drawing submittal, Contractor's designs and all other submissions required under this Contract, and the length of times for the Engineer's review, the number of times a submittal required resubmission by the Contractor and length of time taken by the Contractor to make re-submissions.

Submit an initial itemized submission log, together with Ninety (90) Day Work Plan, within fifteen (15) calendar days of the Notice of Award of the Contract or prior to the Pre-construction Conference, whichever occurs earlier. Submit a complete itemized submission log for the remainder of the Contract, together with the Detailed Construction Schedule, within forty-five (45) calendar days of the actual Notice to Proceed date. The itemized submission log shall conform to the Schedule and include all submittals required under this Contract.

Submittals shall be prioritized and shall be scheduled to allow the specified time for review. If the Engineer determines the number of concurrent submissions scheduled for review and acceptance is excessive, allow an additional amount of time for review that is acceptable to the Engineer.

The Submission log shall include the items listed in Section 10 of this specification plus the following information:

Date of Engineer's Reply to Contractor's Submittal
Action by the Engineer
Number of Calendar Days the Engineer has an Outstanding Drawing

The submittal date of each submission shall be incorporated into Schedule. Make submissions at least fourteen (14) calendar days prior to the date the Contractor needs the information for purchasing or fabricating material, equipment, etc. to allow for a minimum of fourteen (14) calendar days for in-house review by the reviewing party unless specified otherwise. This fourteen (14) calendar days period begins when the Engineer acknowledges receipt of the submission and ends when the Contractor is notified the review is complete.

Be responsible for all time required for re-submissions required to conform with the conditions set forth in this specification.

176. MEASUREMENT AND PAYMENT

Construction Schedule – Incidental

Payment for the construction schedule will be incidental to the Contract Unit Price bid for each and every item in the Contract. All costs for furnishing and updating the progress schedule shall be included in the prices bid for the various Pay Items scheduled in the Proposal.

177. RESERVED

178. RESERVED

PAYMENT

179. PAYMENT FOR MODIFICATIONS

Payment to the Contractor, or credit to the Authority for any modification to the work under the Contract covered by all Modification Orders shall be determined by the methods set forth herein:

A. UNIT PRICES

Unit prices stipulated in the Bid or provided by the Contractor in the Bid breakdown shall be utilized, where they are applicable and determined reasonable by the Authority. In the event that the Contract Modification results in a change in the original quantity by more

than a twenty-five percent (25%) variation to Major Pay Items occurs, the Authority or the Contractor may in writing request a renegotiated unit price for the work in excess of 125%.

Major Pay Items are any Items having an original contract value equal to or in excess of 10 percent of the ORIGINAL Total Contract Price or 20 percent of the ORIGINAL Total Price for Airport Improvement Program projects. The original contract value of a Pay Item equals the per unit price bid for said Pay Item multiplied by the estimated quantity of such item contained in the Proposal Form. All other Pay Items shall be considered Minor Pay Items. Minor Pay Items are not eligible for any adjustment in unit price regardless of how much the total quantity varies from the quantity contained in the Proposal.

When the Authority or the Contractor requests a renegotiated unit price for the work in excess of 125 percent of the work for Major Pay Items, the Contractor shall furnish a breakdown of the cost satisfactory to the Authority for review, for the proposed adjusted unit price, in accordance with C through L below. The basis for the adjustment will be agreed upon prior to the performance of the work. If the basis cannot be agreed upon, the work will be paid on a Force Account Payment basis as specified in C through L below.

When a Major Item experiences a decrease to below 75% of the original contract quantity, the actual quantity below the 75% of the approximate quantity may be paid at an adjusted price, as agreed upon with the Contractor and approved by the Authority; however, total compensation will not exceed the contract item's original value. Item value is defined as the original estimated contract quantity contained in the Proposal Form multiplied by the per unit price bid. The Contractor shall furnish a breakdown of the cost satisfactory to the Authority for review, for the proposed adjusted unit price, in accordance with C through L below. The basis for the adjustment will be agreed upon prior to the performance of the work. If the basis cannot be agreed upon, the work will be paid on a Force Account Payment basis as specified in C through L below.

Where Contract Modifications are determined on the basis of unit prices stipulated in the Bid or provided by the Contractor in the Bid Breakdown, that unit price shall constitute the total equitable adjustment including all overhead and profit due for the modification and no further costs shall be owed under the contract for delay or impact to the unchanged portions of the Contract, or for any other reason.

A unit price for Extra Work shall be mutually determined by the Contractor and the Authority. The Contractor shall furnish a breakdown of the cost satisfactory to the Authority for approval, of the proposed unit price, in accordance with C through L below. The basis for the adjustment will be agreed upon prior to the performance of the work. If the basis cannot be agreed upon, the work will be paid on a Force Account Payment as specified in C through L below.

B. LUMP SUM

Lump Sum prices stipulated in the Bid or provided by the Contractor in the Bid breakdown shall be utilized, where they are applicable and determined reasonable by the Authority. The original contract price of a lump sum item may be adjusted only when the approximate quantities of a component items are designated on component item schedules incorporated in the bid proposal and the original component quantity variation is more than twenty-five percent (25%) for the component items of Major Pay Items. The Authority or the Contractor may in writing request a renegotiated unit price for component items.

Major Pay Items are any Items having an original contract value equal to or in excess of 10 percent of the ORIGINAL Total Contract Price or 20 percent of the ORIGINAL Total Price for Airport Improvement Program projects. The original contract value of a Pay Item equals the per unit price bid for said Pay Item multiplied by the estimated quantity of such item contained in the Proposal Form. All other Pay Items shall be considered Minor Pay Items. Minor Pay Items are not eligible for any adjustment in unit price regardless of how much the total quantity varies from the quantity contained in the Proposal.

When the Authority or the Contractor requests a renegotiated unit price for the component items in excess of 125 percent of the work for Major Pay Items, the Contractor shall furnish a breakdown of the cost satisfactory to the Authority for approval, for the proposed adjusted unit price, in accordance with C through L below. The basis for the adjustment will be agreed upon prior to the performance of the work. If the basis cannot be agreed upon, the component item will be paid on a Force Account Payment basis as specified in C through L below.

When a Major Item experiences a component decrease to below 75% of the original component quantity, the actual quantity of work performed may be paid at an adjusted price, as agreed upon with the Contractor and approved by the Authority; however, total compensation will not exceed the component item's original value. Component item value is defined as the original component quantity multiplied by the contract component unit price. The Contractor shall furnish a breakdown of the cost satisfactory to the Authority for review, for the proposed adjusted unit price, in accordance with C through L below. The basis for the adjustment will be agreed upon prior to the performance of the work. If the basis cannot be agreed upon, the work will be paid on a Force Account Payment basis as specified in C through L below.

A Lump Sum price for Extra Work shall be mutually determined by the Contractor and the Authority. The Contractor shall furnish a breakdown of the cost satisfactory to the Authority for review, of the proposed lump sum, in accordance with C through L below. The basis for the adjustment will be agreed upon prior to the performance of the work. If the basis cannot be agreed upon, the work will be paid on a Force Account Payment as specified in C through L below.

C. FORCE ACCOUNT PAYMENT

If the method or amount of payment cannot be agreed upon prior to beginning the work, and the Authority directs in writing that the work be done on a force Account payment basis, the Contractor shall furnish labor, equipment, and materials necessary to complete the work in a satisfactory manner and within a reasonable period of time. The total cost for labor, material, equipment, bonds, insurance, and tax as provided below, together with applicable markups constitute full compensation for all direct and indirect costs

(including overhead) and profit, and are deemed to include all items of expense not specifically designated.

D. QUOTATIONS FOR PROPOSED MODIFICATIONS

The Authority's request for quotation on a proposed modification shall not be considered authorization to proceed with the work prior to issuance of a formal Modification Order, unless directed otherwise in writing by the Authority. Nor shall such request constitute justification for a delay or a timely extension under the Contract.

The Contractor's quotation for a proposed modification shall be supplied to the Authority in writing, and shall be submitted on the form required by the Authority. The quotation shall be considered firm for a period not less than sixty (60) days from the date of the Contractor's submittal. The Contractor shall submit a written quotation for a proposed modification not later than two (2) weeks after being requested to provide such quotation, unless the Authority allows more time. Time for submitting quotations shall not be cause for a delay or time extension under the Contract.

E. GENERAL

Any compensation paid under a Modification Order shall comprise the total compensation due the Contractor for the work or modification defined in the Modification Order. By signing the Modification Order, the Contractor acknowledges and agrees that the stipulated compensation includes payment for all work contained in the Modification Order, plus all payment for the interruption of schedules, extended overheads, delay and all impact or ripple effect. The signing of other Modification Order shall indicate that the Modification Order constitutes full mutual accord and satisfaction for the change, and that the time and/or cost under the Modification Order constitutes the total equitable adjustment owed the Contractor as a result of the change. No further claim or modification for any foreseeable cause shall arise out of or as a result of a signed Modification Order.

When Work that is paid on a Force Account basis is performed by forces other than the Contractor's organization, the Contractor shall reach an agreement with such other forces as to the distribution of payments made by the Authority for such Work. Additional payment therefor will not be made by reason of the performance of the Work by a Subcontractor or other forces.

It is understood that Force Account payments pursuant to the terms of the Contract are contractual in nature only and are not to be used for any other purpose. More specifically, but not by way of limitation, the Force Account provisions of this Contract are not to be used to prove damages in a court of law in an action for breach of Contract pursuant to the provisions of the New Jersey Contractual Liability Act.

Force Account payment will be based on the following:

F. LABOR

For all necessary labor and foremen in direct charge of the specific operations, whether the employer is the Contractor, Subcontractor, or another, the Contractor shall receive the rate of wage (or scale) actually paid as shown in its certified payrolls for each and every hour that said labor and foremen are actually engaged in such Work.

The Contractor shall receive the actual costs paid to, or on behalf of, workers by reason of health and welfare benefits or other benefits, when such amounts are required by collective bargaining agreements or other employment contracts generally applicable to the classes of labor employed on the Work.

G. BOND, INSURANCE, AND TAX

For bond premiums; property damage, liability, and workers compensation insurance premiums; unemployment insurance contributions; and social security taxes on the Force Account work, the Contractor shall receive the actual incremental cost thereof, necessarily and directly resulting from the Force Account work. The Contractor shall furnish satisfactory evidence of the rate or rates paid for such bond, insurance, and tax.

H. MATERIALS

The Authority reserves the right to furnish such materials as it deems advisable, and the Contractor shall have no claims for costs and markup on such materials.

Only materials furnished by the Contractor and necessarily used in the performance of the Work will be paid for. Sales tax will not be paid on materials which, qualify for an exemption under the Sales and Use Tax Act and the regulations issued thereunder, regardless of whether the exemption is used. The cost of such materials shall be the cost to the purchaser, whether Contractor, Subcontractor, or other forces from the supplier thereto, together with transportation charges actually paid by it, except as follows:

- (1) If a cash or trade discount by the actual supplier is offered or available to the purchaser, it shall be credited to the State notwithstanding the fact that such discount may not have been taken.
- (2) If materials are procured by the purchaser by any method which is not a direct purchase from and a direct billing by the actual supplier to such purchaser, the cost of such materials shall be the price paid to the actual supplier as determined by the Engineer, plus the actual costs, if any, incurred in the handling of such materials.
- (3) If the materials are obtained from a supply or source owned wholly or in part by the purchaser, the cost of such materials shall not exceed the price paid by the purchaser for similar materials furnished from said source on Pay Items or the current wholesale price for such materials delivered to the job site, whichever price is lower.
- (4) If the cost of such materials is, in the opinion of the Engineer, excessive, then the cost of such materials shall be the lowest current wholesale price at which such materials are available in the quantities concerned, delivered to the job site, less any discounts as provided in Item a above.
- (5) If the Contractor does not furnish satisfactory evidence of the cost of such materials from the actual supplier thereof, the cost will be determined in accordance with Item d above.

I. EQUIPMENT AND PLANT

- (1) Contractor Owned Equipment and Plant

The hourly rates for Contractor owned equipment and plant will be determined from the applicable volume of the Rental Rate Blue Book (referred to hereafter as the "Blue Book"), published by Nielsen/DATAQUEST, Inc. of Palo Alto, California.

The Blue Book will be used in the following manner:

- a. The hourly rate will be determined by dividing the monthly rate by 176. The weekly, hourly, and daily rates will not be used.
- b. The number of hours to be paid for will be the number of hours that the equipment or plant is actually used on a specific Force Account activity.
- c. The current revisions will be used in establishing rates. The current revision applicable to specific Force Account work is as of the first day of work performed on that Force Account work and that rate applies throughout the period the Force Account work is being performed.
- d. Area adjustment will be made. Equipment life adjustment will be made in accordance with the rate adjustment tables.
- e. Overtime shall be charged at the same rate indicated in Item (a) above.
- f. The estimated operating costs per hour will be used for each hour that the equipment or plant is in operation on the Force Account work. Such costs do not apply to idle time regardless of the cause of the idleness.
- g. Idle time for equipment will not be paid for, except where the equipment has been held on the Project site on a standby basis at the request of the Engineer and, but for this request, would have left the Project site. Such payment will be made at one-half (.5) the rate established in Item (a) above.
- h. The rates established above include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs, overhaul and maintenance of any kind, depreciation, storage, overhead, profits, insurance, all costs (including labor and equipment) of moving equipment or plant to, on, and away from the site, and all incidentals.
- i. Operator costs will be paid only as provided in Subheading a above.

All equipment shall, in the opinion of the Engineer, be in good operating condition. Equipment used by the Contractor shall be specifically described and be of suitable size and suitable capacity required for the work to be performed. In the event the Contractor elects to use equipment of a higher rental value than that suitable for the Work, payment will be made at the rate applicable to the suitable equipment. The equipment actually used and the suitable equipment paid for will be made a part of the record for Force Account work. The Engineer will determine the suitability of the equipment. If there is a differential in the rate of pay of the operator of oversize or higher rate equipment, the rate paid for the operator will be that for the suitable equipment.

If a rate is not established in the Blue Book for a particular piece of equipment or plant, a monthly rate will be computed on the basis of 6% of the manufacturer's list price for sale (new) of such

equipment; the hourly rate in this case will be determined by dividing the monthly rate by 160, when actually operation, and by 352, when at work site but not operating, with no percentage added. For equipment used for maintenance and protection of traffic (signs, flashers, barricades, drums etc.), with no rate listed in the Rental Rate Blue Book, use a daily rate computed on the basis of 6% of the manufacturer's list price for the sale (new) of this equipment, divided by 22, with no percentage added.

The above provisions apply to the equipment and plant owned directly by the Contractor or by entities which are divisions, affiliates, subsidiaries, or in any other way related to the Contractor or its parent company.

(2) Rented Equipment and Plant

In the event that the Contractor does not own a specific type of equipment or plant and must obtain it by rental, the Contractor shall inform and obtain approval from the Engineer of the need to rent the equipment and of the rental rate for that equipment prior to using it on the Work. The Contractor will be paid the actual rental for the equipment for the time that the equipment is actually used to accomplish the Work, provided that rate is reasonable, plus the cost of moving the equipment to, on, and away from the Project site. The Contractor shall provide a copy of the paid receipt or canceled check for the rental expense incurred.

K. PROFIT

Profit shall be computed at five percent (5%) of the following:

- (1) Total material cost (bare cost FOB).
- (2) Total direct labor cost (actual hours worked multiplied by the regular hourly rate).

L. OVERHEAD

Overhead is defined to include the following:

- (1) All salaries and expenses of executive officers, supervising officers, or supervising employees;
- (2) All clerical or stenographic employees;
- (3) All charges for minor equipment, such as small tools, including shovels, picks, axes, saws, bars, sledges, lanterns, jacks, cables, pails, wrenches, and other miscellaneous supplies and services; and
- (4) All drafting room accessories such as paper, tracing cloth, and blueprinting.

Overhead costs for Force Account work shall be computed at ten percent of the following:

- (1) Total material cost (bare cost FOB).
- (2) Total direct labor cost (actual hours worked multiplied by the regular hourly rate).
- (3) Specific extraordinary overhead expenses, such as hiring of additional supervisory personnel or the use of special minor equipment (as defined above), which the Contractor has to purchase specifically for the Force

Account, may be allowed. In such instances, the Contractor will be paid only the reasonable costs of such extraordinary overhead expenses provided the Engineer has agreed to such costs prior to their being incurred.

- (4) Total fringe benefits on total direct labor cost as computed above.

The Contractor will be allowed an additional ten percent (10%) for overhead on the total amount of all work performed by the Subcontractors.

M. RECORDS

The Contractor shall maintain his records in such a manner as to provide a clear distinction between the direct costs of Work paid for on a Force Account basis and the costs of other operations.

From the above records, the Contractor shall furnish to the Engineer completed daily Force Account work reports for each day's work to be paid for on a Force Account basis. Said daily Force Account work reports shall be signed by the Contractor and submitted daily. The daily Force Account work reports shall be detailed as follows:

- (1) Name, classification, date, daily hours, total hours, rate, and extension for each worker and foreman.
- (2) Designation, dates, daily hours, total hours, rental rate (including a copy of the Blue Book pages used), and extension for each unit of machinery and equipment.
- (3) Quantities of materials, prices, and extensions.
- (4) Transportation of materials.
- (5) Cost of bonds; property damage, liability, and workers compensation insurance premiums; unemployment insurance contributions; and social security taxes.

Material charges shall be substantiated by valid copies of vendor's invoices. Such invoices shall be submitted with the daily Force Account work reports, or if not available, they shall be submitted with subsequent daily Force Account work reports. Should said vendor's invoices not be submitted within 60 days after the date of delivery of the material, or within 15 days after the Completion, whichever occurs first, the Authority reserves the right to establish the cost of such materials at the lowest current wholesale prices at which said materials are available, in the quantities concerned, delivered to the location of Work, less any discounts provided in Subheading H (1) above.

The Engineer's records will be compared with the completed daily Force Account work reports furnished by the Contractor, and any necessary adjustments will be made. When these daily Force Account work reports are agreed upon and signed by both parties, said reports become the basis of payment for the work performed but do not preclude subsequent adjustment based on a later audit by the Authority.

The Contractor's cost records pertaining to work paid for on a Force Account basis shall be open to inspection or audit by representatives of the Authority, during the life of the Contract and for a period of not less than three (3) years after Acceptance thereof, and the Contractor shall retain such records for that period. Where payment for materials or labor is based on the cost thereof to forces other than the Contractor, the Contractor shall ensure that the cost records of such other forces are open to inspection and audit by representatives of the Authority on the same terms and conditions as the cost records of the Contractor. If an audit is to be commenced more than 60 days after Acceptance, the Contractor will be provided a reasonable notice of the time when such audit is to begin. In

case all or a part of such records are not made so available, the Contractor understands and agrees that any items not supported by reason of such unavailability of the records will not be allowed, or if payment therefore has already been made, the Contractor shall refund to the Authority the amount so disallowed.

N. PARTIAL PAYMENT FOR COST REIMBURSEMENT

To receive partial payments and final payment for Force Account Payment work, the Contractor shall submit to the Engineer detailed and documented verification of the Contractor's and any of the Subcontractors' actual costs incurred by the cost reimbursement work as set forth in M above. Such costs shall be submitted within thirty days (30) after said work has been satisfactorily completed.

180. PAYMENT FOR CONTRACTOR'S EXPENSES DURING DELAYS

If the Engineer finds that the Work was delayed on the entire Contract or any part thereof, because of conditions beyond the control and not the fault of the Contractor for causes as to which the provisions of the Contract authorize compensation, the Contractor will be paid its expenses during that period of delay by Change Order in the following manner:

A. LABOR

For all necessary nonproductive labor and foremen in direct charge of specific operations who must remain on the Project during such periods of delay due to collective bargaining contracts or other reasons approved by the Engineer, the Contractor is to receive the prevailing rate of wage as shown in its certified payrolls. The Contractor is also to receive the actual costs paid to, or in behalf of, workers by reason of health and welfare benefits, pension fund benefits, or other benefits, when such amounts are required by collective bargaining agreements or other employee contracts generally applicable to the classes of labor employed on the Work.

B. BOND, INSURANCE, AND TAX

For bond premiums; property damage, liability, and workers compensation insurance premiums; unemployment insurance contributions; and social security taxes during the period of delay, the Contractor is to receive the actual incremental cost thereof, necessarily and directly resulting from the delay. The Contractor shall furnish satisfactory evidence of the rate or rates paid for such bond, insurance, and tax.

C. IDLE EQUIPMENT

For any idle machinery or special equipment other than small tools which must remain on the Project site, with approval of the Engineer, during delays, the Contractor is to receive compensation at one-half (.5) the rate calculated pursuant to Subheading 4 of the fifth paragraph of GENERAL CONDITIONS Article "PAYMENT FOR MODIFICATIONS." Should the Engineer determine that it is not necessary for machinery or equipment to remain on the Project during delays, the Contractor is to receive transportation costs to remove the machinery or equipment and return it to the Project at the end of the delay period.

The time for which such compensation will be paid is the actual normal working time during which such delay condition exists, which in no case exceeds eight (8) hours in any one (1) day or 40 hours per week.

The days for which compensation will be paid are the calendar days, excluding Saturdays, Sundays, and holidays, during the existence of such delay.

D. MISCELLANEOUS

The Contractor further receives an amount equal to ten percent of the sum of the above items, which is full compensation for overhead, general superintendence, or other costs attributed to the delay for which no specific allowance is herein provided. Payment under this Article constitutes full compensation for all items of expense related to such delay.

E. PROFIT

Profit is not allowed under this Article.

F. RECORDS

Payment will not be made for delays until the Contractor has furnished the Engineer with duplicate itemized statements of the cost as hereinabove specified and detailed as follows:

1. Name, classification, date, daily hours, total hours, rate, and extension for each worker and foreman.
2. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
3. Transportation costs.
4. Cost of bonds; property damage, liability, and workers compensation insurance premiums; unemployment insurance contributions; and social security taxes.

The Engineer will compare the Authority's records with completed daily reports furnished by the Contractor and make any necessary adjustments. When these daily reports are agreed upon and signed by both parties, said reports become the basis of payment for the expenses incurred, but do not preclude subsequent adjustment based on a later audit by the Authority.

The Contractor's cost records pertaining to expenses under this Article shall be open to inspection or audit by representatives of the Authority during the life of the Contract and for a period of not less than three (3) years after Acceptance thereof, and the Contractor shall retain such records for that period. Where payment for materials, equipment, or labor is based on the cost thereof to forces other than the Contractor, the Contractor shall make every reasonable effort to ensure that the cost records of such other forces are open to inspection and audit by representatives of the Authority on the same terms and conditions as the cost records of the Contractor. Payment for such cost may be deleted if the records of such third parties are not made available to the Authority's representatives. If an audit is to be commenced more than 60 days after Acceptance, the Contractor is to be provided with a reasonable notice of the time when such audit is to begin. In case all or a part of such records are not made so available, the Contractor understands and agrees that any items not supported by reason of such unavailability of the records will not be allowed, or if payment therefor has already been made, the Contractor shall refund to the Authority the amount so disallowed.

181. PARTIAL PAYMENTS**A. GENERAL**

Nothing contained in this Article shall be construed to affect the right of the Authority to reject the whole or any part of the work found to be defective. All estimated quantities of work for which partial payments have been made are subject to review and correction prior to final payment. Payments by the Authority and acceptance by the Contractor or

partial payments based on periodic estimates of quantities of work executed shall not, in any way, constitute acceptance of the estimated quantities used as the basis for computing the amounts of the partial payments.

B. ESTIMATE FOR PARTIAL PAYMENT

All requests for partial payment must be received by the Authority no later than the 25th day of each calendar month. The Contractor shall submit to the Construction Manager, on the form provided, an estimate based on the approved cost breakdown of the amount earned for the separate portions of the work and request payment. The Construction Manager must approve the request for partial payment prior to forwarding to the Authority. Therefore, the Contractor shall allow a minimum of seven (7) calendar days for the approval of the request by the Construction Manager. As used in this Article, the words "amount earned" mean the value, on the date of the estimate for partial payment, of the work completed in accordance with the Contract Documents, including the value of approved materials delivered to and stored at the project site suitably stored and protected at an approved storage area prior to incorporation into the work. If the Contractor's estimate of the amount earned conforms to the Construction Manager's evaluation, the Construction Manager will make recommendation to the Engineer for payment. The Construction Manager's approval does not constitute approval by the Engineer. The Engineer retains the right to overrule the Construction Manager with regard to approval of the request for partial payment.

If the Contractor's estimate of the amount earned does not agree with the Construction Manager's and the Engineer's evaluations, the Contractor shall submit a revised estimate that will meet with their approvals; or, as an alternative, the Engineer will estimate the percentage of work completed and submit to the Authority and Contractor his recommendation as to the amount earned for partial payment.

Partial Payment requests will not be processed unless ALL of the following criteria have been met:

1. The requirements of the preceding two (2) paragraphs have been fulfilled.
2. The Contractor has fulfilled ALL the requirements contained in the Schedule and Sequence of Operations in the Specifications, for the period.

C. RETAINAGE

Retainage from the estimates of the amounts earned will be as described below.

The Authority will retain ten percent (10%) of the amount of each such estimate until fifty percent (50%) of the work has been completed. At fifty percent (50%) completion, further partial payments will be made in full to the Contractor and no additional amounts will be retained unless the Engineer certifies that the work is not proceeding satisfactorily, but amounts previously retained will not be paid to the Contractor. At fifty percent (50%) completion or any time thereafter when the progress of the work is not satisfactory, additional amounts may be retained, but in no event will the total retainage be more than ten percent (10%) of the value of the work completed. Upon the Engineer's Certification of Substantial Completion, an amount retained may be paid to the Contractor. When the work has been substantially completed, except for work which cannot be completed because of weather conditions, lack of materials, or other reasons which in the judgment of the Authority are valid reasons for non-completion, the Authority may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the

work still to be completed, or in the alternative may pay out the entire amount retained and received from the Contractor guarantees in the form of a bond or other collateral sufficient to ensure completion of the work. For the purposes of this Article, estimates will include any fabricated or manufactured materials and components specified and delivered to the work or properly stored and suitable for incorporation in the work embraced in the Contract.

D. QUALIFICATION FOR PARTIAL PAYMENT FOR MATERIALS DELIVERED OR STORED

Qualification for partial payment for materials delivered or suitably stored, but not yet incorporated into the work shall be as described below.

Materials, as used herein, shall mean fabricated and manufactured material and equipment. Only those materials for which the Contractor can transfer clear title to the Authority will be qualified for partial payment.

To receive partial payment for materials on hand at the jobsite or which are stockpiled in the vicinity of the jobsite at a location approved by the Engineer and that are adequately insured and protected through appropriate security measures, but not incorporated in the work, the Contractor shall submit to the Engineer, at the time of requesting partial payment, a list of such materials. The Engineer, after confirming that such materials are on hand or stockpiled and are adequately insured and protected will recommend to the Authority the items for which partial payment is to be made. The Contractor's actual net cost for the materials must be supported by paid invoices of suppliers. Final payment shall be made only for materials actually incorporated in the work and, upon acceptance of the work, all materials remaining for which partial payments had been made shall revert to the Contractor, unless otherwise agreed, and partial payments made for these items shall be deducted from the final payment or the work.

Partial payments for undelivered, specifically manufactured equipment to be incorporated into the work, excluding "off the shelf" or catalog items, will be made to the Contractor for payment to the equipment manufacturer when all of the following conditions exist.

1. The equipment is so designated in the Specifications.
2. The equipment to be specifically manufactured for the project could neither be readily utilized on nor diverted to another job, and,
3. A fabrication period of more than six (6) months is anticipated.

The first payment for undelivered, specifically fabricated equipment will be made following approval of the shop drawings for the equipment, but in no case will payment exceed fifteen percent (15%) of the quoted price of the equipment. Thereafter monthly payments will be made based on the progress of fabrication a determined by the Engineer, but in no case will the total payments, prior to delivery exceed seventy five percent (75%) of the quoted price of the equipment.

E. PAYMENT

After deducting the retainages and the amount of all previous partial payments made to the Contractor, the amount earned as of the current month will be made payable to the Contractor as follows:

Not later than the 15th of each calendar month, the Authority will make partial payment to the Contractor on the basis of the Engineer's recommended estimate of the work executed during the preceding calendar month.

182. RELEASE OF LIENS OR CLAIMS

The Contractor shall indemnify and save harmless the Authority from all claims for labor and materials furnished under this Contract. Before the Authority pays the Contractor his final payment for the work, the Contractor shall submit satisfactory evidence that all persons, firms, or corporations who have done work or furnished materials under this Contract, for which the Authority may become liable under the laws of the State of New Jersey, have been fully paid or satisfactorily secured. If evidence is not furnished or is not satisfactorily secured. If evidence is not furnished or is not satisfactory, an amount shall retained from moneys due the Contractor which, in addition to any other sums that may be retained, will be sufficient, in the opinion of the Authority, to meet all liens or claims. Such sum or sums shall be retained until the liens or claims are fully discharged or satisfactorily secured.

If any lien or claim remains unsatisfied after all payments to the Contractor are made, the Contractor shall refund to the Authority all moneys that the latter may be compelled to pay in discharging such a lien or claim, including all costs and attorneys' fees.

183. FINAL PAYMENT

Upon completion of all of the work under this Contract, the Contractor shall notify the Engineer, in writing, that he has completed the work and make application for final payment. The Authority shall pay to the Contractor all moneys due him under the provisions of the Contract Documents after the following conditions have been met:

- A. The Authority has accepted the completed work, or formally waived nonconforming work to the extent of the nonconformity;
- B. The Authority has approved the Engineer's recommendation for acceptance of the work;
- C. The Contractor has complied with all the requirements set forth in each Certificate of Substantial Completion;
- D. The Contractor has furnished the Authority with a release of all claims against the Authority or the Engineer arising by virtue of this Contract other than claims in stated amounts as may be specifically accepted by the Contractor from the operation of the release;
- E. The Contractor has complied with all other provisions of the Contract Documents;
- F. Neither the final payment nor the partial payment shall operate to release the Contractor or his Sureties from any obligation under this Contract or any bond or warranty, as herein provided.

184. NO WAIVER OF RIGHTS

Neither the inspection by the Authority, through the Engineer or any employees of the same, nor any order by the Authority for payment of money, nor any payment for, or acceptance of, the whole or any part of the work by the Authority or Engineer, nor any extension of time, nor any possession taken by the Authority or his employees, shall operate as a waiver or any provision of this Contract, or any power herein reserved to the Authority, or any right to damages herein

provided, no shall any waiver of any breach in this Contract be held to be a waiver of any other or subsequent breach.

185. ACCEPTANCE OF FINAL PAYMENT CONSTITUTES RELEASE

The acceptance by the Contractor of the final payment shall release the Authority and the Engineer, as representative of the Authority, from all claims and all liability to the Contractor for all things done or furnished in connection with the work, and every act of the Authority and others relating or arising out of the work. Within 30 days after Final Payment has been issued to the Contractor, the Contractor shall submit to the Engineer a written acceptance of the Final Payment. The Contractor's failure to submit any written acceptance within 30 days will be construed as an acceptance of the Final Payment without exception or reservation.

186. AUDIT: ACCESS TO RECORDS

- A. The Contractor shall maintain books, records, documents and other evidence directly pertinent to performance of work under this Contract in accordance with generally accepted accounting principles and practices consistently applied. The Contractor shall also maintain financial information and data used by the Contractor in the preparation or support of the cost submissions required for this Contract, or any Modification Order or claim, and a copy of the cost summary submitted to the Authority. The Authority and appropriate representative of the federal government (if this project is funded by federal monies) or their authorized representatives shall have access, at all times during normal business hours, to such books, records, documents and other evidence for the purpose of inspection, audit and copying. The Contractor will provide proper facilities for such access and inspection during normal business hours.
- B. The Contractor agrees to make paragraph A through H of this Article applicable to this Contract and all Modification Orders or claims affecting the Contract price. The Contractor agrees to include paragraphs A through H of this Article in all his contracts and all their subcontracts in excess of \$10,000, and to make paragraphs A through H of this Article applicable to all Modification Orders and claims related to project performance.
- C. Audits conducted under this Article shall be in accordance with generally accepted auditing standards and established procedures and guidelines of the reviewing or audit agency.
- D. The Contractor agrees to the disclosure of all information and reports resulting from access to records under paragraphs A and B of this Article, to the agencies referred to in paragraph A of this Article, provided that the Contractor is afforded the opportunity for an audit exist conference, and an opportunity to comment on and submit any supporting documentation on the pertinent portions of the draft audit report, and that the final audit report will include written comments of reasonable length, if any, of the Contractor.
- E. Records under paragraphs A and B of this Article shall be maintained and made available during performance of work under this Contract until final payment, or until settlement of all disputes, claims, or litigation. In addition, those records which relate to any portion of this Contract, to any Modification Order, to any dispute, to litigation, to the settlement of claims arising out of such performance, or to costs or times to which an audit exception have been taken, shall be maintained and made available until final payment or until final resolution of such dispute, litigation, claim or exception, whichever occurs later. As a minimum, the auditors shall have available to them the following documents:

1. Daily time sheets and foreman's daily reports.
 2. Union agreements.
 3. Insurance, welfare, and benefits records.
 4. Payroll registers.
 5. Earnings records.
 6. Payroll tax forms.
 7. Material invoices and/or requisitions.
 8. Material cost distribution worksheet.
 9. Equipment records (list of company equipment and rates).
 10. Vendors', rental agencies', and Subcontractors' invoices.
 11. Subcontractors' payment certificates.
 12. Canceled checks (payroll and vendors).
 13. Job cost report.
 14. Job payroll ledger.
 15. General ledger.
 16. Cash disbursements journal.
 17. Financial statements for all years reflecting the operations on the Project.
 18. Income tax returns for all years reflecting the operations on the Project.
 19. Depreciation records on all company equipment whether such records are maintained by the company involved, or its accountant, or others.
 20. If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents.
 21. All documents which reflect the Contractor's actual profit and overhead during the years the Project was being performed and for each of the five (5) years prior to the commencement of the Project.
 22. All documents related to the preparation of the Contractor's bid including the final calculations on which the bid was based.
 23. All documents which relate to each and every claim together with all documents which support the amount of damages as to each claim.
 24. Worksheets used to prepare the claim establishing the cost components for items of the claim including, but not limited to, labor, benefits and insurance, materials, equipment, Subcontractors, and all documents which establish the time periods, individuals involved, and the hours and rates for these individuals.
- F. The right of access which this Article confers will generally be exercised with respect to financial records, on Modification Orders or claims in excess of \$10,000 affecting the price of this Contract. Such right of access may be exercised with respect to records pertaining directly to Contract performance or claims, or if the Contract is terminated for default or convenience.
- G. If the Authority determines that any price negotiated in connection with this Contract, or any cost reimbursable under this contract, was increased by any significant sums because the Contractor, or any tier Subcontractor, furnished incomplete or inaccurate cost or pricing data or data not current, then such price or cost or profit shall be reduced accordingly and the contract shall be modified in writing to reflect such reduction.
- H. Failure to agree on a reduction under this Article shall be subject to Article "DISPUTES" of these GENERAL CONDITIONS.

187. RESERVED

188. RESERVED

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CONSTRUCTION AGREEMENT

THIS AGREEMENT made this ____ day of ____, 20____, by and between the **SOUTH JERSEY TRANSPORTATION AUTHORITY**, having its principal offices located at Farley Service Plaza, Elwood, New Jersey, hereinafter referred to as “Authority,” and _____, having its principal offices located at _____, hereinafter referred to as “Contractor.”

W I T N E S S E T H:

The Authority operates and maintains the Atlantic City Expressway and Atlantic City International Airport and was established and created pursuant to the South Jersey Transportation Authority Act (the Act), N.J.S.A. 27:25A-1 et seq.; and

1. That for and in consideration of the sum of \$ _____ **DOLLARS**, Contractor agrees to construct the **Atlantic City Expressway 2022 Sign Shop Rehabilitation Project** in accordance with the Contract Documents hereinafter set forth.

2. That for and in consideration of the amount payable under this Agreement by the Authority, the Contractor agrees, at its own proper cost and expense, and with due skill and diligence, that it will perform the aforesaid in accordance with the Contract Documents and in compliance with this Agreement.

3. Contractor agrees to receive as full compensation the amount stated herein, namely, \$ _____, for the aforesaid. Contractor shall be responsible for all loss or damage arising out of the furnishing of the aforesaid or from any action of the elements; or from any unforeseen obstruction or difficulties which may be encountered of every description connected with the furnishing of the aforesaid until the same have been accepted by the Authority.

4. To prevent all disputes and litigation, it is agreed by and between the parties to this Agreement that the Authority shall in all cases determine the services rendered and paid for under this Agreement, and as to the interpretation of the plans and specifications.

5. The Contract Documents shall consist of (1) Notice to Bidders; (2) Bid Specifications; (3) Contractor's Proposal (as accepted); (4) Contract Agreement; (5) All Addenda. (6) Any other written instructions or interpretations given by the Authority, or its representative.

6. The Contractor shall furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the Project described in the Contract Documents.

7. The Contractor shall commence the work required by the Contract Documents within seven (7) calendar days after the date of the notice to proceed. The Contractor shall complete all work required by the Contract Documents within **120 calendar days** from and including the date of the written notice to proceed unless the period of completion is extended otherwise pursuant to the Contract Documents.

8. The Authority will pay to the Contractor, in the manner and at such times as set forth in the Contract Documents, such amounts as required by the Contract Documents. The Contractor specifically agrees to the provision for liquidated damages contained in the Contract Documents.

9. Notwithstanding the fact that a dispute, controversy or question shall have arisen between the Contractor and the Authority under this Contract, Contractor agrees that it will not directly or indirectly stop or delay the Work, or any part thereof, or stop or delay the delivery of any material required to be furnished to the Project site pending the termination of such dispute, controversy or question. This provision does not excuse the Authority from its obligation to pay

the Contractor that portion of an application for payment that is not in dispute nor is it intended hereby that the Contractor is prohibited from stopping or delaying work in the event the Authority does not pay such undisputed amount in accordance with the terms and conditions hereof.

10. Where reference is made in this Contract to a provision of any of the Contract Documents, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

11. The Contract may be terminated by the Authority or Contractor as provided in the Contract Documents; the work may be suspended by the Authority as provided in the Contract Documents. Contract may be terminated by the Authority for failure to provide services in accordance with the contract. The Authority may also terminate the contract for the Contractor's failure to pay Expressway tolls (or other amounts due) when due and owing, or for any other matter as authorized by law.

12. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral.

13. To the extent not superseded by federal law, the contract shall be governed by New Jersey law.

14. The parties to this agreement agree to incorporate into this agreement the mandatory language of subsection 3.6(a) of the Regulations promulgated by the Treasurer pursuant to P.L. 1975, c. 127, as amended and supplemented from time to time, and the contractor or subcontractor agrees to comply fully with the terms, provisions and obligations of said subsection 3.6.

15. The Contractor shall execute the Mandatory Equal Employment Opportunity Language, Exhibit B attached hereto, which shall be incorporated herein by reference.

16. SMALL BUSINESS SET-ASIDE: New Jersey's Small Business Set-Aside Program obligates the Authority to make 25% of all purchases for goods and services from small businesses. Firms classified as a Small Business Enterprise must be registered with the New Jersey Department of Revenue and Enterprise Services. Registration instructions can be obtained by visiting the State's website:

<https://www.njportal.com/DOR/SBERegistry/Default/>

The South Jersey Transportation Authority requests the following for informational purposes only.

This is not a Set-Aside bid; however, please indicate below (if applicable).
Our firm is certified/registered with the State of New Jersey Set-Aside Program.

Certification # _____

	Check here
MBE (Minority Business Enterprise)	_____
WBE (Women Business Enterprise)	_____
SBE (Small Business Enterprise)	_____
None of the Above	_____

POLICY STATEMENT OF THE SOUTH JERSEY TRANSPORTATION AUTHORITY

In accordance with Executive Order No. 84 signed by Governor James J. Florio on March 5, 1993 and Executive Order No. 71 signed by Governor James E. McGreevey on October 2, 2003, it is the policy of the South Jersey Transportation Authority (the "Authority" or "SJTA") that Small Business Enterprises ("SBE"), as determined and defined by the Department of the Treasury, Division of Revenue and Enterprise Services ("Division of Revenue") in N.J.A.C. 17:13 et seq., have the opportunity to compete for and participate in the performance of contracts to the purchase of goods and services and for construction services required by the Authority. The Authority

further requires that its contractors shall agree to take all necessary and responsible steps, in accordance with the aforementioned regulations, to ensure that SBE's have these opportunities.

It is the policy of the South Jersey Transportation Authority (SJTA) that small businesses (each a "small business enterprise" or "SBE"), as determined and defined by the New Jersey Department of the Treasury, Division of Purchase and Property, Contract Compliance and Audit Unit, EEO Monitoring Program ("EEO Monitoring Program") in N.J.A.C. 17:27 et seq. or other application regulation, should have the opportunity to participate in SJTA Contracts.

To the extent the Firm engages subcontractors or sub-consultants to perform Services for the SJTA pursuant to this Contract, the Firm must demonstrate to the SJTA's satisfaction that a **good faith effort** was made to utilize subcontractors and sub-consultants who are **registered with the EEO Monitoring Program as SBEs.**

Furthermore, Proposers and subcontractors shall be evaluated by the EEO Monitoring Program, based on its attainment of the Participation Goals set forth in N.J.A.C. 17:27-5.2

Please refer to the following link for current applicable procurement target(s) guidelines set forth by the NJ Department of Treasury:

https://www.state.nj.us/treasury/contract_compliance/

Evidence of a "good faith effort" includes, but is not limited to:

- (a) Whether the vendor or subcontractor has agreed to make a good faith effort to adhere to targeted minority and women employment goals;
- (b) Whether the vendor or subcontractor has met or documented that it has made a good faith effort to meet targeted employment goals;
- (c) Whether the vendor or subcontractor has adopted an Equal Employment Opportunity (EEO) Policy;
- (d) Whether the vendor or subcontractor has posted an EEO Policy on the job site bulletin board;

(e) Whether the vendor or subcontractor has disseminated the EEO Policy to its workers through various means including company meetings, preconstruction job meetings, written notices, etc.;

(f) Whether the vendor or subcontractor has posted Federal or State issued EEO posters on the job site bulletin board;

(g) Whether the vendor or subcontractor has identified an EEO Officer and established job duties in writing for such position;

(h) Whether the vendor or subcontractor has developed a basic complaint procedure;

(i) Whether the vendor or subcontractor has knowledge of and has considered the general availability of minorities and women having requisite skills in the immediate labor area;

(j) Whether the vendor or subcontractor has knowledge of and has considered the percentage of minorities and women in the total workforce in the immediate labor area;

(k) Whether, when the opportunity has presented itself, the vendor or subcontractor has considered promoting minority and women employees within its organization;

(l) Whether the vendor or subcontractor attempted to hire minorities and women based upon the anticipated expansion, contraction and turnover of its workforce;

(m) Whether the vendor or subcontractor has the ability to consider undertaking training as a means of making all job classifications available to minorities and women and whether it has done so;

(n) Whether the vendor or subcontractor has utilized the available recruitment resources to attract minorities and women with requisite skills, including, but not limited to, public and private training institutions, job placement services, referral agencies, newspapers, trade papers, faith-based organizations, and community-based organizations;

(o) Whether the vendor or subcontractor has requested qualified minorities and women from a labor union with whom it has an exclusive hiring or referral arrangement;

(p) Whether the vendor or subcontractor has actively recruited beyond the traditional sources to attract minority and women applicants;

(q) Whether the vendor or subcontractor has reviewed all personnel actions to ensure actions are taken in compliance with the company's EEO policy; and

(r) Whether the vendor or subcontractor has retained records of employment and personnel actions and payroll records for a three year-period from the date of the contract or project closing.

South Jersey Transportation Authority Substitution Policy

The contractor or consultant must notify and obtain written approval from a small or women or minority-owned or Disadvantaged Business Enterprise (DBE) sub-contractor, sub-consultant, or vendor (SMWBE or DBE contractor) before including that contractor in a bid proposal or similar contract-related submission.

The contractor, consultant must notify and obtain written consent and obtain authorization from South Jersey Transportation Authority's Public Agency Compliance Officer/DBE

Liaison Officer before it substitutes a SMWBE or DBE sub-contractor, sub-consultant named in a bid proposal or other contract related submission; and if the substitution is approved by the Public Agency Compliance Officer/DBE Liaison Officer, the contractor, consultant shall make a good faith effort to utilize another SMWBE or DBE sub-contractor sub-consultant to replace the pervious SMWBE and/or DBE contractor, consultant.

The prime contractor or consultant must give the Public Agency Compliance Officer/DBE Liaison Officer five days to respond to the prime contractor's, consultant's notice and advise the contractor, consultant approval or the reasons, if any, why it objects to the proposed termination of its subcontract subconsultant and why you should not approve the prime contractor, consultant's action.

The Contractor agrees to make a good faith effort to award at least 25% of this contract to subcontractors registered by the Commerce Commission as a SBE. Subcontracting goals are not applicable if the prime contractor is a registered Small Business Enterprise (SBE) firm.

17. The undersigned does hereby warrant and represent that this Agreement has not been solicited or secured, directly or indirectly, in a manner contrary to the laws of the State of New Jersey, and that said laws have not been violated and shall not be violated as they relate to the procurement or the performance of this Agreement by any conduct, including the paying or

giving of any fee, commission, compensation, gift, gratuity or consideration of any kind, directly or indirectly, to any Authority employee, officer or official.

18. The address given below shall be the address of the representative of the parties to which all notices and reports required by this Agreement shall be sent by mail.

As to the Authority:

Mr. Stephen F. Dougherty, Executive Director
SOUTH JERSEY TRANSPORTATION AUTHORITY
P.O. Box 351
Hammonton, NJ 08037

As to the Contractor:

SAMPLE
AGREEMENT

(insert address)

19. If it becomes necessary for the Contractor either as principal or by agent or employee to enter upon the premises or property of the Authority in order to construct, erect, inspect, make delivery or remove property hereunder, the Contractor hereby covenants and agrees to take, use, provide and make all proper, necessary and sufficient precautions, safeguards and protections against the occurrence of happenings or any accidents, injuries damages or hurt to any person or property during the progress of the work herein covered. Contractor shall hold the Authority, its Chairman, commissioners, members, officers and employees harmless from and against all claims, suits, and judgments of every kind and description arising from any damage to or loss of property of the Authority, Contractor, or their respective agents, servants or employees, or any other person, or injury to or death of persons, including agents, servants, or employees of Authority or Contractor, or any other person, arising directly or indirectly from the services provided by this Agreement, except that which is due solely to the fault or negligence of Authority,

its agents, servants or employees. The Contractor will carry insurance and will indemnify the Authority, its Chairman, commissioners, members, officers and employees from and against any such claim for loss, damage or injury to property or person arising out of the services covered by this Agreement and the use, misuse or failure of any equipment used by the Contractor or his employees or agents, and shall provide certification of such insurance to the Authority.

20. The Contractor shall submit a properly completed Affirmative Action Form AA-201 (Initial Project Workforce Report – Construction) prior to execution of this agreement. The Contractor agrees thereafter to submit once a month, prior to the receipt of any monthly payment, Affirmative Action Form AA-202 (Monthly Project Workforce Report).

21. The Contractor shall provide written notice to its subcontractors of the responsibility to submit proof of business registration to the Contractor. The requirement of proof of business registration extends down through all levels (tiers) of the project.

Before final payment on the contract is made by the Authority, the Contractor shall submit an accurate list and the proof of business registration of each subcontractor or supplier used in the fulfillment of the contract, or shall attest that no subcontractors were used.

For the term of the contract, the Contractor and each of its affiliates, and a subcontractor and each of its affiliates, [N.J.S.A. 52:32-44(g)(3)] shall collect and remit to the Director, New Jersey Division of Taxation, the use tax due pursuant to the Sales and Use Tax Act on all sales of tangible personal property delivered into this State, regardless of whether the tangible personal property is intended for a contract with a contracting agency.

A business organization that fails to provide a copy of a business registration as required pursuant to Section 1 of P.L. 2001, c. 134 (C.52:32-44 *et al.*) or subsection e. or f. of Section 92 P.L. 1977, c.110 (C.5:12-92), or that provides false business registration information

under the requirements of either of those sections, shall be liable for a penalty of \$25 for each day of violation, not to exceed \$50,000 for each business registration copy not properly provided under a contract with a contracting agency.

22. This Agreement, together with the contract documents, forms the contract and they are as fully a part of this Agreement as if hereto attached or herein repeated.

23. The Authority and the Contractor for themselves, their heirs, executors, administrators, successors or assigns, hereby agree to the full performance of the covenants herein contained.

IN WITNESS WHEREOF, the parties hereto have set their hands and seals the day and year first written above.

WITNESS & ATTEST:

**SOUTH JERSEY TRANSPORTATION
AUTHORITY**

_____ By _____
CYNTHIA A. BLASBERG **STEPHEN E. DOUGHERTY**
Board Secretary Executive Director

(Seal)

WITNESS & ATTEST:

[CONTRACTOR]

_____ By _____
Secretary President or Owner

(Seal)

EXHIBIT B

MANDATORY EQUAL EMPLOYMENT OPPORTUNITY LANGUAGE

**N.J.S.A. 10:5-31 et seq.
N.J.A.C. 17:27-1.1 et seq.**

CONSTRUCTION CONTRACTS

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth the provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable, will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. 17:27-7.2; provided, however, that the Dept. of LWD, Construction EEO Monitoring Program, may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B, and C, as long as the Dept. of LWD, Construction EEO Monitoring Program is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the

Dept. of LWD, Construction EEO Monitoring Program, that its percentage of active “card carrying” members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. 17:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award, seek assurances from the union that it will cooperate with the contractor or sub-contractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et. seq., as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or sub-contractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

(B) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

- (1) To notify the public agency compliance officer, the Dept. of LWD, Construction EEO Monitoring Program, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers;
- (2) To notify any minority and women workers who have been listed with it as awaiting available vacancies;
- (3) Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;
- (4) To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;

(5) If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;

(6) To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(i) The contractor or subcontractor shall interview the referred minority or women worker.

(ii) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Dept. of LWD, Construction EEO Monitoring Program. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.

(iii) The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Dept. of LWD, Construction EEO Monitoring Program, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(iv) If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the

contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Dept. of LWD, Construction EEO Monitoring Program.

(7) To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Dept. of LWD, Construction EEO Monitoring Program and submitted promptly to the Dept. of LWD, Construction EEO Monitoring Program upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprentice-ship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Dept. of LWD, Construction EEO Monitoring Program an initial project workforce report (Form AA-201) electronically provided to the public agency by the Dept. of LWD, Construction EEO Monitoring Program, through its web-site, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Dept. of LWD, Construction EEO Monitoring Program, and to the public agency compliance officer.

The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off the job programs for outreach and training of minorities and women.

(D) The contractor and its subcontractors shall furnish such reports or other documents to the Dept. of LWD, Construction EEO Monitoring Program as may be requested by the Dept. of LWD, Construction EEO Monitoring Program from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Dept. of LWD, Construction EEO Monitoring Program for conducting a compliance investigation pursuant to N.J.A.C. 17:27-1.1 et seq.

SPECIAL PROVISIONS

CONSTRUCTION REQUIRED BY THE SPECIAL PROVISIONS

These Special Provisions relate generally to the construction of the **ATLANTIC CITY EXPRESSWAY 2022 SIGN SHOP REHABILITATION PROJECT**.

These Special Provisions require the doing of all things necessary or proper for or incidental to the matter referred to in the immediately preceding paragraph, as shown on the Contract Drawings in their present form. In addition, all things shown on the Contract Drawings even though not expressly mentioned in these Special Provisions, all things mentioned in these Special Provisions even though not shown on the Contract Drawings, and all things not specified either on the Contract Drawings or in the Project Manual but involved in carrying out their intent and in the complete and proper execution of the matter referred to in the immediately preceding paragraph, are required by these Special Provisions; and the Contractor shall perform the same as though they were specifically delineated, described and mentioned.

In the event any requirements of the Special Provisions appear to conflict with the requirements of the Contract Drawings, the requirements of the Special Provisions shall prevail.

SPECIFICATIONS TO BE USED

The work shall be performed following the technical specifications contained in the project manual/contract specifications.

CONTRACT DRAWINGS

Contract Drawings for this project are made part of the Contract Documents.

STANDARD DRAWINGS

There are no standard drawings for this contract.

CONSTRUCTION SEQUENCE

No particular sequence is required for this project. However, the contractor shall perform their work without interruption to the SJTA staff performing their work within the building.

APPROVALS BY ENGINEER

Any approval by the Engineer of any materials, workmanship, plant, equipment, drawings, program, methods of procedure, or of any other act or thing done or furnished or proposed by the Contractor to be done or furnished in or in connection with the performance of the Contract shall be construed merely to mean that at the time the Engineer knows of no good reason for objecting thereto; and no such approval shall release the Contractor from his full responsibility for the accurate and complete performance of the Contract in accordance with the Contract Drawings and Special Provisions or from any duty, obligation or liability imposed upon him by the Contract or from responsibility for injuries to persons or damage to property.

ACCIDENTS AND FIRST-AID PROVISIONS

The Contractor shall promptly report in writing to the Engineer and to South Jersey Transportation Authority all accidents whatsoever arising out of or in connection with the performance of the Contract, whether on or adjacent to the construction site, which result in death, injuries or property damage, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damage is caused, the accident shall be reported immediately by telephone to both of the said representatives of South Jersey Transportation Authority.

The Contractor shall provide at the construction site such equipment and medical facilities as are necessary to supply first aid service, in case of accident, to any who may be injured in the progress of the Contract.

If any claim is made by any third person against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the fact in writing to the aforementioned representatives of South Jersey Transportation Authority, giving full details of the claim.

DAILY PROGRESS, EQUIPMENT AND LABOR REPORTS

The Contractor shall furnish to the Engineer at the end of each day, a memorandum showing for that day (a) a detailed narrative of all construction activities performed, (b) all equipment on-site with a description of activities performed, (c) a statement of any unusual happening that occurred, (d) the number of workers in each trade classification that were employed and the number of hours they worked, broken down by direct employing company, (e) the weather conditions for that day, (f) a list of all deliveries, (g) any observed safety issues or concerns, (h) any discussions/conversations with the Owner, Project Manager, etc. related to the work or execution of the work, (i) the name and title of the person writing the report, and (j) relevant photographs. Such memorandum shall not be deemed to be a substitute for the notices, time slips, memoranda or other data required under the clauses of the Form of Contract relating to compensation for extras. A daily report shall be generated for every calendar day from the Notice to Proceed until Final Acceptance and reports shall be submitted (at least) once a week.

IDENTIFICATION

No person will be permitted on or about the construction site without a pass, permit or identification badge approved by the Engineer. The Contractor shall obtain such passes, permits or identification badges for his employees, subcontractors, and materialmen whenever necessary. Identification badges shall be worn in a conspicuous and clearly visible position by all employees of the Contractor whenever they are working at the construction site.

SIGNS

No advertisement or sign, other than the name and address of the Contractor, will be permitted on any fences, temporary structures or elsewhere on the construction site and such advertisement will be permitted only upon the condition that it is first approved by the Engineer. In any event, the advertisement shall not exceed six feet by eight feet in over-all dimensions.

The Contractor will be required to provide temporary construction signage, safety signage, regulation signage, pardon our appearance signage and/or way finding signage as necessary to properly indicate the area as a construction area, warn public of any potential hazards and direct the flow of traffic. The type and quantity of signs that will be required shall be coordinated with the SJTA Project Manager and generally based on the location of the construction areas, staging areas and layout of temporary walls/barricades. The contractor shall provide this signage at no additional cost.

UTILITY SERVICES

The Contractor shall make arrangements for securing at his own expense any heat, light, power, water and other services which may be required for the performance of the Contract.

EQUIPMENT

All equipment necessary for the proper construction of the work under this contract shall be on the project, in first class working condition.

CONSTRUCTION INSPECTIONS

All inspections or testing required by Local or State agencies shall be performed by an independent testing agency at no additional cost to the Authority. The cost thereof shall be included in the various items scheduled in the Proposal.

CONSTRUCTION OPERATION REQUIREMENTS

All work shall be performed during daytime hours from 7:00 a.m. to 3:30 p.m., Monday through Friday; excluding any major holidays, unless otherwise directed by the engineer.

The contractor is required to conduct his work and meet completion dates in accordance with the contract provisions. In order to accommodate this schedule, the contractor will be required to supply sufficient labor, material and equipment to complete the work on schedule. Any deviation from these work hour limits shall be requested in writing and approved in writing by the Authority.

Sufficient lighting of areas to be inspected shall be provided in accordance with the Special Provisions or as directed by the Authority.

CONSTRUCTION LIGHTING

When construction is performed during nighttime hours the Contractor shall ensure the work areas are adequately illuminated. A minimum of 10 foot-candles of illumination shall be provided in the work areas, using maneuverable light plants with 1,000-watt metal halide floodlights. The light should be positioned to provide the most natural color illumination and contrast with a minimum of shadows. Lighting the tunnel work area from both sides shall be preferred as lighting from only one side may result in objectionable shadows. All lighting arrangements, including the number, height and positions of floodlights, shall be as approved by the Engineer.

The Contractor shall equip all equipment with artificial illumination to safely illuminate the area immediately surrounding their work areas. The Contractor shall furnish additional lights when directed by the Engineer at no additional cost.

The Contractor shall install, operate, protect and maintain the temporary service for construction, light and power. The Contractor shall extend the temporary wiring throughout, properly grounded, insulated and installed in a safe manner.

No separate payment shall be made for construction lighting. Construction lighting costs shall be incidental to other items of associated work.

TEMPORARY DRAINAGE

The Contractor will be required to ensure adequate drainage from his area of operation including any runoff at all times. He shall also provide water pollution and erosion control in accordance with the Contract Drawings and Project Manual. No direct payment will be made for this work.

FITTING, MATCHING

The Contractor shall do all the cutting and fitting required for the installation of this work and required to make his work come together properly and shall fit it to receive or be received by existing work or future work shown on the drawings or implied by the drawings and Special Provisions for the work. He shall properly condition his work as the Construction Manager may direct to meet the intent of the Project Manual. All cost caused by defective work shall be borne by the Contractor. The Contractor shall not endanger any existing installation by cutting, digging, or otherwise, nor shall he cut or alter existing work except with the consent of the Engineer. To ensure the proper execution of his subsequent work, the Contractor shall measure work

SPECIAL PROVISIONS

already in place either by the Contractor or by others and shall at once report to the Construction Manager any discrepancy between the executed work and the drawings.

EXISTING MATERIALS

The SJTA reserves the right of first refusal for any material that shall be removed from the project site. If the material is desired by the SJTA, the contractor shall remove it from the site and deliver it to the nearest SJTA Maintenance Facility along the Atlantic City Expressway or the Atlantic City International Airport, as directed. Separate payment will not be made, and the cost shall be incidental to other items of the associated work.

DAILY CONSTRUCTION PROGRESS MEETINGS

A daily progress meeting shall be held between the Engineer and the Contractor. Test results from the previous and current work period will be reviewed. Work requirements for the next work period will be discussed. Arrangements for meeting these work requirements will be reviewed. The weather forecast will also be reviewed during this meeting.

Bi-weekly progress meetings will also be held. Representatives from the Authority, the Engineer, and the Contractor will be present. The agenda for this meeting will include the work schedule for the coming week, any operational problems which, have been encountered or may be expected, and any other operational aspects of the project as noted in other Project Manual sections.

RECORD DOCUMENTS

The Contractor shall provide the Owner's Representative with a set of record documents at the completion of the project. The Owner's Representative will provide the Contractor with a set of reproducible contract drawings. The Contractor shall indicate any and all deviations on the contract drawings, which shall include, but not be limited to, any structures or utilities not shown on the drawings. The Contractor shall also provide a bound copy of all operation manuals, materials lists and catalogs for the materials and equipment utilized for the project. Include all costs for this work in the various items scheduled in the Proposal.

REPORTS

Upon request of the Engineer, at the end of each normal work week, the Contractor shall furnish, for approval, his proposed operating schedule for the following week. This and locations of operations to be performed and the types of equipment to be used. After this schedule has been approved, the Contractor shall not deviate from it without receiving prior permission from the Engineer.

SCALES FOR WEIGHING

Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales. Scales shall be accurate within one-half percent of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of one (1) percent of the nominal rated capacity of the scale, but not less than 1 pound (454 grams). The use of spring balances will not be permitted. Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

Scale installations shall have available ten standard 50-pound (2.3 kilogram) weights for testing the weighing equipment or suitable weights and devices for other approved equipment. Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the

platform level and rigid bulkheads at each end. Scales “overweighing” (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of one-half of one (1) percent. In the event inspection reveals the scales have been “underweighing” (indicating less than correct weight), they shall be adjusted, and no additional payment to the Contractor will be allowed for materials previously weighed and recorded. All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.

When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the Engineer. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

“BUY AMERICA”

Comply with N.J.S.A. 52:32-1 and N.J.S.A. 52:33-1, *et seq.*, which prohibits the use by the Contractor or subcontractors of farm products or materials produced or manufactured outside of the United States on public work. The Authority may allow exceptions if its enforcement would be inconsistent with the public interest, where the cost of enforcing the prohibition would be unreasonable, or where the material in questions is not of a class or kind mined, produced, or manufactured in the United States.

If the use of foreign materials is allowed, the Authority may require the Contractor to deliver the material to an Authority-approved site for sampling, inspection, and testing. Do not use or incorporate the foreign material into the Work before the Authority approves the material.

If the Authority finds that the Contractor failed to comply with the Federal or State provisions regarding foreign materials, the Authority may require the unapproved foreign material be removed and replaced with acceptable material. If the Authority decides not to remove the unapproved foreign material, the Authority will not make payment for the Item incorporating unapproved foreign material, and will make the findings, including the Contractor’s name, public.

TOLLS AND USE OF MEDIAN CROSSOVERS/U-TURN

It is the policy of the South Jersey Transportation Authority **not to** offer toll-free passage on the Atlantic City Expressway for its vendors; New Jersey Title 19:2-6.2(a) (Subchapter 6. Tolls) - contractor to pay all tolls. Simply notifying the toll collector they are working for the SJTA is not allowable. Furthermore, the contractor shall only use official Expressway exits to change travel direction along the Expressway. Median crossovers are for official use only and shall not be used by the contractor. Contractors will be ticketed by State Troopers if they use these crossovers. All costs for anticipated tolls shall be included in the various pay items of the bid. Unauthorized use of the median crossovers will also result in the removal of that individual from the project.

NJDCA PERMITS

The Contractor is required to obtain and pay for all New Jersey Department of Community Affairs (NJDCA) permits to construct the work. The Engineer will provide the contractor with electronically, NJ Engineers signed and sealed NJDCA released construction plans. Separate payment will not be made for the permit application preparation and all permit fees, but the costs shall be included in the various items of the bid.

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SCOPE OF WORK

1.01 DESCRIPTION

In general, the work on this project consists of the rehabilitation of the existing sign shop building at the Central Maintenance Facility along the Atlantic City Expressway.

Project location:
Milepost 28, Atlantic City Expressway

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Owner Identification: South Jersey Transportation Authority
PO Box 351
Hammonton, NJ 08037

B. Engineer Identification: Remington & Vernick Engineers
2059 Springdale Road
Cherry Hill, NJ 08003

C. Contract Documents:

These Specifications and Drawings indicate the extent of the Contract. Contract Documents were prepared for the Project by Remington & Vernick Engineers, 2059 Springdale Road, Cherry Hill, NJ 08003.

1. Contracts:

- a. The Project will be constructed under a single Prime Contracting arrangement.
- b. The contract will be awarded to one Contractor for the work required at the storage building contained herein. Contract award will be based on the sum of a Contractor's pricing for the addition.
- c. The Contractor's completed bid form shall reflect the actual amount of work required at the sign shop building. The amounts on the Contractor's bid form as submitted with their bid will be used to generate the project schedule of values for payment purposes.
- d. The Specifications & Drawings indicate the extent of the Contract Documents.
- e. The quantities described in the specifications are for the convenience of the Contractor only. Items will be paid on a lump sum basis and no additional payment will be made if as-built quantities exceed plan quantities.
- f. Only major items of work are given in the Bid Form, but it is the intent of the specifications to secure a completely interconnected and functioning system, and if any workmanship or materials be required which are obviously necessary to carry out the full intent and meaning of the plans and specifications or to be reasonably inferred there from, the cost of such workmanship or materials shall be included in the unit price bid for the major items of work.

- g. Local custom and trade-union jurisdictional settlements do not control the scope of work included in the Prime Contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, the affected Prime Contractor shall promptly negotiate a reasonable settlement to avoid interruption and delays at no additional cost to the Owner
 2. This Scope of Work outlines the general items and distribution of work and shall not be construed as being all-inclusive

D. Scope of Work -

The **BASE BID** work on this project consists of the following:

1. Partially remove and properly dispose of the existing roofing system, roof decking and roof framing inside the limits shown on the Contract Documents.
2. Remove and properly dispose of the existing garage doors and man doors as shown on the Contract Documents.
3. Remove and properly dispose of the existing CMU walls, steel HSS columns and corrugated metal wall panels as shown on the Contract Documents. The existing concrete foundations below the existing CMU walls on the sides of the structure shall remain.
4. Remove and properly dispose of the existing asphalt and concrete pavement as indicated on the Contract Documents.
5. The Contractor shall inspect the conditions of the existing column foundations and piers in coordination with the Engineer. The Contractor shall repair all deteriorated areas identified by the Engineer prior to installation of the new enclosed structure.
6. The Contractor shall provide new concrete footing bases at each existing column location as indicated on the Contract Documents. Please note that this is only necessary if the existing column footings are less than 3'-0" x 3'-0" at the base. This includes tying the new concrete footing base to the existing CMU wall foundations as shown on the Contract Documents.
7. The Contractor shall furnish and install new concrete wall footings for proposed CMU walls as shown on the Contract Documents. This includes all steel reinforcement as detailed on the Contract Documents.
8. The Contractor shall furnish and install new 8" CMU walls up to elevation 3'-4" as indicated on the Contract Documents. This includes all necessary steel reinforcement and grouting.
9. The Contractor shall furnish and install concrete and steel reinforcement for a new 6" slab-on-grade as indicated on the Contract Documents. This includes the installation of a vapor barrier and 6" of $\frac{3}{4}$ " crushed stone. All expansion joints and control joints shall be per Contract Documents.
10. The Contractor shall furnish and install new steel HSS6"x6"x $\frac{3}{8}$ " columns as indicated on the Contract Documents. This includes the installation of new base plates and anchor

bolts as shown on the Contract Documents. The new columns will be installed on the existing 18"x18" concrete piers.

11. The Contractor shall furnish and install new W12x22 steel girders as shown on the Contract Documents.
12. The Contractor shall furnish and install all steel lintels for CMU wall openings as shown on the Contract Documents. All lintels shall bear a minimum of 8" on each end.
13. The Contractor shall furnish and install 2"x12" wood roof joists as shown on the Contract Documents. Proper care shall be taken to ensure 1/8"/1 foot roof slope is achieved.
14. The Contractor shall furnish and install 3/4" CDX plywood sheathing for the entire area of the building addition.
15. The Contractor shall furnish and install new EPDM membrane roofing system, including all flashing and insulation as required.
16. The Contractor shall furnish and install new aluminum gutters and downspouts as detailed in the Specifications.
17. The Contractor shall furnish and install metal man doors and overhead garage doors as shown on the Contract Documents and detailed in the Specifications.
18. The Contractor shall furnish and install metal stud walls on top of the new CMU walls for the building addition. Metal studs shall be 600S162-54 at 16 inches on center.
19. The Contractor shall furnish and install new metal wall panels as indicated on the Contract Documents.
20. The Contractor shall provide new bollards as indicated on the Contract Documents.
21. The Contractor shall furnish and install new metal stud walls and joists in the existing storage building as shown on the Contract Documents. The Contractor shall also install R-19 insulation and 5/8" gypsum board in this area.
22. The Contractor shall demolish one (1) existing oil-fired unit heater and all associated oil piping, accessories, and the above-ground storage tank. The demolition work also consists of the demolition of existing through-the-wall air conditioning units, as well as the relocation of existing outdoor condensing units.
23. The Contractor shall furnish and install new gas-fired unit heaters and an exhaust fan ventilation system in the proposed enclosure addition. The new exhaust fan and louvers shall be controlled by a gas detection system that includes carbon monoxide and nitrogen dioxide sensors. In the existing building, the mechanical work consists of the installation of a new gas-fired unit heater and ductless split systems.
24. The plumbing work on this project consists of the provision of new fuel gas piping to the proposed gas-fired unit heaters. The proposed gas piping will be installed to an existing capped gas service. A new gas meter will also be installed for the building.

25. The Contractor shall provide select electrical demolition of existing HVAC equipment, ceiling paddle fan, electrical panels and miscellaneous wiring devices as indicated on the Contract Documents. All wiring and conduit shall be removed back to the source. The Contractor shall maintain all existing electrical infrastructure that is not shown to be demolished.
26. The Contractor shall provide new lighting, wiring devices, HVAC equipment power and low voltage wiring, panelboards, raceways and conductors as indicated on the Contract Documents.
27. The contractor is responsible for cleaning and restoration of the site to the pre-construction conditions.
28. All work not specifically described or listed in the specifications that are incidental to work completion shall be considered as included within scope.
29. All work not specifically listed in a bidform pay item shall be incorporated into the lump sum/unit pay items listed.

1.03 SPECIAL CONDITIONS

1. The Contractor shall be responsible for coordinating all work with the Engineer and the South Jersey Transportation Authority so that all access and operations at this building remain continuous and are not affected by this construction.
 2. The Contractor should visit the site and include all costs for a complete demolition and building addition. The Owner is not responsible for additional costs based on the contractor failure to properly inspect the existing conditions and include all costs in his bid.
 3. Extra work allowance is only to be used at the owner's/engineer's discretion.
 4. A preconstruction video or photographs is recommended.
 5. Night and/or weekend work shall be permitted at no cost to Owner.
 6. Contractor is responsible for clean-up of site and shall provide dumpsters as required.
- 1.05 The above Scope of Work outlines the general items and distribution of work and shall not be construed as being all-inclusive.

END OF SCOPE OF WORK

SECTION 010000 - GENERAL REQUIREMENTS

1.01 GENERAL

- A. Only major items of work are given in the Bid Form, but it is the intent of the specifications to secure a completely interconnected and functioning system, and if any workmanship or materials be required which are obviously necessary to carry out the full intent and meaning of the plans and specifications or to be reasonably inferred therefrom, the cost of such workmanship or materials shall be included in the unit price bid for the major items of work.
- B. Reproducible As-built drawings must be furnished by the Contractor to the Engineer prior to final payment in accordance with Section 010100.
- C. Contractor shall notify all utility companies prior to construction of utilities by contacting 1-800-272-1000.
- D. Prior to any excavation, the Contractor shall have all utilities marked and shall excavate or otherwise determine the exact location and elevations of said utilities. The Contractor shall notify the Engineer of any conflicts. The Contractor shall arrange for any necessary utility relocations or plan changes and shall reschedule his operations appropriately.
- E. The Contractor, in the construction of any project, shall not stockpile materials or his equipment on any private property; except areas designated by the drawings as directed by the Engineer. If so required, the Engineer may direct the Contractor to have his equipment removed from any project during weekend hours.
- F. All work of refilling sunken ditches, repaving over trenches and keeping streets and sidewalks in passable condition shall be done to the satisfaction of the Engineer during the construction of the above work as well as during the maintenance period. If any work is not done within five (5) days after written notice is given by the Engineer, the work may be done by the Owner and charged to the Contractor.
- G. Special care shall be taken to prevent contamination, siltation, or interfering in any way with the stream flows or ponds along the line of work. No waste matter of any kind will be allowed to discharge into the stream flows or impounded water of any ponds or other bodies of water.
- H. The Contractor shall apply and pay for all local permits that may be required for any of the work involved with this project.
- I. All notes on drawings shall be made a part of the specifications.
- J. Contractor shall notify Engineer at least forty-eight (48) hours in advance of any work on Saturdays. There will be no work permitted on Sundays or holidays. This project will receive inspection and the normal working hours for the Inspector are from 7:30 AM to 4:00 PM, Monday through Friday. Any overtime inspection costs which are not specifically mentioned in the drawings and specifications will be reimbursed by the Contractor. Holidays are New Years Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving and Christmas.
- K. It shall be the Contractor's responsibility to keep the concrete curb clean of asphaltic tack coat.

1.02 PUBLIC UTILITIES

- A. The contract drawings indicate the approximate location of existing overhead and subsurface utilities in the vicinity of the work. The bidder is advised to ascertain for himself all the facts concerning the location of these utilities.
- B. The Contractor shall cooperate with the utility owners in the adjustment of their facilities and shall notify the utility owners not less than five (5) days in advance of the time he proposes to perform any work that will endanger or affect their facilities.
- C. The Contractor shall permit the owners of utilities, or their agents, access to the site of the work at all times in order to relocate, construct or protect their lines and he shall cooperate with them in performing this work.
- D. Separate payments will not be made for the coordination and cooperation of the Contractor with the utility companies, nor for the protection or replacement of utilities for the resequencing or delay of work due to a utility company and the bidder shall include all such costs in the prices bid for the various related items of work in the Bid Form.
- E. The Contractor is responsible for repairing all located utilities (water, sewer, storm sewer, gas lines, etc.) which are broken or damaged during construction.

1.03 PHOTOGRAPHS & VIDEO TAPES

The Contractor shall video tape in digital format the construction site prior to the commencement of construction. Two copies of the digital recording shall be forwarded and kept by Remington and Vernick Engineers to resolve any disputes arising over the restoration of all curbs, sidewalks, driveways, fences, lawns, landscaped areas, or any other items that may be disturbed during construction.

1.04 TESTING MATERIALS

- A. Except as may be provided elsewhere, test or analysis of materials which are usually tested after delivery to the site, such as concrete aggregate, mixed and placed concrete, and similar materials; will be performed by the Engineer or test laboratories which will be approved by the Engineer and selected and paid for by the Contractor. The preliminary testing of concrete mixtures and test or analysis of other materials, samples of which are to be submitted prior to delivery, will also be performed by the laboratory and paid for by the Contractor at the Engineer's request.
- B. If the Engineer orders sampling and analysis or tests of materials which are usually accepted on Certification of the manufacturer but which appear defective or not conforming to the requirements of the Specifications, the Contractor will bear the reasonable costs of sampling, transportation, test and analysis.

END OF SECTION

SECTION 010100 - AS-BUILT DRAWINGS

1.01 GENERAL

The Contractor shall provide a set of reproducible as-built drawings prior to final payment.

2.01 MATERIALS

- A. As-builts shall be a reproducible of the original contract drawings including any additional sheets required. All deviations from the original contract drawings shall be on the as-builts. The drawings shall be legible, neat, and of a quality acceptable to the Engineer.
- B. The Engineer shall provide a set of reproducibles at the beginning of the project.

3.01 EXECUTION

- A. The Contractor shall be responsible for keeping the as-built up-to-date as the project progresses.
- B. Building Construction: Actual installation with all items clearly identified shall be indicated. Location of installed items and any deviations from contract documents shall be so shown with boxes around the as-built numbers or labels.
- C. This section is intended to provide a minimum level of acceptance. Any section with more stringent requirements shall have precedence over this section.

4.01 PAYMENT

No separate payment will be made for work performed under this section.

END OF SECTION

SECTION 017400 - CLEANING AND RESTORATIONS

1.01 DESCRIPTION

- A. Contractor shall provide all equipment, labor & materials required to clear the site of all debris to match the natural grade conditions. Backfill shall be provided as required to provide positive drainage from any disturbed areas so that there is no ponding water on the site. All disturbed areas shall be seeded to establish vegetation and prevent erosion.
- B. Maintain premises and public properties free from accumulations of waste, debris and rubbish caused by work operations.
- C. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials; clean all sight exposed surfaces; leave project clean and ready for occupancy.
- D. At completion of work, restore or replace, when and as directed by the Engineer, any public or private property disturbed or damaged by Contractor's work operations to a condition at least equal to that existing prior to beginning work, or as otherwise specified. Materials, equipment and methods shall be approved by the Engineer.

2.01 MATERIALS

- A. For restorations all materials shall comply with the following Articles of the New Jersey Department of Transportation Standard Specifications latest revision and these specifications.
- B. Pavement restorations: See Section 903 "Bituminous Concrete".
- C. Restoration of curbs and other concrete structures:
 - 1. Concrete:
 - a. Shall conform to Section 605 for Curbs, Section 607 for sidewalks and driveways, and Section 405 for concrete surface course.
 - b. Compressive Strength: 4,000 psi at 28 days.
 - c. Air-entrained.
 - 2. Joint Fillers: Section 908, bituminous cellular type.
 - 3. Curing Compound: Section 905.03, white-pigmented liquid.
- D. Driveway Restoration: Driveway Aprons shall be replaced in kind with Portland Cement Concrete, Bituminous Concrete or 3/4 inch stone. Dirt driveway aprons are to be upgraded to stone.
- E. All other Materials: As approved by the Engineer or authorities having jurisdiction.

3.01 METHODS OF CONDUCTING WORK – CLEANING

- A. Requirements of regulatory agencies:

The Contractor shall comply with all Federal, State, and local anti-pollution laws, ordinances, codes and regulations when disposing of waste materials, debris and rubbish. All excess material shall be removed from the site and disposed of by the Contractor. Cost to be included in the unit price bid for all items.

The disposal site shall be in permanently established licensed OSWA (Office of Solid Waste Administration, New Jersey Department of Environmental Protection) landfills or a NJDEP certified recycling center if applicable.

B. Cleaning during construction:

Provide periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish and windblown debris resulting from construction operations.

The Contractor is responsible for street sweeping as directed by the Engineer or Owner. The Contractor shall keep all public roadways free of dirt and debris from any trucks entering or leaving the demolition site.

Provide on-site containers for the collection of waste materials, debris and rubbish. Maintain containers as required.

C. Dust Control:

The Contractor will be required to maintain all excavations, embankments, stockpiles, haul roads, permanent access roads, plant sites, waste areas, borrow areas, and all other work areas within or without the project boundaries free from dust which would cause a hazard or nuisance to others. Approved temporary methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment or similar methods will be permitted to control dust. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs. If any dust control is not done within twenty-four (24) hours after written notice is given by the Engineer, the work may be done by Owner and charged to the Contractor.

3.02 METHODS OF CONDUCTING WORK - RESTORATIONS

A. General: All existing structures, unpaved areas and paved areas disturbed or damaged during the work under this contract shall be restored or replaced to a condition at least equal to that existing prior to beginning work, or as otherwise specified. The methods of conducting this work shall, as a minimum, conform to the New Jersey Department of Transportation Standard Specifications, latest revision.

B. Pavement Restorations:

The methods of construction employed shall conform to the requirements set forth in Section 208, 304, 305 & 404 of the Standard Specifications as applicable to the type of material being utilized.

Restoration type and thickness shall be as shown on the contract drawings.

C. Restorations of Curbs and Other Concrete Structures:

1. Curbs: Section 605
2. Other concrete structures: Restore in accordance with applicable Sections of the Standard Specifications.

D. Fence Restorations:

Contractor shall remove all concrete from existing fence posts and appurtenances before reinstalling fence in kind.

E. All Other Restorations:

Restore in accordance with applicable Sections of the Standard Specifications, or as approved by the Engineer or authorities having jurisdiction.

END OF SECTION

SECTION 024100 - BUILDING DEMOLITION

1.01 DESCRIPTION

- A. The existing structures to be demolished, in general, consist of the following:
 - 1. Removal of existing roofing system, including but not limited to roofing membrane, existing roof joists, insulation & flashing.
 - 2. Removal of existing masonry walls as directed in Contract Documents.
 - 3. Removal of existing steel columns as directed in Contract Documents.
 - 4. Removal of existing bituminous paving as directed in Contract Documents.
 - 5. Removal of existing overhead doors as directed in Contract Documents.
 - 6. Removal of existing corrugated metal wall panels as directed in Contract Documents.
- B. Adjacent areas required to remain shall be left in a safe condition, and shall not be defaced, marred, or jeopardized in any way and any damage done to them shall be repaired or restored to the satisfaction of the Engineer, without additional compensation.
- C. Contractor shall remove all equipment and excess materials during the process of demolition. This material shall be disposed of by the Contractor at his expense.
- D. The Contractor shall employ all possible methods to minimize the noise. All construction equipment powered by internal combustion engines shall be equipped with a properly maintained muffler. Air powered equipment shall be fitted with pneumatic exhaust silencers. Equipment powered by an internal combustion shall not be operated within 150 feet of residential properties without portable noise barriers placed between the equipment and the noise sensitive sites.

1.02 PERMITS

- A. Contractor is responsible to complete and file all required Uniform Construction Code and Township demolition permit applications, if required. No demolition work shall commence without a permit being issued.

2.01 EXECUTION

- A. Inspection:

Verify that areas of demolition work are unoccupied.

2.02 PREPARATION

- A. Prior to commencement of demolition operations, arrange for, and verify shut off of utility services, including electric, gas, telephone, water, and sewer, if required.

2.03 DEMOLITION

- A. Demolition of structures shall be in accordance with the demolition procedures submitted to and accepted by the Engineer.

- B. Suitable barriers shall be erected and maintained around all operations as long as such operations constitute a hazard or dangerous condition. "Keep Out" signs shall be maintained in places and locations where the placing of protective devices are warranted.
- C. Only methods of demolition will be permitted which will ensure that all phases of demolition are confined within the limits of the demolition area and without hazard to adjacent areas or to the public.
- D. Adjacent areas shall be left in a safe condition, and shall not be defaced, marred, or jeopardized in any way and any damage done to them shall be repaired or restored to the satisfaction of the Engineer, without additional compensation.
- E. Any additional materials required for repairs shall be furnished without any additional cost to the Owner.
- F. All materials, including fixtures and equipment, as well as debris and rubbish, except personal property belonging to Owners shall be removed as it accumulates and not stored on the Project. Materials and debris shall not be placed or stored within the limits of any existing streets.

3.01 QUANTITY AND PAYMENT

All costs for clearing and restorations shall be included in the prices bid for the various scheduled items in the Bid Form and no separate payment will be made thereto.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Construction, Expansion and Control Joint Shop Drawings: Indicate locations of all joints in concrete slabs.
- E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- F. Welding Certificates: Copies of certificates for welding procedures and personnel.

- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Waterstops.
 - 5. Curing materials.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Vapor retarders.
 - 9. Joint-filler strips.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.
- C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. 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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- 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 (25 mm) to the plane of the exposed concrete surface.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Severe weathering region, but not less than 3S.
 - 2. Nominal Maximum Aggregate Size: 3/4 inch (19 mm).
- C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 WATERSTOPS

- A. Hydrophilic Waterstops: Butyl Polymer based sealant tape that is water-swellaable on contact with water and provides a waterproof sealant at concrete joints.
- B. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Ribbed with center bulb.
- C. Manufacturers: Subject to compliance with requirements, provide the following products or equal:
 - 1. Sika
 - 2. Greenstreak
 - 3. Progress Unlimited, Inc.
 - 4. Williams Products, Inc.

2.7 VAPOR RETARDERS

- A. Vapor Retarder: polyethylene sheet, not less than 6 mils (0.15 mm) thick.

2.8 FLOOR AND SLAB TREATMENTS

- A. Slip_Resistive Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- B. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
- C. Products: Subject to compliance with requirements, provide the following penetrating liquid floor treatment products or equal:
 - 1. Day-Chem Sure Hard; Dayton Superior Corporation
 - 2. Euco Diamond Hard; Euclid Chemical Co.
 - 3. Seal Hard; L&M Construction Chemicals, Inc.

2.9 CURING MATERIALS

- A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
 - a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).
 - b. Polyseal WB; ChemMasters.
 - c. UV Safe Seal; Lambert Corporation.
 - d. Lumiseal WB Plus; L&M Construction Chemicals, Inc.

2.10 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 - 2. Type I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 3. Type IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
 1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
 2. Maximum Slump: 4 inches (100 mm).
- D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
 1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
 2. Maximum Slump: 4 inches (100 mm).
- E. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- F. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5 percent +/- 1 percent, unless otherwise indicated.
- G. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- H. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing admixture, 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.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

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 concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. Do not use rust-stained steel form-facing material.
- E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- F. Chamfer exterior corners and edges of permanently exposed concrete.
- G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

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 bolts, accurately located, to elevations required.

3.3 REMOVING AND REUSING FORMS

- A. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. 28-day design compressive strength.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

3.6 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.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 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 Architect.
 - 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 from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Use a bonding agent or epoxy-bonding adhesive, as required, 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. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groove tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) 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.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 - 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 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. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Deposit concrete continuously or in 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 specified. Deposit concrete to avoid segregation.

- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) 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 mix 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.
 2. Maintain reinforcement in position on chairs during concrete placement.
 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, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
 - 1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
- C. 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 restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first trowel finish 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 to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
 - 2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and 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 Architect before application.

- G. Slip-Resistant Aggregate finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread 25 pounds per 100 square feet of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 - 2. After broadcasting and tamping, apply float finish.
 - 3. after curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete 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 of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTION 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 with recommendations in ACI 305R for hot-weather protection during curing.
- B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, as follows:
 - 1. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions. Penetrating liquid floor treatment shall be applied to all exposed interior concrete floor slabs.
 - 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 seven 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.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting portland cement to two and one-half parts fine aggregate passing of one part a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or

that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article. The scheduling and costs for all testing shall be the responsibility of the contractor.
- B. Testing Services: 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. (76 cu. m) or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, 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; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. 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 mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. 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.
- D. Strength of each concrete mix 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 (3.4 MPa).
- E. Test results shall be reported in writing to Architect, 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 mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- G. 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 Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 033000

SECTION 042200 - UNIT MASONRY ASSEMBLIES

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 unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Mortar and grout.
 - 4. Reinforcing steel.
 - 5. Masonry joint reinforcement.
 - 6. Ties and anchors.
 - 7. Embedded flashing.
 - 8. Miscellaneous masonry accessories.
 - 9. Masonry-cell insulation.
- B. Related Sections include the following:
 - 1. Division 7 Section "Water Repellents" for water repellents applied to unit masonry assemblies.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels for unit masonry, furnished under Division 5 Section "Metal Fabrications."
 - 2. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames"."

1.3 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

- C. Samples for Initial Selection: For the following:
1. Unit masonry Samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
 2. Colored mortar Samples showing the full range of colors available.
- D. Samples for Verification: For the following:
1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project.
 3. Weep holes/vents in color to match mortar color.
 4. Accessories embedded in the masonry.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Each type of masonry unit required.
 - a. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 3. Each material and grade indicated for reinforcing bars.
 4. Each type and size of joint reinforcement.
 5. Each type and size of anchor, tie, and metal accessory.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Sample Panels: Before installing unit masonry, build sample panels, using materials indicated for the completed Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build sample panels for each type of exposed unit masonry assembly in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.
1. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
 2. Clean exposed faces of panels with masonry cleaner indicated.

3. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels, unless such deviations are specifically approved by Architect in writing.
7. Demolish and remove sample panels when directed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
 - 1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners, unless indicated as bullnose.
- B. Concrete Masonry Units: ASTM C90 and as follows:
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa)
 - 2. Weight Classification: Normal weight.
 - 3. Provide Type I, moisture-controlled units.

4. Size (Width): Manufactured to the following dimensions as indicated on the plans:
 - a. 4 inches (102 mm) nominal; 3-5/8 inches (92 mm) actual.
 - b. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.
 - c. 12 inches (305 mm) nominal; 11-5/8 inches (295 mm) actual.
5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

C. Decorative Concrete Masonry Units: ASTM C90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight.
3. Provide Type I, moisture-controlled units.
4. Size: Manufactured to dimensions indicated for nondecorative units.
5. Finish: Exposed faces of the following general description matching color, pattern, and texture of Architect's samples.
 - a. Normal-weight aggregate, split-face finish.
6. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Block Plus W-10; Addiment Inc.
 - 2) Dry-Block; W. R. Grace & Co., Construction Products Division.
 - 3) Rheopel; Master Builders.

2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- B. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 1. White-Mortar Aggregates: Natural white sand or ground white stone.
 2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
- C. Aggregate for Grout: ASTM C 404.

- D. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
- E. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
- F. Water: Potable.
- G. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Colored Portland Cement-Lime Mix:
 - a. Eaglebond; Blue Circle Cement.
 - b. Color Mortar Blend; Glen-Gery Corporation.
 - c. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
 - d. Centurion Colorbond PL; Lafarge Corporation.
 - e. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
 - f. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).
 - 2. Cold-Weather Admixture:
 - a. Accelguard 80; Euclid Chemical Co.
 - b. Morseled; W. R. Grace & Co., Construction Products Division.
 - c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.
 - 3. Water-Repellent Admixture:
 - a. Mortar Tite; Addiment Inc.
 - b. Dry-Block Mortar Admixture; W. R. Grace & Co., Construction Products Division.
 - c. Rheopel; Master Builders.

2.3 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; **Grade 60**.

2.4 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A951 and as follows:
 - 1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
 - 2. Wire Size for Side Rods: W1.7 or 0.148 inch (3.8 mm).
 - 3. Wire Size for Cross Rods: W1.7 or 0.148 inch (3.8 mm).
 - 4. Provide in lengths of not less than **10 feet (3 m)**, with prefabricated corner and tee units where indicated.
- B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than **16 inches (407 mm)** o.c.

- C. For multiwythe masonry, provide types as follows:
1. Ladder type with perpendicular cross rods spaced not more than **16 inches (407 mm)** o.c. and 1 side rod for each face shell of hollow masonry units more than **4 inches (100 mm)** in width, plus 1 side rod for each wythe of masonry **4 inches (100 mm)** or less in width.
 2. Tab type with single pair of side rods spaced for embedment within each face shell of backup wythe and rectangular box-type cross ties spaced not more than **16 inches (407 mm)** o.c. Size ties to extend at least halfway through outer wythe but with at least **5/8-inch (16-mm)** cover on outside face.

2.5 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
- B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
- C. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
- D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.6 BENT WIRE TIES

- A. General: Rectangular units with closed ends and not less than **4 inches (100 mm)** wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than **2 inches (50 mm)** long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of **1-1/4 inches (32 mm)**.
- B. Wire: Fabricate from 3/16 inch (4.8 mm) diameter, hot-dip galvanized steel wire.

2.7 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section: Crimped **1/4-inch- (6.4-mm-)** diameter, hot-dip galvanized steel wire anchor section for welding to steel.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within **1 inch (25 mm)** of masonry face, made from 0.1875 inch (4.8 mm) diameter, hot-dip galvanized steel wire.

2.8 ADJUSTABLE MASONRY-VENEER ANCHORS

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
1. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
- B. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:
1. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches (70 mm) wide by 3 inches (75 mm) high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
 2. Anchor Section: Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.
 - a. Plate 1-1/4 inches (32 mm) wide by 6 inches (150 mm) long with strap 5/8 inch (16 mm) wide by 3-5/8 inches (92 mm) long; slot clearance formed between face of plate and back of strap shall not exceed diameter of wire tie by more than 1/32 inch (0.8 mm).
 3. Wire Tie Section: Triangular or Rectangular shaped wire tie sized to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.
 4. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0966 inch (2.5 mm), thick, steel sheet, galvanized after fabrication.
 5. Fabricate wire tie sections from 0.1875 inch (4.8 mm) diameter, hot-dip galvanized steel wire.
- C. Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 (4.8-mm) diameter by length required to penetrate steel stud flange by not less than 3 exposed threads, and with the following corrosion protective coating:
1. Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
- D. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Screw-Attached, Masonry-Veneer Anchors:
 - a. D/A 213; Dur-O-Wal, Inc.
 - b. D/A 210 with D/A 700-708; Dur-O-Wal, Inc.
 - c. 315-D with 316; Heckman Building Products, Inc.
 - d. Pos-I-Tie; Heckman Building Products, Inc.
 - e. DW-10; Hohmann & Barnard, Inc.
 - f. DW-10HS; Hohmann & Barnard, Inc.
 - g. DW-10-X; Hohmann & Barnard, Inc.
 - h. 1004, Type III; Masonry Reinforcing Corporation of America.
 - i. RJ-711; Masonry Reinforcing Corporation of America.

2. Organic-Polymer-Coated, Steel Drill Screws:

- a. Dril-Flex; Elco Industries, Inc.
- b. Traxx; ITW-Buildex.

2.9 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Steel bolts complying with **ASTM A 307, Grade A** (**ASTM F 568, Property Class 4.6**); with **ASTM A 563 (ASTM A 563M)** hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
 1. Headed bolts.
 2. Nonheaded bolts, bent in manner indicated.
- B. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 1. Type: Expansion anchors.
 2. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 3. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.10 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim" and below:
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, **3/8-inch (9-mm)** OD by **4 inches (100 mm)** long.

- E. Wicking Material: Cotton or polyester rope, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required to produce 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.
- F. Plastic Weep Hole/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, designed to fill head joint with outside face held back 1/8 inch (3 mm) from exterior face of masonry, in color selected from manufacturer's standard.
- G. Cavity Drainage Material: 3/4 inch (19 mm) thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.
- H. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142 inch (3.6 mm) steel wire, hot-dip galvanized after fabrication.
 - 1. Provide units with either two loops or four loops as needed for number of bars indicated.
- I. Available Products: Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Plastic Weep Hole/Vent:
 - a. Cell Vent; Dur-O-Wal, Inc.
 - 2. Cavity Drainage Material:
 - a. Mortar Break; Advanced Building Products, Inc.
 - b. CavClear Masonry Mat; CavClear.
 - c. Mortar Net; Mortar Net USA, Ltd.
 - d. Mortar Stop; Polytite Manufacturing Corp.
 - 3. Reinforcing Bar Positioners:
 - a. D/A 811; Dur-O-Wal, Inc.
 - b. No. 376 Rebar Positioner; Heckman Building Products, Inc.
 - c. #RB Rebar Positioner; Hohmann & Barnard, Inc.
 - d. O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.

2.12 MASONRY-CELL INSULATION

- A. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units. Provide cell insulation in units as located in the architectural plans or specifications.

2.13 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification.
 - 1. For masonry below grade, in contact with earth, and where indicated, use Type S.
 - 2. For reinforced masonry and where indicated, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/4 inch in 20 feet (6 mm in 6 m)**, nor **1/2 inch (12 mm)** maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, nor **1/2 inch (12 mm)** maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than **1/4 inch in 20 feet (6 mm in 6 m)**, nor **1/2 inch (12 mm)** maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**, with a maximum thickness limited to **1/2 inch (12 mm)**. Do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3 mm)**.
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**. Do not vary from adjacent bed-joint and head-joint thicknesses by more than **1/8 inch (3 mm)**.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
 - 1. One-half running bond with vertical joint in each course centered on units in courses above and below.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond. Clean exposed surfaces of set masonry and remove loose masonry units and mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout for full height of wall under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
- B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
 - 1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 BONDING OF MULTI-WYTHE MASONRY

- A. Use masonry joint reinforcement installed in horizontal mortar joints to bond wythes together.
- B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
 - 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
 - 1. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 CAVITIES

- A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.
 - 1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

3.8 MASONRY-CELL INSULATION

- A. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.9 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch (16 mm)** on exterior side of walls, **1/2 inch (13 mm)** elsewhere. Lap reinforcement a minimum of **6 inches (150 mm)**.
 - 1. Space reinforcement not more than **16 inches (406 mm)** o.c.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
1. Provide an open space not less than **1 inch (25 mm)** in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than **16 inches (610 mm)** o.c. vertically and **32 inches (915 mm)** o.c. horizontally.

3.11 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
1. Fasten each anchor section through sheathing to wall framing with two metal fasteners of type indicated.
 2. Embed tie sections in masonry joints. Provide not less than **2 inches (50 mm)** of air space between back of masonry veneer and face of sheathing.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than **16 inches (406 mm)** o.c. vertically and **32 inches (813 mm)** o.c. horizontally with not less than 1 anchor for each **3.5 sq. ft. (0.33 sq. m)** of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **36 inches (914 mm)**, around perimeter.

3.12 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry as follows unless otherwise indicated on drawings. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
1. Vertical control joints shall be spaced at maximum 20'-0" o.c. in any continuous run of wall.
- B. Form control joints in concrete masonry as follows:
1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

3.13 LINTELS

- A. Install steel lintels where indicated or as required to provide support above all openings as shown on the architectural, structural, mechanical, plumbing or electrical plans.
- B. Provide masonry lintels where shown and where openings of more than **12 inches (305 mm)** for brick-size units and **24 inches (610 mm)** for block-size units are shown without structural steel or other supporting lintels.
 - 1. Provide prefabricated or built-in-place masonry lintels if required in the architectural plans. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
- C. Provide minimum bearing of **8 inches (200 mm)** at each jamb, unless otherwise indicated.
- D. Fill cores in hollow concrete masonry units with grout for full height of wall under all lintels.

3.14 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
- C. Install flashing as follows:
 - 1. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least **8 inches (200 mm)**, and behind air-infiltration barrier or building paper.
 - 2. At lintels and shelf angles, extend flashing a minimum of **4 inches (100 mm)** into masonry at each end. At heads and sills, extend flashing **4 inches (100 mm)** at ends and turn flashing up not less than **2 inches (50 mm)** to form a pan.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
 - 1. Use round plastic tubing, wicking material or plastic weep hole/vents to form weep holes.
 - 2. Use wicking material to form weep holes above flashing in brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 - 3. Space weep holes formed from plastic tubing or wicking material **16 inches (400 mm)** o.c.
 - 4. Place cavity drainage material immediately above flashing in cavities.
- E. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.
- F. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.15 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.16 PARGING

- A. Parge predampened masonry walls, where indicated, with Type S or Type N mortar applied in 2 uniform coats to a total thickness of **3/4 inch (19 mm)**. Scarify first parge coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of **1/8 inch per foot (3 mm per 300 mm)**. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect the parging until cured.

3.17 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

3.18 MASONRY WASTE DISPOSAL

- A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

SECTION 050310 - METAL WALL AND ROOF PANELS

1.01 GENERAL

- A. The contractor shall furnish and install the metal wall, ceiling, and roof panels for the building complete as shown on the plans and specified herein.
- B. The metal panels for the building shall be as designed and manufactured by Fabral Metal Wall and Roof Systems, or equal.

1.02 SUBMITTALS

- A. Samples, shop drawings and manufacturer's product literature.
- B. Samples include all factory-made items.
- C. Color chart of manufacturer's standard finishes for roofing and siding panels.
- C. Shop drawings shall show thicknesses, sizes and construction of all materials. Show true profiles and all other pertinent information. Submit six (6) copies of all shop drawings.

1.03 DESIGN LOADS

All standard building components shall be sized to support the loads as noted on the drawings and meet the minimum required loads and load combinations as required by the local or state building codes.

1.04 PRIMARY FRAMING

- A. The metal stud frame shall be designed, fabricated and installed per Section 054000 of these Specifications.

1.06 BRACING

- A. All miscellaneous bracing required for complete installation of all wall, ceiling and roof panels shall be included in the design and installation of the complete building structure.

1.07 ROOF AND WALL PANELS

- A. Roof panels shall be Grandrib 3 PLUS, 29 gauge painted steel panels, by Fabral or equal.
- B. Walls panels shall be Grandrib 3 PLUS, 29 gauge painted steel wall panels, by Fabral or equal. Provide exterior wall panels and panels on the interior of the building as shown on the plans. Provide interior liner panels for the ceiling installation.
- C. Panel material as specified shall be 29 gauge steel.
- D. Panels shall have the high performance Enduracote paint system coating.

- E. Panel Length: All wall panels shall be continuous from sill to roof line and all roof panels shall be continuous from eave to ridge except where lengths become prohibitive for handling purposes. All end laps shall be at least 6" on roof and 4" on walls.
- F. Color of roof and wall panels shall be as selected by Owner from standard color samples.
- G. Provide clear side light panels at the top of wall as shown on the plans.

1.08 MISCELLANEOUS MATERIALS

- A. Structural Bolts: All bolts used in frame splices and in connections of secondary framing to primary framing shall be ASTM A307 or ATT M A325 as required by design.
- B. Fasteners: All roof and wall panels shall be attached to secondary framing members self-drilling screws as required to meet design loads. Fasteners shall be of weather resistant material and provide a weathertight seal.
- C. Closure Strips: The corrugations of the roof and wall panels shall be filled with solid or closed-cell, preformed rubber, neoprene or polyethylene closures along the eave, ridge and rake when required for weather tightness.
- D. Sealers: All panel end laps and side laps shall be sealed with a mastic sealer to provide weather tightness. The sealer shall have good adhesion to metal and be non-staining, non-corrosive, non-shrinking, non-toxic, non-oxidizing, non-volatile and meet the requirements of Federal Specification TT-C-1796A Type II, Class B.
- E. Caulk: All gutter and downspout joints, rake flashing laps, ridge flashing laps, doors, windows, and louvers shall be sealed with color matched caulk, which shall meet or exceed the requirements of Federal Specification TT-S-00230C, Type 2, Class A.

1.09 ACCESSORIES

- A. Eave Gutters & Downspouts: Gutters and Downspouts shall sized as shown on the plans, minimum 24 Gauge, and match the building construction as provided by the manufacturer. They shall be installed as shown on the plans.
- B. Provide ice and snow guards in accordance with manufactures design requirements.

1.10 ERECTION AND INSTALLATION

The erection of the metal wall, ceiling, and roof panels for the building and the installation of accessories shall be performed in accordance with manufacturer's erection drawings by a qualified erector using proper tools and equipment.

4.01 QUANTITY AND PAYMENT

All costs for furnishing and installing the work of this section shall be included in with the prices bid for the various related items of work as listed in the Proposal.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL

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 structural steel.
- B. This Section includes structural steel and architecturally exposed structural steel.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Shop Drawings detailing fabrication of structural steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
 - 1. Structural steel, including chemical and physical properties.
 - 2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - 3. Shop primers.
 - 4. Nonshrink grout.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 - 3. AISC's "Seismic Provisions for Structural Steel Buildings."
 - 4. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
 - 5. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."
 - 1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 SEQUENCING

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel Shapes, Plates, and Bars: As follows:
 - 1. Carbon Steel: ASTM A 992.
- B. Miscellaneous Steel Shapes, Bars, Plates & Angles ASTM A 36 (ASTM A 36M).
- C. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.
- D. Steel Pipe: ASTM A 53, Type E or S, Grade B.
 - 1. Weight Class: Standard.
 - 2. Finish: Galvanized.
- E. Anchor Rods, Bolts, Nuts, and Washers: As follows:
 - 1. Unheaded Rods: ASTM A 572, Grade 50 (ASTM A 572M, Grade 345).
 - 2. Headed Bolts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
 - 3. Washers: ASTM A 36 (ASTM A 36M).
- F. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.
- G. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

- A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
 - 1. Camber structural steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
 - 5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
 - 6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
 - 1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
 - 2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded.
- D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- E. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
 - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
 - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

- A. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
- B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

2.6 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 2. Surfaces to be field welded.
 3. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to applicable SSPC specifications as follows in accordance with paint manufacturers requirements:
 1. SSPC-SP 2 "Hand Tool Cleaning."
 2. SSPC-SP 3 "Power Tool Cleaning."
 3. SSPC-SP 6 "Commercial Blast Cleaning."
 4. SSPC-SP 7 "Brush-Off Blast Cleaning."
 5. SSPC-SP 11 "Power Tool Cleaning to Bare Metal."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in

intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B.
- C. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 - 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
- D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- E. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
- F. Splice members only where indicated.
- G. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- H. Finish sections thermally cut during erection equal to a sheared appearance.
- I. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.5 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

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. Exterior load-bearing wall framing.
 - 2. Interior non load-bearing wall framing.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.

1.3 DEFINITIONS

- A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.
- C. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and galvanized-coating thickness.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- E. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" or "Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members" and the following for calculating structural characteristics of cold-formed metal framing:
 - 1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied American Studco, Inc.
 - 2. California Metal Systems, Inc.
 - 3. Clark Steel Framing Industries.
 - 4. Consolidated Systems, Inc.
 - 5. Design Shapes in Steel.
 - 6. Knorr Steel Framing Systems.
 - 7. Steel Construction Systems.
 - 8. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 33 (230) for minimum uncoated steel thickness of 0.0428 inch (1.09 mm) and less; 40 (275) for minimum uncoated steel thickness of 0.0538 inch (1.37 mm) and greater.
 - 2. Coating: G60 (Z180).

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0677 inch.
 - 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0677 inch.
 - 2. Flange Width: 2 inches.
- C. Steel Headers: Provide steel headers to span all openings as indicated. Headers shall be designed to support all wall loadings.

2.4 NON-LOAD-BEARING CURTAIN-WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0677 inch.
 - 2. Flange Width: 2 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0677 inch.
 - 2. Flange Width: 1-1/4 inches (32 mm).
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0677 inch.
 - 2. Flange Width: A minimum of 2 inches (50 mm).

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi (230 MPa).
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. End clips.
 - 5. Foundation clips.
 - 6. Gusset plates.
 - 7. Stud kickers, knee braces, and girts.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

2.8 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.
- C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
- D. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: 24 inches (610 mm).

- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced 36 inches (910 mm) apart. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING CURTAIN-WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
- E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches (1370 mm) apart. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 055000 - MISCELLANEOUS METAL WORK

1.01 GENERAL

The Contractor shall furnish, erect, and set all miscellaneous steel, aluminum and iron work necessary for the completion of this contract as indicated on the drawings and as herein specified. All such work shall be fabricated as detailed or approved and installed complete with all necessary anchors, bolts and other accessories.

1.02 SUBMITTALS

- A. Samples, shop drawings and manufacturer's product literature.
- B. Samples include all factory made items.
- C. Shop drawings shall show gauges, thicknesses, sizes and construction of all members as well as the manner of assembling the various members that make up the different items. Show true profiles, connections and relationship to adjoining work, methods of anchoring, and all other pertinent information. Submit eight (8) copies of all shop drawings.

1.03 QUALITY ASSURANCE

- A. Welder Qualifications: Welds shall be made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, AWS D1.1 of the American Welding Society to perform the type of work required.
- B. Anchor and Fastener Design Requirements:
 - 1. Sizing: Provide anchors and fasteners for product installations of such diameters and lengths as recommended by the particular product manufacturer involved.
 - 2. Safety Factor: Determine the lengths of anchors and fasteners based on substrate materials at points of anchor installation and to provide a safety factor of four to one.
 - 3. Materials Compatibility: Where anchors and fasteners contact dissimilar metal products provide anchors and fasteners of compatible material so that neither will have a deteriorating action on the other.

1.04 WORKMANSHIP

- A. Steel shall be well formed to shape and size with sharp lines and angles. Shearing and punching shall leave clean, true lines and surfaces. Permanent connections shall be welded or riveted, unless bolting is indicated on the drawings or specified. The design details and workmanship shall conform to the current AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings insofar as applicable.
- B. Castings shall be sounded and free from warp and defects that impair their strength or appearance. Exposed surfaces shall be smooth and shall have sharp, well-defined lines and arises. Joints shall be milled to a close fit.
- C. Aluminum shall be of alloy and temper suitable for each specific use.

2.01 MATERIALS

- A. Steel plates and structural shapes shall conform to the ASTM Standard Specifications for Structural Steel, Designation A36-70a.
- B. Steel pipe shall conform to ASTM Standard Specifications for Seamless and Welded Steel Pipe, Designation A53-69a, Grade B.
- C. Cast steel shall be Grade N2 conforming to the ASTM Tentative Specifications for Mild-to Medium Strength Carbon-Steel Castings for General Application, Designation A27-46T.
- D. Iron castings shall be of good quality, strong, tough, even-grained iron, free from scale, lumps, blisters, sand holes and defects of every nature which would render them unfit for the service for which they are intended. Castings shall conform at least to the ASTM Standard Specifications for Gray Iron Castings, Designation A48-48 for Class 25 castings. All castings shall be thoroughly cleaned and subjected to a careful hammer inspection.
- E. Abrasive cast iron shall be "Feralun" made by the American Abrasive Metals Company, or approved equal.
- F. Stainless steel shall be Type 316, unless otherwise specified.
- G. Welding Electrodes: Table 4.1.1 of AWS D1.1 as required for applicable base metals and welding process.
- H. Round bars used in diagonal bracing shall conform to ASTM specification A-572 GR50, 60 or 65 with the respective minimum yield strength.

2.02 FABRICATION

- A. Form metals to shape and size, with sharp lines and angles, and with smooth surfaces and faces. Shearing and punching shall leave clean true lines and surfaces, free from distortion. Weld or rivet permanent connections with all rivets in finished work countersunk. Do not use screws unless specifically shown and if used shall be countersunk stainless steel or metal compatible with the members being joined. Mill fastenings to a close fit. Provide necessary rabbets, lugs and brackets, etc., so that work can be assembled neatly. Thickness of metals and details of assembly and supports shall provide ample strength and stiffness. Form joints exposed to the weather to exclude water. Countersink and recess to receive hardware. Provide with proper bevels and clearances.
- B. Provide all anchors, sleeves, screws, bolts and connecting members necessary for securing metal work to other adjacent or adjoining work. Provide and install angles and other reinforcement. Do all cutting, drilling or modifying of adjacent or adjoining work where necessary for proper installation. Set all hardware that is shop installed. Do all fittings true to line. Bend or form all tubing, pipe and other members to continuous and true curves, with all joints flush, hairline, neatly fastened together and assembled to other materials. Furnish all necessary patterns and templates and check all measurements with the work at the site. Furnish all sockets, anchors and other portions of this work that are to be built into the structure and supervise and be responsible for their accurate spacing and setting.

- C. Furnish in ample time all anchors, bolts, inserts, clips and other items furnished under this section, but built in with the work of other trades.
- D. Use plug welds wherever practicable in work exposed to view. Use fillet welds only where plug welding is impractical. Where welds are exposed to view, bevel members prior to welding and weld full. Grind welds flush and smooth, level with the adjacent surfaces so that the resultant weld provides the appearance and strength of a continuous member of uniform thickness.

Grind welds at intersecting member of uniform thickness. Grind welds at intersecting members to sharp lines.

2.03 PRIME COAT

- A. Sandblast interior steel to remove all dust and dirt. Shop prime all ferrous metal.
- B. Use shop and field primer and touch-up that will be compatible with the finish paint coating. Where two coats of primer are required, tint the second coat a recognizably different shade. Clean and touch-up with a zinc rich paint all welds and abrasions on galvanized items before shipment.

PART 3 - EXECUTION

3.01 ERECTION

- A. Erect all metal items in proper position, securely fastened, plumb, in line, and level. The completed installation shall be free of sharp edges and rough spots. Touch up all abrasions and metal cuts, bolts and nut with the material used for shop priming so that the entire assembly, as erected, presents a complete smooth prime coat of paint.
- B. Provide and set structural shapes such as angles, channels, plates, etc., shown to be built-in or anchored into concrete for attachment of other work. Anchors, unless otherwise shown, shall be 1/4" x 1-1/4" x required lengths for secure anchorage, spaced approximately 24" o.c. Coordinate with the trades furnishing items that will attach to these built-in members for proper positioning.

3.02 SCHEDULE

- A. Loose lintels: Of sizes shown or required, minimum 6" bearing on each side of masonry opening. Lintels are furnished under this section but erected under Division 4, Masonry.
- B. Angle guards: Structural steel angles of sizes indicated. Weld a minimum of 3 strap anchors spaced to suit coursing approximately 24" o.c.
- C. Channel door guards: Structural steel channels of sizes indicated. Weld a minimum of three anchors at least 8-1/2" long after bending to each jamb, spaced to suit coursing and approximately 24" o.c.
- D. Pipe railing: 1-1/4" IPS, all welded construction and flush fittings. Where pipe rails are detailed, construct as shown. Where pipe rails are shown only in plan, construct with a top and intermediate rail with standard spaced not more than 6'-0" o.c. Mount wall rails with plain design brackets spaced not over 6'-0" o.c. with a minimum of 1 intermediate bracket per run. Return ends to wall.

Where railings are mounted in concrete, grout into galvanized steel sleeves. Where railings are mounted on steel, weld and grind smooth. Galvanize all exterior pipe railings.

4.01 QUANTITY AND PAYMENT

All costs for furnishing and installing the work of this section shall be included in with the prices bid for the various related items of work as listed in the Proposal.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

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. Framing with dimension lumber.
 - 2. Framing with timbers.
 - 3. Framing with engineered wood products.
 - 4. Wood furring, grounds, nailers, and blocking.
 - 5. Sheathing.
 - 6. Subflooring.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.
- B. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for the following products:
 - 1. Engineered wood products.
 - 2. Underlayment.
 - 3. Insulating sheathing.
 - 4. Air-infiltration barriers.
- C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.
- D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- B. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood product from one source and by a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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:
 1. Wood-Preservative-Treated Materials:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Osmose Wood Preserving, Inc.
 2. Laminated-Veneer Lumber:
 - a. Alpine Structures.
 - b. Georgia-Pacific Corp.
 - c. Trus Joist MacMillan.
 3. Prefabricated Wood I-Joists:
 - a. Trus Joist MacMillan.
 - b. Alpine Structures.
 - c. Georgia-Pacific Corp.
 4. Gypsum Sheathing Board:
 - a. Georgia-Pacific Corp.

- b. National Gypsum Co.; Gold Bond Building Products Division.
 - c. United States Gypsum Co.
5. Air-Infiltration Barriers:
- a. Celotex Corporation (The); Building Products Division.
 - b. DuPont Company; Fibers Department.

2.2 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
- 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. NLGA - National Lumber Grades Authority (Canadian).
 - 3. RIS - Redwood Inspection Service.
 - 4. SPIB - Southern Pine Inspection Bureau.
 - 5. WCLIB - West Coast Lumber Inspection Bureau.
 - 6. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
- 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
- B. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m).

2.4 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.

B. Non-Load-Bearing Interior Partitions: Provide framing of the following grade and species:

1. Grade: No. 2.
2. Species: Eastern softwoods; NELMA.
3. Species: Northern species; NLGA.
4. Species: Mixed southern pine; SPIB.
5. Species: Western woods; WCLIB or WWPA.
6. Species: Any species above.

C. Exterior and Load-Bearing Walls: Provide framing of the following grade and species:

1. Grade: No. 2.
2. Species: Hem-fir (north); NLGA..
3. Species: Southern pine; SPIB.
4. Species: Douglas fir-larch; WCLIB or WWPA.
5. Species: Mixed southern pine; SPIB.
6. Species: Spruce-pine-fir; NLGA.
7. Species: Douglas fir-south; WWPA.
8. Species: Hem-fir; WCLIB or WWPA.
9. Species: Douglas fir-larch (north); NLGA.
10. Species: Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
11. Species: Any species above.

D. Framing Other than Non-Load-Bearing Partitions: Provide framing of the following grade and species:

1. Grade: No. 2.
2. Species: Spruce-pine-fir south; NELMA.
3. Species: Hem-fir north; NLGA.
4. Species: Spruce-pine-fir north; NLGA.
5. Species: Mixed southern pine; SPIB.
6. Species: Hem-fir; WCLIB or WWPA.
7. Species: Any species above.

2.5 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:

1. Moisture Content: 19 percent maximum.
2. Species and Grade: Spruce-pine-fir, C & Btr per WCLIB rules or C Select per NLGA or WWPA rules.
3. As noted on plans by Architect.

B. Concealed Boards: Where boards will be concealed by other work, provide lumber with 19 percent maximum moisture content and of following species and grade:

1. Species and Grade: Eastern softwoods, No. 3 Common per NELMA rules.
2. Species and Grade: Mixed southern pine, No. 2 per SPIB rules.
3. Species and Grade: Spruce-pine-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules.

4. Species and Grade: Western woods, Standard per WCLIB rules or No. 3 Common per WWPA rules.
5. Species and Grade: Any species above.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.7 ENGINEERED WOOD PRODUCTS

- A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.
 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Laminated-Veneer Lumber: Lumber manufactured by laminating wood veneers in a continuous press using an exterior-type adhesive complying with ASTM D 2559 to produce members with grain of veneers parallel to their lengths and complying with the following requirements:
 1. Extreme Fiber Stress in Bending: 2500 psi (17 MPa) for 12-inch nominal- (286-mm actual-) depth members.
 2. Modulus of Elasticity: 2,000,000 psi (13 800 MPa).
 3. Tension Parallel to Grain: 1850 psi (13 MPa).
 4. Compression Parallel to Grain: 2800 psi (19 MPa).
 5. Compression Perpendicular to Grain: 400 psi (3 MPa) perpendicular to and 500 psi (3.5 MPa) and parallel to glue line.
 6. Horizontal Shear: 285 psi (2 MPa) perpendicular to and 190 psi (1.3 MPa) parallel to glue line.

- C. Prefabricated Wood I-Joists: Units manufactured by bonding stress-graded lumber flanges to wood-based structural-use panel webs with exterior-type adhesives complying with ASTM D 2559, to produce I-shaped joists complying with the following requirements:
1. Flange Material: Laminated-veneer lumber.
 2. Web Material: Oriented-strand board (OSB) complying with DOC PS 2.
 3. Web Material: Plywood complying with DOC PS 2.
 4. Web Material: Either material indicated above, as standard with joist manufacturer.
 5. Structural Capacities: Establish and monitor structural capacities according to ASTM D 5055.
 6. Sizes: Depths and widths as indicated, with flanges not less than 1-1/2 inches (38 mm) in actual width.
 7. I-Joists shall be installed with all required anchors, stiffeners and bracing in accordance with manufacturer requirements.
- D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
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. Louisiana-Pacific Corporation.
 - b. Weyerhaeuser Company.
 - c. Or equal.
 2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi (20 MPa) for 12-inch nominal- (286-mm actual-) depth members.
 3. Modulus of Elasticity, Edgewise: 2,200,000 psi (15 100 MPa).

2.8 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

- A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).
1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
 2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
- B. Subflooring: APA-rated sheathing.
1. Exposure Durability Classification: Exposure 1.
 2. Span Rating: 48/24.
 3. Minimum thickness: $\frac{3}{4}$ inch.
 4. Floor sheathing shall be tongue and groove and installed with both construction adhesive and required nailing.
- C. Wall Sheathing: APA-rated sheathing.
1. Exposure Durability Classification: Exposure 1.

2. Span Rating: As required to suit stud spacing indicated.
3. Minimum thickness indicated on plan.

D. Roof Sheathing: APA-rated sheathing.

1. Exposure Durability Classification: Exposure 1.
2. Minimum Span Rating: 32/16.
3. Minimum thickness: 5/8 inch.
4. Roof sheathing shall be installed with panel clips.

2.9 STRUCTURAL-USE PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch (11.9 mm) thick.

2.10 AIR-INFILTRATION BARRIER

- A. Air retarder complying with ASTM E 1677; made from polyolefins; either cross-laminated films, woven strands, or spunbonded fibers; coated or uncoated; with or without perforations to transmit water vapor but not liquid water; and as follows:

1. Minimum Thickness: 3 mils (0.08 mm).
2. Minimum Water-Vapor Transmission: 10 perms (575 ng/Pa x s x sq. m) when tested according to ASTM E 96, Procedure A.
3. Maximum Flame Spread: 25 per ASTM E 84.
4. Minimum Allowable Exposure Time: 3 months.

2.11 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

- B. Nails, Wire, Brads, and Staples: FS FF-N-105.

- C. Power-Driven Fasteners: CABO NER-272.

- D. Wood Screws: ASME B18.6.1.

- E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)

- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.12 METAL FRAMING ANCHORS

- A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:
 - 1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
 - 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.
- C. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.064 inch (1.6 mm).
- D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 - 1. Strap Width: 2 inches (50 mm).
 - 2. Thickness: 0.064 inch (1.6 mm).
- E. Bridging: Rigid, V-section, nail less type, 0.064 inch (1.6 mm) thick, length to suit joist size and spacing.
- F. Rafter Tie-Downs (Hurricane Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-5/8 inches (41 mm) wide by 0.052 inch (1.3 mm) thick minimum. Tie-Downs must be selected to meet uplift forces as calculated in the wood truss design.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWP A M4 to cut surfaces of preservative-treated lumber and plywood.

- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
 - 2. Published requirements of metal framing anchor manufacturer.
 - 3. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction."
 - 4. "Table 2305.2--Fastening Schedule" of the BOCA National Building Code.
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
- H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD FRAMING, GENERAL

- A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Install framing members of size and at spacing indicated.
- D. Do not splice structural members between supports.
- E. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal- (38-mm actual-) thickness lumber of same width as framing members.

3.3 AIR-INFILTRATION BARRIER

- A. Cover sheathing with air-infiltration barrier as follows:
 - 1. Apply air retarder to comply with manufacturer's written instructions.
 - 2. Apply air-infiltration barrier to cover upstanding flashing with 4-inch (100-mm) overlap.

END OF SECTION

SECTION 075000 - EPDM MEMBRANE ROOFING

PART 1 – GENERAL

1.01 DESCRIPTION

Work in this section includes but is not limited to removing the existing roofing to the existing decking preparation of substrate and installation of roofing insulation, installation of a fully adhered EPDM membrane roofing system, including flashing as required to provide a complete watertight roof. All work is to be completed in strict accordance with the drawings, specification and manufacturer requirements.

1.02 RELATED WORK

Section 07600 – Sheet Metal Flashing and Trim

1.03 REFERENCES

A. American Society for Testing and Materials:

1. ASTM D 297; Rubber Products - Chemical Analysis, Methods for.
2. ASTM D 412; Rubber Properties in Tension, Test Methods for.
3. ASTM D 573; Rubber-Deterioration in an Air Oven, Test Methods for.
4. ASTM D 624; Rubber Property - Tear Resistance, Test Methods for.
5. ASTM D 746; Brittleness Temperature of Plastics and Elastomers by Impact, Test Methods for.
6. ASTM D 1149; Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimens), Test Methods for.
7. ASTM D 2240; Rubber Property - Durometer Hardness, Test Methods for.
8. ASTM E 96; Water Vapor Transmission of Materials, Tests Methods for.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualification: Provide documentation from the manufacturer that their roofing products have been in service for a minimum period of five years.
- B. Applicator Qualification: All roofing systems must be installed by a manufacturer authorized roofing applicator.
- C. Inspection: Upon completion of the installation a technical representative of the Elastic Sheet Roofing manufacturer shall make an inspection to ascertain that the roofing system has been installed according to the manufacturer's published specifications, details, and warranty requirements. No deviation from the preceding requirements without prior written approval of the manufacturer.

- D. Design Criteria: It is a requirement of this Specification Section that a UL Class A rated roofing system be provided for each roof in the project.
1. The roofing system as designed includes the Carlisle products specified herein. If manufacturers' roofing systems other than the system as designed are accepted, provide at no increase in Contract Price such additional products and differing methods of execution (if any) required by such manufacturer.
 2. The roofing system as designed includes both roof membrane and roof insulation being supplied by the same manufacturer in order to provide a total system warranty as specified hereinafter, and in order to provide single source responsibility for a complete, functional roof from the deck on up.
 3. Roofing system insulation as specified in Section 07200 – Roof Insulation.

1.05 SUBMITTALS

A. Approved Applicators Shop Drawings:

1. Prepare the following drawings for Engineer's approval prior to delivery of materials and start of installation:
 - a. Outline of roof area including dimensions.
 - b. Location and type of roof penetrations.
 - c. Perimeter and penetration flashing details for membrane flashing.
2. Prepare such additional shop drawings including as build shop drawings required by roofing material manufacturer for warranty final inspection, and such drawings of unusual roofing and flashing conditions not entirely consistent with manufacturer's usual practice. Such shop drawings must be approved by both roofing material manufacturer and the Engineer.

B. Product Data:

1. Submit roofing material manufacturer's published product descriptive data and materials/installation data as evidence of compliance with this Specification.
2. Product data must include minimum physical properties data and descriptive test data for each product used in the project.

C. Certificates:

1. Submit certificate by roofing materials manufacturer attesting to product compliance with physical properties of this Specification.
2. Submit certificates of acceptance by roofing materials manufacturer attesting to product installation being in compliance with manufacturer's installation instructions, approved details, and shop drawings as prepared for this project.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original, unopened containers.
- B. Containers are to be labels with the manufacturer's name, brand name and installation instructions.
- C. All materials, except membrane, must be stored between 60° F and 80° F. If exposed to lower temperatures, restore materials to 60° F minimum temperature before using.
- D. All materials, except membrane, must be stored in a dry area and protected from water and direct sunlight. Damaged materials shall be replaced at the Roofing Contractor's expense.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Do not perform roof work when precipitation of any kind is occurring.
 - 2. Observe roof materials manufacturer's recommendations concerning substrate conditioning with respect to water or moisture presence.
 - 3. Observe roof materials manufacturer's temporary sealing requirements of new roof material edge sealing for weather and moisture protection and sealing of unfinished work when stopping for the day.
- B. Protection:
 - 1. Do not use oil base or plastic roof cement.
 - 2. Do not adhere EPDM membrane to low melting point asphalt.
 - 3. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with EPDM Roofing System.
 - 4. Do not expose membrane and accessories to a constant temperature in excess of 180° F.

1.08 WARRANTY

- A. Provide the Owner a manufacturer's 20 year total roofing system (roof membrane and insulation) warranty commencing with date of final inspection and certificate of acceptance of roofing system installation by roofing materials manufacturer.
 - 1. Roofing system warranty shall include roofing membrane manufacturer's Insulation System (or other roofing membrane manufacturer's acceptable insulation product) as part of a total system warranty.
 - 2. Insulation systems same as EPDM membrane roofing.
- B. Roofing materials manufacturer shall warrant to the Owner that during the 20 year warranty period, leaks in the roofing system caused by defective roofing system materials, or defective workmanship by manufacturer's authorized roofing applicator, will be repaired by the manufacturer, but not to exceed original cost of the installed roofing system.

- C. Provide as part of the roofing materials manufacturer's warranty, an additional condition that the roof insulation be included in a total system warranty.
- D. Limitations, terms and conditions of warranty as follows:
 - 1. Owner shall notify manufacturer within thirty (30) days of date any roof leak occurs.
 - 2. Manufacturer shall have free access to roof during Owner's regular business hours.
 - 3. Manufacturer shall have no warranty obligation until materials and installation have been paid in full.
 - 4. Warranty not applicable for damage by accidents, acts of negligence, vandalism, civil disobedience, natural disasters or acts of God.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Acceptable Manufacturers:

Carlisle, Firestone Building Products, Johns Manville Corporation or approved equal.

2.02 ROOFING SYSTEM SHEET PHYSICAL PROPERTIES

- A. Before submission for consideration, additional manufacturer's products must meet or exceed the minimum physical properties requirements specified herein.
- B. Minimum physical properties for EPDM (Ethylene Propylene Diene Monomer) compounded elastomer roofing system sheet as follows:

PROPERTY	SPECIFICATIONS
Sheet Thickness	0.060 inch reinforced
Flashing Membrane Thickness	0.060 inch reinforced
Color	Black
Tearing Strength, Min., lbf	10
Breaking Strength, Min., lbf	90
Elongation, Ultimate, Min, %	300
Factory Seam Strength, Min.	Membrane Rupture

Resistance to Heat Aging

Properties after 4 weeks @ 240° F

Breaking Strength, Min., lbf	80
Elongation, Ultimate, Min.,%	200
Linear Dimensional Change, Max., %	+/- 1.0

Ozone Resistance No cracks

Brittleness Temperature Max., degrees F -49.0°

Resistance to Water Absorption

7d imm. @ 158° F, Change in mass max., % 4.0

Resistance to Outdoor (Ultraviolet) Weathering No cracks

2.03 ROOFING SYSTEM ACCESSORIES

- A. Molding Flashing: Use factory fabricated tapered pipe flashing manufactured from EPDM having physical properties compatible with roofing system sheet material.
- B. Rubber Nailing Strip: Specially designed strips for roof perimeter EPDM sheet fastening using sheet manufacturer's coated screws.
- C. Warranty shall include all accessories required in the roofing system installation and shall be consistent with the roofing system manufacturer's warranty.

2.04 BONDING, SPLICING AND SEALING MATERIALS

- A. General: Bonding adhesives, splicing cement and sealing materials must be products manufactured or formulated specifically for use with the EPDM roofing system sheets and membrane flashing.
- B. Bonding Adhesive: Use materials by membrane manufacturer as designed for compatibility and bonding with substrate.
- C. Splicing Cement: Use materials by membrane manufacturer as designed for sheet to sheet splicing only.
- D. Lap Edge Sealant: Use materials by membrane manufacturer as designed for lap or splice edge sealing and sheet to flashing edge sealing.
- E. Water Cut-Off Mastic and Temporary Work Stop Sealants: Use materials by membrane manufacturer as designed for new work continuance and such other temporary work conditions encountered.
- F. Pourable Sealer: Use pourable consistency materials by membrane manufacturer as designed for applications such as pitch pocket filling and transition sealing.

2.05 INSULATION

- A. Rigid polyisocyanurate board, with a strong white or black fibrous glass facer conforming to or exceeding the requirements of ASTM C 1289 / FS HH-I-1972, EnergyGuard Polyiso, with the following characteristics:
 - 1. Board Thickness: 2" (Min.)
 - 2. Thermal Resistance (LTTR value): R-8
- B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
- C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.06 INSULATION ACCESSORIES

- A. Cant Strip: Factory fabricated rigid perlite strip cut at angles to provide a true 45 degree angle between horizontal and vertical surfaces, EnergyGuard Perlite Cant Strip, by BMCA.
- B. Tapered Edge Strip: Factory fabricated rigid perlite strip cut at angles to provide a smooth transition between differences in elevation. EnergyGuard Tapered Edge Strip, by BMCA.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify that work of other trades, which penetrates roof deck or requires men and equipment to traverse roof deck, has been completed.
- B. Examine surfaces for inadequate anchorage, foreign material, moisture and unevenness which would affect the execution and quality of elastic sheet roofing system and membrane flashing work.

3.02 PREPARATION

- A. Clear insulated roof surface of accumulated foreign materials and debris.
- B. Perform surface deficiency corrective work in accordance with roofing system manufacturer's recommended practice consistent with warranty requirements.

3.03 APPLICATION

- A. Perform roofing system installation in accordance with the elastic sheet roofing system manufacturer's requirements for a fully adhered system, which conforms to the previously referenced warranty period.

1. Installation requirements for the referenced warranty period includes installation of roofing system accessories, bonding, splicing and sealing operations.
2. Observe materials manufacturer's cold temperature installation instructions regarding material installation and substrate preparation.
3. Install mechanical fasteners and adhesives in accordance with manufacturer's requirements.
4. Observe materials manufacturer's installation instructions regarding material installation with respect to sheet metal flashings.

END OF SECTION

SECTION 076000 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufactured reglets and counterflashing.
 - 2. Formed roof drainage sheet metal fabrications.
 - 3. Formed low-slope roof sheet metal fabrications.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
- C. Samples: For each exposed product and for each finish specified.
- D. Maintenance data.
- E. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.4 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

- B. Aluminum Sheet: ASTM B 209 alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
1. As-Milled Finish: One-side bright mill finish.
 2. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.
 3. Factory Prime Coating: Where painting after installation is indicated, pretreat with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.
 4. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 5. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 6. Exposed Coil-Coated Finishes:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - b. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat.
 7. Color: Match Existing
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; finish.

2.2 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
- B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
- D. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 REGLETS

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated [with factory-mitered and -welded corners and junctions.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
 2. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- C. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- F. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim and built-in overflows. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.
 2. Stainless Steel: 0.016 inch thick.
 3. Galvanized Steel: 0.028 inch > thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide, joint cover plates. Fabricate from the following materials:
1. Aluminum: 0.050 inch thick.
 2. Stainless Steel: 0.019 inch thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight. Fabricate from the following materials:
1. Aluminum: 0.050 inch thick.
 2. Stainless Steel: 0.025 inch thick.
- C. Base Flashing: Fabricate from the following materials:
1. Aluminum: 0.040 inch thick.

2. Stainless Steel: 0.019 inch thick.
- D. Counterflashing and Flashing Receivers: Fabricate from the following materials:
 1. Aluminum: [0.032 inch thick.
 2. Stainless Steel: 0.019 inch > thick.
- E. Roof-Penetration Flashing: Fabricate from the following materials:
 1. Stainless Steel: 0.019 inch thick.
- F. Roof-Drain Flashing: Fabricate from the following materials:
 1. Stainless Steel: 0.016 thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.
- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches). Roll laps with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.

- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as shown and as required for watertight construction.
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder aluminum sheet.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below discharge.
- C. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
 - 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.

- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

SECTION 077100 - GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gutters and Downspouts.
- B. Related Accessories.

1.2 REFERENCES

- A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. SMACNA - Architectural Sheet Metal Manual.

1.3 DESIGN / PERFORMANCE REQUIREMENTS

- A. Conform to applicable code for size and method of rain water discharge.
- B. American Architectural Manufacturers Association (AAMA) Specification 1405.1 "Specification for Aluminum Raincarrying Systems".

1.4 SUBMITTALS

- A. Product Data: Manufacturer's catalog data, detail sheets, and specifications.
- B. Shop Drawings: Prepared specifically for this project; showing dimensions of metal gutters and accessories, fastening details and connections and interface with other products.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- F. Manufacturers warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
- B. Installer Qualifications: Certified and approved installer of the sheet metal roofing manufacturer.
- C. Perform Work in accordance with SMACNA Manual

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products to prevent twisting, bending, and abrasion, and to provide ventilation. Slope stored materials to drain.

- C. During storage prevent contact with materials capable of causing discoloration, staining, or other damage.

1.7 PROJECT CONDITIONS

- A. Coordinate installation with installation of adjacent roofing, siding and related materials.

1.8 WARRANTY

- A. Provide the Manufacturer's Limited 20-Year, pro-rated and non-transferable Warranty covering labor materials.

1.9 COORDINATION

- A. Coordinate Work with other operations and installation of floor finish materials to avoid damage to installed underlayment and membrane materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Mazmet Metal Products, which is located at: 1050 Bristol Road; Mountainside, NJ 07092; Phone: 908.654.7686; Fax: Fax: 908.654.7898;
- B. Substitutions: Approved equal.

2.2 COMPONENTS

- A. Gutters: Aluminum sheet, ASTM B 209, Alloy 3105-H24. Minimum tensile strength 26,000 psi, minimum yield strength 25,000 psi or equivalent. Continuous and seamless sheet aluminum, roll formed.
 - 1. Thickness:
 - a. 0.063 inch
- B. Downspouts: Aluminum sheet, ASTM B 209, Alloy 3105-H24. Minimum tensile strength 26,000 psi, minimum yield strength 25,000 psi or equivalent.
 - 1. Thickness:
 - a. 0.063 inch
 - 2. Size:
 - a. Match Existing : 4 inches by 4 inches (min.).
- C. Endcaps: Aluminum sheet, ASTM B 209, Alloy 3105-H24, thickness 0.063 inch
- D. Inside and Outside Mitres: Aluminum sheet, ASTM B 209, Alloy 3105-H24, thickness 0.063inch
- E. Gutter Hangers and Anchors: Aluminum sheet, ASTM B 209, Alloy 3105-H24, thickness 0.063 inch. Provide types required to suit project requirements.
- F. Downspout Anchors: Aluminum. Provide types required to suit project requirements.
- G. Elbows: Aluminum sheet, ASTM B 209, Alloy 3105-H24. Minimum tensile strength 26,000 psi, minimum yield strength 25,000 psi or equivalent.
 - 1. Thickness:

- a. 0.063 inch
- 2. Size: To match downspouts.
- H. Aluminum Finish: Kynar 500 system factory applied in a continuous process in a single operation.
 - 1. Color:
 - a. Approved by Owner from Manufacturer's Standard Colors.
- I. Sealant: As recommended by manufacturer.
- J. Fasteners: Same material and finish as gutters and downspouts.

2.3 FABRICATION

- A. Continuously form seamless gutters to the profiles and sizes specified.
- B. Form downspouts of profiles and sizes specified.
- C. Hem exposed edges of metal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify governing dimensions at building.
- C. Verify surfaces are ready to receive gutters and downspouts.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Clean and repair if necessary any adjoining work on which this work is in any way dependent for its proper installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install gutters using appropriate hangers to allow normal expansion and contraction.
- C. Install gutter hangers using two 1-1/4 inch (32 mm) screw shank nails and fastened into solid lumber.
- D. All gutters shall be in continuous length for each elevation (run). No end laps are allowed.
- E. Exercise care in placing aluminum in contact with other dissimilar metals or materials that are not compatible with aluminum.
- F. Providing adequate insulation/separation where ever necessary, such as by painting or otherwise protecting when they are in contact with aluminum or when drainage from them

passes over aluminum surfaces.

- G. Install sealants where indicated to clean dry surfaces only without skips or voids.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 081000 - METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

The Contractor shall provide hollow metal flush doors and frames, complete in place as required for a complete and operable facility. The hollow metal door shall be 90 minute fire-rated, including self-closing and positive latching.

1.02 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Engineer.
- B. Basis of Acceptance: The manufacturer's recommended installation procedures, when approved by the Engineer, will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's descriptive literature and installation instructions.
- B. Shop Drawings: Illustrations and schedule of door and frame sizes, types, materials, construction, finishing, anchoring, accessories, and preparation for installing hardware (six copies required).
- C. Certificates: Manufacturer's certification that materials meet specification requirements.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Shipment: For welded type frames, provide temporary steel spreaders fastened across bottom of frames; where construction will permit concealment, leave spreaders in place after installation, otherwise remove spreaders after frames are set and anchored. Before shipping, label each frame with metal or plastic tags to show their location, size, door swing and other pertinent information.
- B. Deliver material in manufacturer's original packaging with all tags and labels intact and legible.
- C. Store and handle material in such manner as to avoid damage; store at site under cover on wood blocking or on suitable floors.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Hollow metal flush doors and frames shall be products of the following manufacturers or equivalent, subject to compliance with specification requirements:
 - 1. Thermatru Door

2. Overly Manufacturing Co.
3. Pioneer Fireproof Door Corp.

B. All work of this section shall be the products of a single manufacturer.

2.02 FABRICATION

Surfaces shall be smooth and free from warp or buckles. Arrises shall be straight, sharp and out of wind. Assemble joints so that the intersection will be imperceptible when finished.

2.03 HOLLOW METAL DOORS

- A. Hollow metal doors shall be full flush, 1-3/4" thick, constructed of two (2) sheets of finest grade, cold rolled stretched leveled steel with not less than 18 ga. channel or "HI-HAT" stiffers placed vertically 6" o.c. Steel sheets for exterior doors shall be 16 ga. and for interior doors 18 ga. Top and bottom of door shall be reinforced horizontally with channels, full width. Both edges of door to be reinforced with channel to run full height of door. Edge joints shall be welded, ground smooth and filled with metallic filler. Welding at edges of door shall be continuous, or 1/2" long welds no more than 1-1/2" o.c. and filled. No mechanical seams such as "lock joint type" will be accepted even if spot welded and filled. Doors shall be completely sound and fire insulated with an approved filler such as fiberglass or mineral wool, completely filling all voids inside door. There shall be 1/8" in 2" bevel at lock edge of door.
- B. Tops of all hollow metal doors shall have flush surfaces. In reinforcing channels of top rails are installed with legs pointed upwards, a closure channel shall be installed in an inverted position to close top. Top of door shall be watertight.
- C. All doors shall be accurately mortised and reinforced for all hardware including surface mounted hardware. Reinforcement for mortise hardware shall be in accordance with the hereinafter listed "Table of Hardware Reinforced Gauges" (Section 2.04 H of this specification). Doors must be reinforced for hardware specified to be through bolted to eliminate any possibility of door compressing on tightening of through bolts. Where the door is extremely heavy, use one continuous structural channel inside hollow metal frame for hinge reinforcing. This is to be in addition to the reinforcing called for in the Table of Hardware Reinforcing Gauges.
- D. Mortise hardware reinforcing shall be drilled and tapped at the shop from the hardware manufacturer's templates and surface applied hardware shall be drilled and tapped in the field. Clearance at head and jamb should be no more than 3/16". Clearance at bottom should be coordinated with threshold condition (where thresholds are required) so that stop strips are effective and that clearance above a threshold is no more than 3/16" or 3/8" above finish floor when no threshold is used.
- E. After assembly, exposed surfaces of doors shall be thoroughly cleaned, all rough spots smoothed and given two (2) coats of a zinc chromate rust inhibitive primer, baked on.
- F. Glazing stops on exterior doors are to be integral with the door. Removable channels for glazing shall be on the interior only and shall be fastened with stainless steel Phillips head sheet metal or machine screws. Glass and glazing furnished under that Section.

2.04 HOLLOW METAL FRAMES

- A. All hollow metal door frames shall be combination buck, frame and integral trim type, formed of steel and constructed as full welded units. Frame profile jamb depth, trim and design shall be detailed job conditions as shown on the drawings. Frame, trim corners and door stops shall be mitered and continuously welded. Corner joints shall be well formed and in true alignment. All contacts between head and jambs shall be closed tight. Finished work shall be strong, rigid, neat in appearance and free from defects, warps, bulges or buckles. Steel for frames, including all components and reinforcements shall be first quality cold rolled or hot rolled pickled sheets with clean, smooth and level surfaces. All interior frames shall be a minimum of 16 gauge up to 4'0" wide. Frames over 4'0" wide for doors in pairs and multiple openings shall be 14 gauge. Exterior frames to be 14 gauge.
- B. Frames shall be prepared at the factory to receive mortise type hardware where specified under "Finish Hardware" (Section 2.06 of this specification) and shall be reinforced in accordance with the hereinafter listed "Table of Hardware Reinforcing Gauges" (Section 2.04 H of these Specifications). Twenty-four (24) gauge galvanized steel plaster guards shall be spot welded over mortise hardware reinforcing plates.
- C. Holes required for attachment of mortise hardware shall be drilled and tapped in the shop from templates furnished by the hardware manufacturer. Drilling and tapping for surface hardware shall be done in the field.
- D. Anchors shall be furnished in sizes, shapes and designs suited to adjoining wall construction. Frames to 7'6" in height shall be provided with three (3) anchors per jamb, over 7'6" in height, four (4) anchors per jamb. Generally, for new work, anchors are to be of "T" type of Underwriters yoke, type as required. Floor clips shall be welded at the bottom of each jamb and punched for floor anchoring. Jamb anchors shall not be less than 14 gauge. Each frame shall be supplied with a temporary spreader. Hollow metal frames for openings over 3'0" wide shall have head sections reinforced with two (2) each 10 gauge 1/2" x 1" angles welded to head at 4" centers the full width of frame. Frames shall be cleaned of all scale, rust and rough spots and shall be given a hot-dip phosphate treatment followed with a baked on prime coat.
- E. After assembly, all tool marks and surface imperfections shall be dressed smooth by grinding, filing and sanding as necessary. All exposed surfaces both inside and outside the frame shall be thoroughly cleaned of rust, oil and other impurities and phosphate coated to condition the surface of the metal to resist and inhibit corrosion and promote paint adhesion in accordance with Federal Specification TT-C-490.
- F. All doors and their frames shall be fabricated and hung in accordance with the requirements of Underwriter Laboratories Bulletin #200, ASTM-E152, latest edition, and shall have designated time rating and shall bear required labels. So called "Label Construction" doors conforming to UL Requirements are not acceptable.
- G. Labeled fire doors shall have a maximum transmitted temperature end point of not more than 450° F. above ambient at the end of 30 minutes of standard fire test exposure, (for interior stairways only).
- H. Hardware Reinforcing - Minimum Hardware Reinforcing Gauges listed below. All gauges to be U. S. Standard:

1. Hinges - 1-3/4" - Frame 7 gauge - Door 7 gauge
2. Mortise Locksets and Deadlocks - Door 14 gauge, frame 14 gauge
3. Bored or Cylindrical Locks - Door 14 gauge, frame 14 gauge
4. Flush Bolts and Chain and Foot Bolts - Door 14 gauge, frame 14 gauge
5. Surface Applied Closers - Door 12 gauge, frame 12 gauge
6. Hold-Open Arms - Door 12 gauge, frame 12 gauge
7. Push and Pull Plates & Bars - Door 16 gauge except when thru bolts are used
8. Surface Panic Devices - Door 14 gauge, frame 14 gauge
9. Floor Checking Hinges - Door 7 gauge, frame 7 gauge

2.05 FACTORY FINISH

- A. Thoroughly clean all surfaces. Sand free of all imperfections.
- B. Prime all hollow metal doors with rust inhibiting paint, baked on. Primer to be compatible with finish coating.
- C. Give exposed surfaces of doors a sufficient number of filler coats baked-on and sanded to provide a flush even surface without voids, pits or construction marks.

2.06 HARDWARE SCHEDULE

- A. All Doors - The following is the minimum hardware required per door.
 1. 4 1/2" X 4 1/2" Stainless Steel Butt Hinges with non-removable pins and ball bearings (3 hinges per door).
 2. Heavy Duty Cylindrical Locksets. Provide a minimum of five keys per lock. Contractor must use a construction lock set during construction.
 3. Kickplates - brushed aluminum inside and out.
 4. Door stops - brush aluminum.
 5. Door closer with hold open arm.
 6. Panic devices on all exit doors from building.
 7. Wall bumpers.
 8. Thresholds caulked with approved mastic.

B. Key Schedule: The keying schedule shall be coordinated with the owner.

END OF SECTION

SECTION 083300 - OVERHEAD COILING SERVICE DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. The work of this Section includes Overhead Coiling Service Doors.
 - 1. Interior mounted, insulated, coiling door with hood; motor operator and manual operator, including all tracks and miscellaneous hardware for a complete installation.
- B. Related Sections: Other specification sections which directly relate to the work of this Section include, but are not limited to, the following:
 - 1. Section 055000: Miscellaneous Metals

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each type of coiling door. Include both published data and any specific data prepared for this project. Provide exploded view of doors with all materials of construction identified.
- B. Shop Drawings: Submit shop drawing for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.
- C. Name manufacturer's authorized representative who will supervise the installation.
- D. Certify door, hood and all appurtenances can be successfully installed based on dimensions provided.

1.04. QUALITY ASSURANCE

- A. Manufacturer: Coiling Service Doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of rolling doors. Manufacturers proposed for use, which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past five years.
- B. Installer: Installation of rolling doors shall be supervised on-site by an authorized representative of the manufacturer.
- C. Single-Source Responsibility: Provide doors, guides, motors, and related primary components from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.05 WARRANTY

- A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000

cycles, whichever occurs first.

B. PowderGuard Finish

1. PowderGuard Max: Applied to curtain, guides, bottom bar, headplates: Manufacturer's limited Max Finish warranty for 5 years.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturers instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. Provide rolling doors by Overhead Door Corporation, or equal.

2.02 ROLLING DOORS

- A. Trade Model Number: 625 Series Stormtite Insulated Service Doors by Overhead Door Corporation or equal.
- B. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

1. Flat profile type F-265I for doors up to 40'0" wide. Slats shall be fabricated as follows:
 - Front Slats: 20 gauge galvanized steel.
 - Back Slats: 24 gauge galvanized steel.

2. Slat cavity shall be filled with CFC-free foamed-in- place, polyurethane insulation.

C. Finish:

1. Galvanized Steel Materials: Slats and hood shall be galvanized steel in accordance with ASTM A 525 and receive rust-inhibitive, roll coating process, including bonderizing, 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on powder coated top coat. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
- D. Color: Powder coating finish, PowderGuard Max or equal, in color as selected by Owner from manufacturer's standard colors.
- E. Windload Design: 20 PSF.
- F. Weatherseals: Provide vinyl bottom seal and internal hood seals, interior guide seals, lintel seals and, where applicable, exterior guide seals and interior guide seals.
- G. Bottom Bar: Two angles; minimum thickness 1/8" bolted back to back to reinforce curtain in the guides.

- H. Guides: Three structural angles with minimum thickness of 3/16". Guides shall be weatherstripped with a vinyl weather seal at each jamb, on the exterior and interior curtain side.
- I. Brackets: Hot rolled material to support counterbalance, curtain and hood.
- J. Counterbalance: Helical torsion spring type designed for standard 100,000 cycle life design. Counterbalance shall be housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 per foot of span. Counterbalance shall be adjustable by means of an adjusting tension wheel.
- K. Hood: Galvanized steel, 24 gauge with intermediate supports as required. Provide with internal hood baffle weatherseal. Hood flanges shall be accessible and turned under hood.
- L. Electric Motor Operator and Controls
 - 1. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
 - a. Sensing Edge Protection:
 - 1) Pneumatic sensing edge.
 - b. Operator Controls:
 - 1) Push-button operated control stations with open, close, and stop buttons.
 - 2) Key operation with open, close, and stop controls.
 - 3) Push-button and key operated control stations with open, close, and stop buttons.
 - 4) Controls for both interior and exterior location.
 - 5) Controls surface mounted.
 - c. Motor Voltage: 115/230 single phase, 60 Hz.
- M. Manual Operation: Chain hoist.
- N. Locking: Interior slide bolt lock.
- O. Wall Mounting Condition: Face-of-wall mounting.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Strictly comply with manufacturers installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- B. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

- C. Grind block surface to produce a directly vertical installation with minimal gap between block and guide. All grinding shall be limited to the outside dimensions of the guides. Neatly inject all weather silicone caulk material (minimum 20 year warranty) of an identical color to block between guide and block.

3.03 ADJUSTING AND CLEANING

- A. Test rolling doors for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

4.01 QUANTITY AND PAYMENT

No separate payment shall be made for rolling doors. Include all costs in the appropriate proposal bid item.

END OF SECTION

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. HVAC demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Sheet metal construction documents are diagrammatic. Equivalent sizes can be substituted when construction begins as long as aspect ratios are no greater than 3:1 for rectangular, or round instead of square substitutions provide the same static pressure per 100ft. Duct runs are to be coordinated in the field with the other trades. Duct materials can not be changed without the permission of the engineer. Flex ducts are to be no longer than eight feet and must be supported from overhead.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAgl, unless otherwise indicated.

- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.

- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Sections.

3.7 PAINTING AND FINISHING

- A. Apply semi-gloss, acrylic-enamel finish to exposed piping according to the following:
 1. Interior, Ferrous Piping and Ferrous Supports: Finish coat over enamel undercoat and primer.

2. Interior and Exterior, Galvanized-Steel Piping: Two finish coats over galvanized metal primer.
3. Exterior, Ferrous Piping and Ferrous Supports: Two finish coats over rust-inhibitive metal primer.
4. Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved. Repair cut surfaces to match adjacent surfaces.

3.9 CONTROLS COORDINATION

- A. For electrical interface of controls the following is the method to be coordinated with division 23. Division 23 is to provide junction box with cover, conduit, and power to JB. The cover is to be labeled with its respective panel number and breaker number. Control contractor will provide the control transformers and all wiring there after to devices and is to coordinate with Division 16 in the field.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.12 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 230500

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 COORDINATION

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

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

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

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

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

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

- 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Sections:

1. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 1. Trapeze pipe hangers.
 2. Metal framing systems.
 3. Fiberglass strut systems.
 4. Pipe stands.
 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 1. Detail fabrication and assembly of trapeze hangers.
 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- D. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

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

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Metallic Coating: Electroplated zinc.
8. Paint Coating: Epoxy.
9. Plastic Coating: Epoxy.

2.5 FIBERGLASS STRUT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Allied Tube & Conduit.
 2. Champion Fiberglass, Inc.
 3. Cooper B-Line, Inc.
 4. SEASAFE, INC.; a Gibraltar Industries Company.
- B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
 1. Channels: Continuous slotted fiberglass channel with inturned lips.
 2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.6 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.8 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Stainless steel.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 2. Bases: One or more; plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.
 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.9 EQUIPMENT SUPPORTS

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

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

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

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.

1.2 SUMMARY

- A. Provide seismic restraints and supports for all mechanical equipment, piping, plumbing, and fire protection in accordance with the International Building Code, NFPA-13, SMACNA and standard practice.
- B. Provide vibration isolators on all piping, ductwork, and equipment.

1.3 SUBMITTALS:

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Include the following:
 - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for vibration isolation bases. All calculations shall be signed and sealed by a professional Engineer licensed in the state of New Jersey.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Mason Industries, Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. Kinetics Noise Control, Inc.
- B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- C. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 2. Base: Factory drilled for bolting to structure.
 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.
- D. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- E. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers:
1. Amber/Booth Company, Inc.
 2. California Dynamics Corp.
 3. Isolation Technology, Inc.
 4. Kinetics Noise Control, Inc.
 5. Mason Industries, Inc.
 6. Vibration Eliminator Co., Inc.
 7. Vibration Isolation Co., Inc.
 8. Vibration Mountings & Controls/Korfund.

- B. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - 4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.
- B. Install resilient bolt isolation washers on equipment anchor bolts.

3.3 EQUIPMENT BASES

- A. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete; trowel to a smooth finish.
- B. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic codes at Project site.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. Isolator deflection.

3.5 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust active height of spring isolators.

3.6 CLEANING

- A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION 230548

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

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

- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White .
- C. Background Color: Black
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches
 - 2. Fasteners: Brass grommet and wire
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting".

- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Refrigerant Piping:
 - a. Background Color: Black.
 - b. Letter Color: Yellow.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue For cold-air supply ducts.
 - 2. Yellow For hot-air supply ducts.
 - 3. Green For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Chilled Water: 2 inches, round.
 - b. Condenser Water: 2 inches, round.

- c. Refrigerant: 2 inches, round.
 - d. Hot Water: 2 inches, round.
 - e. Gas: 2 inches, round.
2. Valve-Tag Color:
- a. Chilled Water: Blue .
 - b. Condenser Water: Yellow.
 - c. Refrigerant: Black.
 - d. Hot Water: Red.
 - e. Gas: Yellow.
3. Letter Color:
- a. Chilled Water: White.
 - b. Condenser Water: Black.
 - c. Refrigerant: White.
 - d. Hot Water: White.
 - e. Gas: Black.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

- A. Qualification Data: Submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.
- C. Sample report forms.
- D. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.

5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.
- B. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section

"Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.

5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the following:
 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.

- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.

- C. Record compressor data.

3.8 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.9 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 1. Title page.
 2. Name and address of the TAB contractor.
 3. Project name.
 4. Project location.

5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.

- i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
2. Motor Data:
- a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches , and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
- a. Total air flow rate in cfm .
 - b. Total system static pressure in inches wg .
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg .
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft.
 - h. Tube size in NPS
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm
 - b. Average face velocity in fpm
 - c. Air pressure drop in inches wg
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F
 - e. Return-air, wet- and dry-bulb temperatures in deg F.

- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.
- h. Ignition type.
- i. Burner-control types.
- j. Motor horsepower and rpm.
- k. Motor volts, phase, and hertz.
- l. Motor full-load amperage and service factor.
- m. Sheave make, size in inches, and bore.
- n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm.
- b. Entering-air temperature in deg F.
- c. Leaving-air temperature in deg F.
- d. Air temperature differential in deg F.
- e. Entering-air static pressure in inches wg.
- f. Leaving-air static pressure in inches wg.
- g. Air static-pressure differential in inches wg.
- h. Low-fire fuel input in Btu/h.
- i. High-fire fuel input in Btu/h.
- j. Manifold pressure in psig.
- k. High-temperature-limit setting in deg F.
- l. Operating set point in Btu/h.
- m. Motor voltage at each connection.
- n. Motor amperage for each phase.
- o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.

- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.

- J. Air-Terminal-Device Reports:
 1. Unit Data:
 - a. System and air-handling unit identification.

- b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft..
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
- a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
- a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.

- i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
2. Test Data (Indicated and Actual Values):
- a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

M. Instrument Calibration Reports:

- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.11 INSPECTIONS

A. Initial Inspection:

- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
- 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer
 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer
 3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 231123

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.
 - 6. Service meters.
 - 7. Concrete bases.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: 65 psig .
- B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - 5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars
 - 6. Dielectric fittings.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Shop Drawing Scale: 1/4 inch per foot .
 - 2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.
- C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- D. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- E. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- F. Qualification Data: For qualified professional engineer.
- G. Welding certificates.
- H. Field quality-control reports.
- I. Operation and Maintenance Data: For motorized gas valves, pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Architect, Construction Manager, Owner and Engineer no fewer than ten days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Construction Manager's and Owner's written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
 6. Mechanical Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
 - b. Stainless-steel flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. Stainless-steel bolts, washers, and nuts.
 - e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. OmegaFlex, Inc.

- b. Parker Hannifin Corporation; Parflex Division.
 - c. Titeflex.
 - d. Tru-Flex Metal Hose Corp.
2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 3. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.
 4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 5. Striker Plates: Steel, designed to protect tubing from penetrations.
 6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 7. Operating-Pressure Rating: 5 psig.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig .
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches .

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: 60 mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig .

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig .

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig .

- F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 1. CWP Rating: 125 psig .
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.

4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated brass.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig .
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.

f. .

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig .
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.

7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McDonald, A. Y. Mfg. Co.
 - b. Mueller Co.; Gas Products Div.
 - c. Xomox Corporation; a Crane company.
2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig .
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flowserve.
 - b. Homestead Valve; a division of Olson Technologies, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Milliken Valve Company.
 - e. Mueller Co.; Gas Products Div.
 - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig .
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

J. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig
8. Operating Temperature: Minus 20 to plus 140 deg F
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

K. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Dungs, Karl, Inc.
 - c. Eaton Corporation; Controls Div.
 - d. Eclipse Combustion, Inc.
 - e. Honeywell International Inc.
 - f. Johnson Controls.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Dungs, Karl, Inc.
 - c. Eclipse Combustion, Inc.
 - d. Goyen Valve Corp.; Tyco Environmental Systems.
 - e. Magnatrol Valve Corporation.
 - f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
 - g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Vanguard Valves, Inc.
2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig .
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

B. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pacific Seismic Products, Inc.
2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 7 psig

4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - d. Invensys.
 - e. Richards Industries; Jordan Valve Div.
 - .
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Line Pressure Regulators: Comply with ANSI Z21.80.

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

- a. Actaris.
 - b. American Meter Company.
 - c. Eclipse Combustion, Inc.
 - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - e. Invensys.
 - f. Maxitrol Company.
 - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 12. Maximum Inlet Pressure: 5 psig (34.5 kPa).
- D. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
 2. Body and Diaphragm Case: Die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber.
 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 9. Maximum Inlet Pressure: 2 psig

2.8 SERVICE METERS

- A. Diaphragm-Type Service Meters: Comply with ANSI B109.1 and ANSI B109.2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Invensys.
2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet and liters.
8. Meter Case and Index: Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig.
11. Pressure Loss: Maximum 0.5-inch wg.
12. Accuracy: Maximum plus or minus 1.0 percent.

B. Rotary-Type Service Meters: Comply with ANSI B109.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Meter Company.
 - b. Invensys.
2. Case: Extruded aluminum.
3. Connection: Flange.
4. Impellers: Polished aluminum.
5. Rotor Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet and liters.
8. Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig .
11. Accuracy: Maximum plus or minus 2.0 percent.

C. Turbine Meters: Comply with ASME MFC-4M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Meter Company.
 - b. Invensys.
2. Housing: Cast iron or welded steel.
3. Connection Threads or Flanges: Steel.
4. Turbine: Aluminum or plastic.

5. Turbine Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet and liters.
8. Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig .
11. Accuracy: Maximum plus or minus 2.0 percent.

D. Service-Meter Bars:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Actaris.
 - b. American Meter Company.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Mueller Co.; Gas Products Div.
 - f. Perfection Corporation; a subsidiary of American Meter Company.
2. Malleable- or cast-iron frame for supporting service meter.
3. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
4. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.

E. Service-Meter Bypass Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lyall, R. W. & Company, Inc.
 - b. Williamson, T. D., Inc.
2. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
3. Integral ball-check bypass valve.

2.9 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

- f. Wilkins; Zurn Plumbing Products Group.
 - 2. Minimum Operating-Pressure Rating: 150 psig .
 - 3. Combination fitting of copper alloy and ferrous materials.
 - 4. Insulating materials suitable for natural gas.
 - 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- B. Dielectric Flanges:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - d. Wilkins; Zurn Plumbing Products Group.
 - 2. Minimum Operating-Pressure Rating: 150 psig .
 - 3. Combination fitting of copper alloy and ferrous materials.
 - 4. Insulating materials suitable for natural gas.
 - 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- C. Dielectric-Flange Kits:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Minimum Operating-Pressure Rating: 150 psig.
 - 3. Companion-flange assembly for field assembly.
 - 4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
 - 5. Insulating materials suitable for natural gas.
 - 6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.10 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE 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 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 yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Provide an additional twenty five feet of gas piping and accessories and installation labor for each size of pipe used on the project to accommodate any changes required to resolve interferences or as directed by the engineer.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

- P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- Q. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 5. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- R. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- S. Connect branch piping from top or side of horizontal piping.
- T. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- U. Do not use natural-gas piping as grounding electrode.
- V. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- W. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
- X. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

- Y. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- Z. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION

- A. Install service-meter assemblies aboveground, on concrete bases.
- B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.
- G. Install metal bollards to protect meter assemblies. Comply with requirements in Division 05 Section "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.8 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches ; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

CONNECTIONS

D. Connect to utility's gas main according to utility's procedures and requirements.

E. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

F. Install piping adjacent to appliances to allow service and maintenance of appliances.

- G. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- H. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel gloss.
 - d. Color: Yellow.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex gloss.
 - d. Color: Yellow.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.13 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.

- C. Underground, below building, piping shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with steel welding fittings and welded joints.
- C. Underground, below building, piping shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG

- A. Aboveground Piping: Maximum operating pressure more than 5 psig.
- B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
- C. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with steel welding fittings and welded joints.
- D. Underground, below building, piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.
- E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 1. NPS 2-1/2 and Larger: Cast-iron, lubricated plug valves.

3.18 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
- E. Valves in branch piping for single appliance shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Centrifugal roof ventilators.
 - 2. Ceiling-mounting ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- 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. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 1. Roof framing and support members relative to duct penetrations.
 2. Ceiling suspension assembly members.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - D. Field quality-control test reports.
 - E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: two set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Centrifugal Roof Ventilators:
 - a. Greenheck Fan Corp (Basis of Design).
 - b. Cook, Loren Company
 - c. Penn Ventilation Companies, Inc.
 - 2. Ceiling-Mounting Ventilators:
 - a. Greenheck Fan Corp (Basis of Design).
 - b. Cook, Loren Company.
 - c. Penn Ventilation Companies, Inc.

2.2 CENTRIFUGAL ROOF VENTILATORS

- A. Description: Belt-driven and direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories as scheduled on the contract drawings.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.

4. Fan and motor isolated from exhaust airstream.
- E. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 3. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
 4. Variable-Speed Controller for Direct Drive Fans: Solid-state control to reduce speed from 100 percent to less than 50 percent.
 5. Additional accessories as noted on the exhaust fan equipment schedules.
- F. Roof Curbs: Roof curb shall be Trapezoidal fixed cell standing seam roof sloped seismic roof curb by Thybar or approved equal. Coordinate final roof type with Architect and Structural contractor.
1. Overall Height: 18 inches.
 2. Sound Curb: Curb with sound-absorbing insulation matrix.
 3. Pitch Mounting: Manufacture curb for roof slope.
 4. Metal Liner: Galvanized steel.
 5. Hinged Subbase: Galvanized steel hinged arrangement permitting service and maintenance.
 6. Mounting Pedestal: Galvanized steel with removable access panel.

2.3 CEILING-MOUNTING VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Painted Steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
 2. Manufacturer's standard roof jack or wall cap, and transition fittings.
 3. Isolation: Rubber-in-shear vibration isolators.
 4. Additional accessories as noted on the exhaust fan equipment schedules.

2.4 MOTORS

- A. Refer to Division 15 Section "Motors" for general requirements for factory-installed motors.
- B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- C. Enclosure Type: TEFC.

2.5 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of **1 inch**. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

SECTION 238126.13
MINI-SPLIT SYSTEMS (0.75 TO 2.0 TONS)

PART 1 – GENERAL

1.01 System Description

- A. The heat pump air conditioning system shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.
- B. Indoor units shall be for single-zone (1:1) systems

1.02 Quality Assurance

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 240 and bear the AHRI Certification label.
- D. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- E. A dry air holding charge shall be provided in the indoor section.
- F. System efficiency shall meet or exceed 16 SEER when part of a 1:1 (indoor/outdoor) system.
- G. Delivery, Storage and Handling
 - 1. Unit shall be stored and handled according to the manufacturer's recommendations.
 - 2. The hand held wireless controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

PART 2 – WARRANTY

- 2.01 The units shall have a manufacturer's parts and defects warranty for a period five (5) years from date of installation. The compressor shall have a warranty of seven (7) years from the same date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
- 2.02 Manufacturer shall have over 30 years of continuous experience in the U.S. market.

PART 3 – PERFORMANCE

- 3.01 Each system shall perform in accordance with the ratings shown in the schedules.
- 3.02 Cooling performance shall be based on 80°F DB, 67°F WB (27°C DB, 19°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 23.9°C WB) for the outdoor unit.

3.03 Heating performance shall be based on 70°F DB, 60 °F WB (21°C DB, 16°C WB) for the indoor unit and 47 ° F DB, 43° F WB (8 ° C DB, 6° C WB) for the outdoor unit.

Operating Range		Indoor Air Intake Temperature	Outdoor Air Intake Temperature
Cooling	Maximum	D.B. 90°F (32.2°C) W.B. 73°F (22.7°C)	D.B. 115°F (46.1°C)
	Minimum	D.B. 67°F (19.4°C) W.B. 57°F (13.8°C)	D.B. 32°F (0°C)
Heating	Maximum	D.B. 80°F (27°C) W.B. 67°F (19°C)	D.B. 75°F (24°C) W.B. 65°F (18°C)
	Minimum	D.B. 70°F (21°C) W.B. 60°F (16°C)	D.B. 5°F

PART 4 – PRODUCTS

4.01 : Manufacturers

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

1. Trane NTXS (Basis of Design)
2. Mitsubishi
3. Or Approved Equal

4.02 : Indoor Unit

A. General:

The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board, fan and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function after power interruption. Indoor unit shall be purged with dry air before shipment from factory.

B. Unit Cabinet:

1. The casing shall have a smooth front, white finish – Munsell 1.0Y 9.2/0.2.
2. Multi directional drain connection and refrigerant piping, offering three (3) direction pipe alignments for all refrigerant piping and two (2) direction pipe alignments for condensate draining shall be standard.
3. There shall be a separate, metal installation-plate that secures the indoor unit firmly to the wall. The installation-plate shall be securely attached to the wall using appropriate anchor method. Installing contractor shall determine the best method and be responsible for proper mounting of the installation plate to the wall.

C. Fan:

1. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor.
2. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearing.

3. A manual adjustable guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
4. An integral, motorized, multi-position, horizontal air sweep flow louver shall provide for uniform air distribution, up and down. Five (5) positions plus Auto and Swing shall be provided, controlled from the remote controller.
5. The indoor fan shall operate at one of five (5) speeds: Super High, High, Medium, Low, and Quiet plus Auto Fan Mode for models up to 24,000 BTU/h. All speeds shall be selected from the remote controller.

Indoor unit sound level shall not exceed:

Model / Speed		Super High	High	Medium	Low
09 MBH	Cooling dB(A)	43	37	30	22
	Heating dB(A)	43	37	30	22
24 MBH	Cooling dB(A)	50	44	38	33
	Heating dB(A)	50	44	38	32

D. Filter:

1. Return air shall be filtered by means of easily removed, washable, Antioxidant Pre-filter and an Anti-allergy enzyme filter – blue, pleated type.

E. Coil:

1. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with silver alloy.
4. The coils shall be pressure tested at the factory.
5. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil.
6. An optional drain pan level switch (DPLS2), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing.

F. Electrical:

1. The unit electrical power shall be
 1. 115 volts, 1-phase, 60 hertz (size 09 system)
 2. 208-230 volts, 1-phase, 60 hertz (size 24 system)

2. The system shall be equipped with A-Control – a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14 gauge AWG connections plus ground.
3. The indoor unit shall not have any supplemental electrical heat elements.

4.02: Control

A. Wired controller

a. Wired Remote Controller

The Wired Remote Controller shall require a Terminal Interface for communications. Interface will be mounted at the indoor unit. A two (2) conductor, stranded, 22 AWG twisted pair, jacketed, cable shall connect the interface to the wall controller. Connection shall not be polarity sensitive and controller wire shall not exceed thirty-three (33) feet (10m) length.

The wired remote controller shall be approximately 5” x 5” in size and white in color with a light-green LCD display. The controller shall support a selection from multiple languages (Spanish, Russian, Swedish, English, Portuguese, Italian, or French) for display information. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of 1°F (0.5°C). The controller shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters).

The basic functions are:

Wired Remote Controller	
Item	Description
Number of Units Controllable	16 units as 1 group
ON/OFF	Run and stop operation
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat.

Wired Remote Controller	
Item	Description
Temperature Setting (Range and modes depend on connected unit model)	Sets the set point temperature in the following range Cool/Dry: 67°F-87°F Heat: 63°F-83°F Auto: 67°F-83°F
Fan Speed Setting (Range and modes depend on connected unit model)	Hi/Mid-2/Mid-1/Low/Auto
Air Flow Direction Setting (Air flow direction settings depend on the unit model)	Air flow direction angles 100%-80%-60%-40%, Swing.
Weekly Scheduler	ON/OFF/Temperature setting can be done up to 8 times one day in the week. The time can be set by the 1-minute interval.
Operating Conditions Display	Set point and room temperature. Sensing can be done at the remote controller or the indoor unit depending on the indoor unit dipswitch setting Liquid, discharge, indoor and outdoor pipe temperatures LEV opening pulses, sub cooling and discharge super heat Compressor Operating Conditions: Running current, frequency, input voltage, On/Off status and operating time
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit. LOSSNAY items that can be set are “Hi”, “Low”, and “Stop”. Ventilation mode switching is not available.
Auto Lock Out Function	Setting/releasing of simplified locking for remote control buttons can be performed. <ul style="list-style-type: none"> • Locking of all buttons • Locking of all buttons except ON/OFF button

9. The indoor units shall be capable of working with single-zone or multi-zone outdoor units

4.03: Outdoor Units

General:

The NTX Series outdoor units are specifically designed to work with the NTX indoor units. The outdoor units must have a thermally fused powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

A. Unit Cabinet:

1. The casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Assembly hardware shall be cadmium plated for weather resistance.
2. Cabinet color shall be Munsell 3Y 7.8/1.1.
3. Two (2) mild steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes shall be furnished. Assembly shall withstand lateral wind gust up to 155 MPH to meet applicable weather codes.

B. Fan:

1. The unit shall be furnished with a direct drive propeller type fan.
2. The outdoor unit fan motor shall be a direct current (DC) motor and have permanently lubricated bearings.
3. The fan motor shall be mounted for quiet operation.
4. The fan shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have horizontal discharge airflow.
6. Outdoor unit sound level shall not exceed:

Model	Cooling	Heating
Size 09	46 dB(A)	50 dB(A)
Size 24	57 dB(A)	55 dB(A)

C. Coil:

1. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil shall be protected with an integral metal guard.
3. Refrigerant flow from the outdoor unit shall be regulated by means of an electronically controlled, precision, linear expansion valve.
4. Outdoor unit shall be pre-charged with sufficient R-410a refrigerant for up to twenty five (25) feet of refrigerant piping.

5. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.
6. All refrigerant connections between outdoor and indoor units shall be flare type.

D. Compressor:

1. The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type manufactured by Mitsubishi Electric Corporation.
2. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.
3. The outdoor unit shall be equipped with an accumulator.
4. The compressor will be equipped with internal thermal overload protection.
5. The outdoor unit must have the ability to operate over the full capacity range with a maximum height difference of 40 feet and have refrigerant tubing length of 65 feet for capacities up to 15,000 BTU/h and a maximum height difference of 50 feet and have refrigerant tubing length of 100 feet for capacities above 15,000 BTU/h between indoor and outdoor units.
6. There shall be no need for line size changes. Filters, sight glasses, and traps shall not be used, and no additional refrigerant oil shall be required.
7. The compressor shall be mounted so as to avoid the transmission of vibration.

E. Electrical:

1. The outdoor unit electrical power supply shall be
 - a. 115 volts, 1-phase, 60 hertz (size 09 unit)
 - b. 208/230 volts, 1-phase, 60 hertz (size 24 unit)
2. The units shall be capable of satisfactory operation within voltage limits
 - a. of 103 volts to 127 volts
 - b. of 187 volts to 253 volts.
3. The outdoor unit shall be controlled by microprocessors located in the indoor unit and outdoor unit. A 12 to 24 volt DC data stream shall communicate between the units providing all necessary information for full function control.

END OF SECTION 238126

SECTION 078413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Construction Solutions.
 - d. Grabber Construction Products.
 - e. Hilti, Inc.
 - f. HOLDRITE; Reliance Worldwide Company.
 - g. NUCO Inc.
 - h. Passive Fire Protection Partners.
 - i. Specified Technologies, Inc.
 - j. STC Sound Control.
 - k. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- D. Install fill materials by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.3 FIELD QUALITY CONTROL

- A. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- B. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 078413

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL – MATERIALS & METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electrical demolition.
 - 6. Cutting and patching for electrical construction.

1.2 SUBMITTALS

- A. Product Data: For utility company electricity-metering components.

1.3 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. The contractor shall be fully responsible in the coordination and installation of all electrical products as per the manufacturer's recommendations. Should the contractor alter or change the manufacturer's installation recommendations, the contractor shall submit a certified installation report from the manufacturer's representative stating the installed is acceptable. Any discrepancies in the installation shall be corrected per the manufacturer's requirements at no additional cost to the owner and before final closeout of the project.
- C. Comply with the latest adopted edition of NFPA 70 and the International Building Code.

1.4 COORDINATION

- A. The contractor shall be fully responsible for all coordination of the electrical work required to meet the design intent and the scope of work related to the project. This includes but not limited to all other trades, material handling, equipment rentals, tools, automobiles, parking and travel expenses, engineering review and consult, as-built drawings and any/all construction site requirements that are necessary to provide a turnkey electrical installation.
- B. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work and all trades.
- C. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building or space.

- D. Coordinate all electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for service entrances and electricity-metering components.
- E. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.
- F. The 'Basis of Design' is the product that is specified which supports the design contained within the contract documents. Should the contractor elect to use an alternate manufacturer listed within the specifications the contractor is still required to meet the full intent of the specifications and the contract documents at no additional cost.
- G. It shall be the contractor's responsibility to acknowledge any long lead delivery items with written response from the manufacturer, at the time of Notice to Proceed. Should the contractor fail to inform the client and the A/E of any material or equipment delays at the time Notice to Proceed has been given, the contractor will take full responsibility in completing the project in the same allowed construction period, based on the approved construction schedule.
- H. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

1.5 ITEMS NOT SHOWN OR SPECIFIED

- A. Any item of material not indicated on the drawings and/or not specified, but which is required for the complete and proper installation and/or operation of any part of the work, shall be provided as if indicated and specified, at no additional cost to the Owner.
- B. Any work not indicated on the drawings and/or not specified, but which is required for compliance with applicable codes and regulations, shall be provided as if indicated and specified, at no additional cost to the Owner.
- C. The drawings and specifications provided indicate the scope of work. However they do not provide a complete description of the existing site and building conditions. The contractor shall be fully responsible for the verification of all existing conditions. All work shall incorporate the existing site appurtenances without disturbance unless otherwise noted. Any revisions to the installations of the project scope of work to address interferences shall be considered as the contractor's responsibility at no additional cost.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. EMT: Electrical metallic tubing; ANSI C80.3, zinc-coated steel, with compression fittings.
- B. FMC: Flexible metal conduit; zinc-coated steel.
- C. Raceway Fittings: Specifically designed for raceway type with which used.

2.2 WIRES, CABLES, AND CONNECTIONS

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

- B. Conductors, Larger Than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic, rated 600 V, 75 deg C minimum, Type THW, THHN-THWN, or USE depending on application.
- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.3 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs. Strength rating to suit structural loading.
- D. Nonmetallic Slotted Channel and Angle: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least one surface. Strength rating to suit structural loading.
- E. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.
 - 1. Materials: Same as channels and angles, except metal items may be stainless steel.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- H. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- I. Expansion Anchors: Carbon-steel wedge or sleeve type.
- J. Toggle Bolts: All-steel springhead type.

2.4 ELECTRICAL IDENTIFICATION

- A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).
- C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

- D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- E. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
- F. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.2 RACEWAY APPLICATION

- A. Indoor Installations:
 1. Exposed: EMT except in wet or damp locations, use IMC.
 2. Concealed in Walls or Ceilings: EMT.
 3. Below Slab on Grade or in Crawlspace: EMT
 4. Connection to Vibrating Equipment: FMC; except in wet or damp locations: LFMC.
 5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.3 RACEWAY AND CABLE INSTALLATION

- A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- B. Keep legs of raceway bends in the same plane and keep straight legs of offsets parallel.
- C. Where required to provide a Rough-in Only device application concealed within the vertical walls the contractor shall provide the device work box and 3/4" EMT raceway to above the ceiling with a 90 degree bend turned into the ceiling space and apply an open end plastic bushing or cap for future wiring application.
- D. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or woven polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wires.
- E. Equipment subject to vibration, noise transmission, or movement with a maximum of 72-inches (1830-mm) flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

3.4 WIRING INSTALLATION

- A. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.5 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.
- B. Dry Locations: Steel materials.
- C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb (90-kg) minimum design load for each support element.

3.6 SUPPORT INSTALLATION

- A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.
- C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps.
- D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:
 - 1. Wood: Wood screws or screw-type nails.
 - 2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.
 - 3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Structural Steel: Welded threaded studs.
 - a. Comply with AWS D1.1 for field welding.
 - 6. Light Steel Framing: Sheet metal screws.
 - 7. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

3.7 FIRESTOPPING

- A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies.

3.8 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety and back to electrical panel source.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.9 DISPOSAL

- A. The contractor shall assume all cost and service fees for the removal of all construction debris generated by demolition and installation of new work throughout the entire project construction period.
- B. The disposal of all debris generated from the construction project shall be disposed of in a legal and safe manner as regulated by the local Authority Having Jurisdiction and the State of New Jersey Department of Environmental Protection.

3.10 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. The contractor shall not disturb any existing surfaces, furnishings, equipment, or building appurtenances without assuming that the contractor will be required to repair, patch and/or replace any damages caused by construction.
- C. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

END OF SECTION 260500

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

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

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

1. Alpha Wire Company.
2. Belden Inc.
3. Cerro Wire LLC.
4. Encore Wire Corporation.
5. Okonite Company (The).
6. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Conductor Insulation:
 1. Type NM: Comply with UL 83 and UL 719.
 2. Type THHN and Type THWN-2: Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Alpha Wire Company.
 2. Belden Inc.
 3. Encore Wire Corporation.
 4. Okonite Company (The).
 5. Southwire Company.
- C. Standards:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
 3. RoHS compliant.
 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 1. Single circuit.
- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
 1. Type TFN/THHN/THWN-2: Comply with UL 83.
- H. Armor: Steel, interlocked.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Electrical Products.
 - 2. ABB (Electrification Products Division).
 - 3. Emerson Electric Co. (Automation Solutions - Appleton - O-Z/Gedney).
 - 4. Hubbell Incorporated (Hubbell Power Systems).
 - 5. Service Wire Co.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. 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. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION 260519

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Emerson Electric Co. (Automation Solutions - Appleton - O-Z/Gedney).
 2. Hubbell Incorporated (Burndy).
 3. nVent (ERICO).
 4. Siemens Industry, Inc., Energy Management Division.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 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. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- C. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- D. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- E. Conduit Hubs: Mechanical type, terminal with threaded hub.
- F. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- G. Straps: Solid copper, copper lugs. Rated for 600 A.

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.
- B. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

- B. 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.
 - 4. Flexible raceway runs.
 - 5. Armored and metal-clad cable runs.

- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted

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.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

1.2 ACTION SUBMITTALS

- ###### A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ###### A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
 2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- ###### A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atkore International (Allied Tube & Conduit).
 - b. Atkore International (Unistrut).
 - c. Eaton (B-line).
 - d. Flex-Strut Inc.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Material for Channel, Fittings, and Accessories: Plain steel.
 4. Channel Width: Selected for applicable load criteria.
 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Eaton (B-line).
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 5. Toggle Bolts: All-steel springhead type.
 6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA 101
 - 3. NECA 102.
 - 4. NECA 105.
 - 5. NECA 111.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

END OF SECTION 260529

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB (Electrification Products Division).
 - b. Republic Conduit.
 - c. Southwire Company.
 - d. Wheatland Tube Company.
2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. EMT: Comply with ANSI C80.3 and UL 797.
4. FMC: Comply with UL 1; [zinc-coated steel] [or] [aluminum].

- B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB (Electrification Products Division).
 - b. Republic Conduit.
 - c. Southwire Company.
 - d. Wheatland Tube Company.
 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 5. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (B-line).
 2. MonoSystems, Inc.
 3. nVent (Hoffman).
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB (Electrification Products Division).
 2. Emerson Electric Co. (Automation Solutions - Appleton - EGS).

3. Hubbell Incorporated.
 4. Hubbell Incorporated (Raco Taymac Bell).
 5. Hubbell Incorporated (Wiring Device-Kellems).
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
 - C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
 - D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
 - E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
 - F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 - G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
 - H. Gangable boxes are allowed.
 - I. Hinged-Cover Enclosures: Comply with UL 50 and 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.
 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
 - J. 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. Indoors: Apply raceway products as specified below unless otherwise indicated.
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.
- B. Minimum Raceway Size: [1/2-inch (16-mm)] [3/4-inch (21-mm)] trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
 2. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- O. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Conduit extending from interior to exterior of building.
 - 4. Conduit extending into pressurized duct and equipment.
 - 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6. Where otherwise required by NFPA 70.
- Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches (915 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- S. 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. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

- T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- U. Locate boxes so that cover or plate will not span different building finishes.
- V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel.
 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HOLDRITE; Reliance Worldwide Company.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- F. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.

- E. Comply with NFPA 70E requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
 - 1. Color shall be factory applied[or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit].
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Color for Neutral: White.
 - 4. Color for Equipment Grounds: Green.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
- E. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Brady Corporation.
 - b. emedco.
 - c. Panduit Corp.

- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services, Inc.
 - c. Panduit Corp.

- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. Panduit Corp.

 - 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.

 - 3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.

 - 4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

- D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. emedco.
 - c. Panduit Corp.

 - 2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches (37 by 150 mm)for raceway and conductors.
 - b. 3-1/2 by 5 inches (76 by 127 mm)for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameter and that stay in place by gripping action.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. HellermannTyton.
 - c. Marking Services, Inc.
 - d. Panduit Corp.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Champion America.
 - c. HellermannTyton.
 - d. Ideal Industries, Inc.
 - e. Marking Services, Inc.
 - f. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Marking Services, Inc.
- C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and is 12 inches (300 mm) wide. Stop stripes at legends.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HellermannTyton.
 - b. LEM Products Inc.
 - c. Marking Services, Inc.
 - d. Seton Identification Products; a Brady Corporation company.

- D. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. Seton Identification Products; a Brady Corporation company.
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.6 TAGS

- A. Write-on Tags:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlton Industries, LP.
 - b. LEM Products Inc.
 - c. Seton Identification Products; a Brady Corporation company.
 - 2. Polyester Tags: 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment.
 - 3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 4. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. emedco.
 - d. Marking Services, Inc.
 - 2. Engraved legend.
 - 3. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face.

- d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
- e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. HellermannTyton.
 - 2. Ideal Industries, Inc.
 - 3. Marking Services, Inc.
 - 4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain 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 and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Vinyl Wraparound Labels:
 - 1. Secure tight to surface at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

- M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- O. Self-Adhesive Labels:
 - 1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- V. Write-on Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- W. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.
- X. Metal-Backed Butyrate Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

Y. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

Z. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

END OF SECTION 260553

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Load centers.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
 - 2. 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.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 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 NECA 407.

1.10 FIELD 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 (minus 30 deg C)** to **plus 104 deg F (plus 40 deg C)**.
 - b. Altitude: Not exceeding **6600 feet (2000 m)**.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

- 1. Ambient temperatures within limits specified.
- 2. Altitude not exceeding **6600 feet (2000 m)**.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

- 1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
- 2. Do not proceed with interruption of electric service without Owner's written permission.
- 3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

- 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

- 1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Height: 84 inches (2.13 m) maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 - 5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 7. 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: Galvanized steel.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- G. Incoming Mains:

1. Location: Convertible between top and bottom.
 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Terminations shall allow use of 75 deg C rated conductors without derating.
 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
- J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- K. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 20 percent.

- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
 - 1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
 - 2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company; GE Energy Management - Electrical Distribution.
 - 3. Siemens Energy.
 - 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than **36 inches (914 mm)** high, provide two latches, keyed alike.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
- G. Branch Overcurrent Protective Devices: Fused switches.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Eaton.
 - 2. General Electric Company; GE Energy Management - Electrical Distribution.
 - 3. Siemens Energy.

4. [Square D; by Schneider Electric.](#)
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.5 LOAD CENTERS

- A. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
 1. [Eaton.](#)
 2. [General Electric Company; GE Energy Management - Electrical Distribution.](#)
 3. [Siemens Energy.](#)
 4. [Square D; by Schneider Electric.](#)
- B. Load Centers: Comply with UL 67.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges secured with flush latch with tumbler lock; keyed alike.
- F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
 1. [Eaton.](#)
 2. [General Electric Company; GE Energy Management - Electrical Distribution.](#)
 3. [Siemens Energy.](#)
 4. [Square D; by Schneider Electric.](#)
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers:

- a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. Subfeed Circuit Breakers: Vertically mounted.
 9. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - h. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.

2.7 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- 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.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407.
- D. Provide an additional 225A Main Circuit Breaker Panelboard w.(42) 20A/1P 14KAIC branch breakers and accessories of each voltage type used (480-277V or 208-120V, 3 phase) on the project to accommodate any changes required to resolve interferences as directed by the Engineer.

- E. Equipment Mounting:
 - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- G. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- H. Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.
- I. Mount panelboard cabinet plumb and rigid without distortion of box.
- J. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- K. Mount surface-mounted panelboards to steel slotted supports **5/8 inch (16 mm)** in depth. Orient steel slotted supports vertically.
- L. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- M. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- N. Install filler plates in unused spaces.
- O. Stub four **1-inch (25 mm)** empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four **1-inch (25 mm)** empty conduits into raised floor space or below slab not on grade.
- P. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- Q. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 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.
- B. 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.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Perform optional tests. 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.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
 - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Straight-blade convenience receptacles.
 - 2. GFCI receptacles.
 - 3. Toggle switches.
 - 4. Wall-box dimmers.
 - 5. Wall plates.

1.3 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
 - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
 - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
 - 3. Leviton: Leviton Mfg. Company, Inc.
 - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.
- H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
 - 3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
 - 4. SPD Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, 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. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.
- D. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
 2. Cord and Plug Sets: Match equipment requirements.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2.3 GFCI RECEPTACLES

- A. General Description:
1. 125 V, 20 A, straight blade, feed-through type.
 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).

2.4 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
1. Single Pole:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) [Eaton \(Arrow Hart\).](#)
 - 2) [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - 3) [Leviton Manufacturing Co., Inc.](#)
 - 4) [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
 2. Two Pole:
 - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1) [Eaton \(Arrow Hart\).](#)
 - 2) [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - 3) [Leviton Manufacturing Co., Inc.](#)
 - 4) [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
 3. Three Way:
 - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1) [Eaton \(Arrow Hart\).](#)
 - 2) [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - 3) [Leviton Manufacturing Co., Inc.](#)
 - 4) [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
 4. Four Way:
 - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1) [Eaton \(Arrow Hart\).](#)
 - 2) [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - 3) [Leviton Manufacturing Co., Inc.](#)
 - 4) [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
- C. Pilot-Light Switches: 120/277 V, 20 A.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [Eaton \(Arrow Hart\).](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - c. [Leviton Manufacturing Co., Inc.](#)
 - d. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
 2. Description: Single pole, with LED-lighted handle, illuminated when switch is off.
- D. Key-Operated Switches: 120/277 V, 20 A.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

- a. [Eaton \(Arrow Hart\).](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - c. [Leviton Manufacturing Co., Inc.](#)
 - d. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
2. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.
- 1. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
 - a. [Eaton \(Arrow Hart\).](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - c. [Leviton Manufacturing Co., Inc.](#)
 - d. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)
- F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
- 1. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
 - a. [Eaton \(Arrow Hart\).](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems.](#)
 - c. [Leviton Manufacturing Co., Inc.](#)
 - d. [Pass & Seymour/Legrand \(Pass & Seymour\).](#)

2.5 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
- E. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.6 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: **0.035-inch- (1-mm-)** thick, satin-finished, Type 302 stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp 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. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Black unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.
 - 3. SPD Devices: Blue.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right 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.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that 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 (152 mm)** in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by 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.
10. As directed by the Engineer, furnish and install and additional (40) duplex receptacles and (30) additional switches.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. 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. As directed by the Engineer, furnish and install and additional 50 device plates.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Provide an additional twenty of each wiring device and accessories of each type and size used on the project (including but not limited to; device, grounding assembly, work box, raceway,

cabling, cover plate, etc.) to accommodate any changes required to resolve interferences as directed by the Engineer.

- I. 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, multi-gang wall plates.
- J. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required. As directed by the Engineer, furnish and install an additional (30) 20A, GFI receptacles.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

- E. Wiring device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.
- B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
 2. Altitude: Not exceeding **6600 feet (2010 m)**.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB Inc.
 - 2. Eaton.
 - 3. General Electric Company.
 - 4. Siemens Industry, Inc.
 - 5. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole.
 - 3. 240-V ac or 600-V ac.
 - 4. 1200 A and smaller.
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
 - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton.
 2. General Electric Company.
 3. Siemens Industry, Inc.
 4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240-V ac or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 7. Service-Rated Switches: Labeled for use as service equipment.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1) or directly operable through the dead front

trim of the enclosure (NEMA 250 Type 3R). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.4 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.
- F. Provide an additional two enclosed switches and 2 enclosed circuit breakers and accessories of each type and size used on the project to accommodate any changes required to resolve interferences as directed by the Engineer.

3.5 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

E. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:
 - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify that the unit is clean.
 - e. Operate the circuit breaker to ensure smooth operation.
 - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.

- a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.
- 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
 - e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

- f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
- 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 4. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
 - G. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262816

SECTION 262913

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following enclosed controllers rated 600 V and less:
 - 1. Full-voltage manual.
 - 2. Full-voltage magnetic.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
 - 1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.

- c. Nameplate legends.
 - d. Short-circuit current rating of integrated unit.
 - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
 - f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field quality-control reports.
- C. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- D. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Routine maintenance requirements for enclosed controllers and installed components.
 - 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - 3. Manufacturer's written instructions for setting field-adjustable overload relays.
 - 4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.7 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Indicating Lights: Two of each type and color installed.
 - 4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.

5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 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. 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 NFPA 70.
- D. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
 2. Altitude: Not exceeding **6600 feet (2010 m)**.
- B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 1. Notify Owner no fewer than two days in advance of proposed interruption of electrical systems.
 2. Indicate method of providing temporary utilities.
 3. Do not proceed with interruption of electrical systems without Owner's written permission.
 4. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton.
 - b. General Electric Company.
 - c. Rockwell Automation, Inc.
 - d. Siemens Industry, Inc.
 - e. Square D; by Schneider Electric.
 - 2. Configuration: Nonreversing.
 - 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 - 4. Flush mounting.
 - 5. Green pilot light.
- C. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton.
 - b. General Electric Company.
 - c. Rockwell Automation, Inc.
 - d. Siemens Industry, Inc.
 - e. Square D; by Schneider Electric.

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button; bimetallic type.
4. Flush mounting.
5. Green pilot light.

D. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton.
 - b. General Electric Company.
 - c. Rockwell Automation, Inc.
 - d. Siemens Industry, Inc.
 - e. Square D; by Schneider Electric.
2. Configuration: Nonreversing.
3. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 50 VA.
6. Melting Alloy Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 10 tripping characteristic.
 - c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
7. Bimetallic Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 10 tripping characteristic.
 - c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - d. Ambient compensated.
 - e. Automatic resetting.
8. Solid-State Overload Relay:

- a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - e. Analog communication module.
- 9. N.C., isolated overload alarm contact.
 - 10. External overload reset push button.
- E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton.
 - b. General Electric Company.
 - c. Rockwell Automation, Inc.
 - d. Siemens Industry, Inc.
 - e. Square D; by Schneider Electric.
 - 2. Fusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - 3. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 - 4. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 - 5. MCP Disconnecting Means:
 - a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
 - d. N.C. alarm contact that operates only when MCP has tripped.
 - e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

2.2 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: Type 1.
 - 2. Outdoor Locations: Type 3R.
 - 3. Kitchen Areas: Type 4X, stainless steel.
 - 4. Other Wet or Damp Indoor Locations: Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.3 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - 1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, type.
 - a. Push Buttons: Shrouded types; maintained as indicated.
 - b. Pilot Lights: LED types; colors as indicated; push to test.
 - c. Selector Switches: Rotary type.
 - 2. Elapsed Time Meters (1HP and above): Heavy duty with digital readout in hours; resettable.
 - 3. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.
- B. N.C. auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
- E. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- F. Space heaters, with N.C. auxiliary contacts, to mitigate condensation in Type 3R enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- G. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch (100-mm) nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in each fusible-switch enclosed controller.
- E. Provide an additional controller and accessories of each type and size used on the project to accommodate any changes required to resolve interferences as directed by the Engineer.
- F. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- H. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.
- C. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.
- D. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage solid-state controllers.

END OF SECTION 262913

SECTION 265119

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of LED luminaires:
 - 1. Lowbay.
 - 2. Surface mount, linear.
 - 3. Surface mount, nonlinear.
 - 4. Suspended, linear.
 - 5. Suspended, nonlinear.
 - 6. Materials.
 - 7. Finishes.
 - 8. Luminaire support.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Standards:
 - 1. ENERGY STAR certified.
 - 2. California Title 24 compliant.
 - 3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
 - 4. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
 - 5. UL Listing: Listed for damp location.
 - 6. Recessed luminaires shall comply with NEMA LE 4.
- C. CRI of minimum 70. CCT of 3000 K.
- D. Rated lamp life of 50,000 hours to L70.
- E. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- F. Internal driver.
- G. Nominal Operating Voltage: 120 V ac.
 - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- H. Housings:
 - 1. Extruded-aluminum housing and heat sink.

2.2 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.3 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
 - 2. Ceiling mount with pendant mount with [5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
 - 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

J. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265619
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.
 - 3. Luminaire-mounted photoelectric relays.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaire.
 - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

- a. **Manufacturer's Certified Data:** Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 - b. **Testing Agency Certified Data:** For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - 6. Wiring diagrams for power, control, and signal wiring.
 - 7. Photoelectric relays.
 - 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. **Product Schedule:** For luminaires and lamps. Use same designations indicated on Drawings.
 - C. **Delegated-Design Submittal:** For luminaire supports.
 - 1. Include design calculations for luminaire supports.

1.5 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For testing laboratory providing photometric data for luminaires.
- B. **Product Certificates:** For each type of the following:
 - 1. Luminaire.
 - 2. Photoelectric relay.
- C. **Product Test Reports:** For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. **Source quality-control reports.**
- E. **Sample warranty.**

1.6 CLOSEOUT SUBMITTALS

- A. **Operation and Maintenance Data:** For luminaires and photoelectric relays to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. **Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.**
 - 1. **Lamps:** Ten for every 100 of each type and rating installed. Furnish at least one of each type.

2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 50 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 50 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 1598 and listed for wet location.
- C. Lamp base complying with ANSI C81.61.
- D. Bulb shape complying with ANSI C79.1.
- E. CRI of minimum 70 CCT of 3000 K.
- F. L70 lamp life of 50,000 hours.
- G. Internal driver.
- H. Nominal Operating Voltage: 120 V ac.
- I. Lamp Rating: Lamp marked for outdoor use.
- J. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- K. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.3 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to

prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage and coating.
 - c. CCT and CRI for all luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings, and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Install lamps in each luminaire.
- C. Fasten luminaire to structural support.
- D. Supports:
 1. Sized and rated for luminaire weight.
 2. Able to maintain luminaire position after cleaning and relamping.
 3. Support luminaires without causing deflection of finished surface.
 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
- F. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.
- H. Coordinate layout and installation of luminaires with other construction.
- I. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- J. Provide an additional five exterior lighting fixtures and accessories of each type and size used on the project to accommodate any changes required to resolve interferences as directed by the Engineer.
- K. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

- A. Aim as indicated on Drawings.
- B. Install on concrete base with top **4 inches (100 mm)** above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with **0.010-inch- (0.254-mm-)** thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.8 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION 265619

APPENDIX I

NEW JERSEY PREVAILING WAGE RATES

ATLANTIC COUNTY

It is recommended the bidder download the wage rates immediately prior to the scheduled bid due date to ensure the latest rates are included in their bid.

https://www.nj.gov/labor/wagehour/wagerate/prevailing_wage_determinations.html

APPENDIX II

BID EXPRESS



Bidexpress.com Set-up Guide

Follow this detailed guide to get set up and start bidding on bidexpress.com today!

How to register and get your Info Tech Digital ID...

1. To complete the registration process for your company, go to www.bidexpress.com and click the blue Register button at the top right of the page.
2. Enter your name in the First Name and Last Name fields. This name will appear on the registration page for your company. Type in your email address.

NOTE: *This email address will become your username for the account. It is also where all email notifications from the agencies with which you bid will be received.*

3. Create a secure password for your account. The password must be at least eight characters long and contain at least one capital letter, one lowercase letter, one number, and one symbol.
4. Select a security question and provide your answer. The answer to this question will be requested of you each time you've clicked that you've forgotten your account password and is case sensitive.
5. Next, complete the Business Name and contact information fields. After doing so, agree to the Privacy Policy, Terms of Use, and DMCA Policy at the bottom of the registration page and click the green REGISTER button. The Bid Express service sends a registration confirmation email to the address entered as the username.
6. Click the Activate Account link in the email. Enter the password you used on the registration page in the Password field and click ACTIVATE. The Bid Express service displays the HOME tab where you must install the Info Tech Express Sign Tool and Generate an Info Tech Digital ID.
7. Click INSTALL SIGN TOOL. Note that you will have to install the sign tool on every computer you wish to set up for bidding. Once installed, close your internet browser and start it back up.
8. Click the blue GENERATE DIGITAL ID link. This will walk you step by step through creating a Digital ID for your company.
9. The blue and gray My Info Tech Digital ID page appears. Click the blue CREATE button to continue your ID generation.
10. A United States map pop-up will appear. Select the agency or agencies with which you intend to do business with and click the blue NEXT.

NOTE: *If you do not see the agency you plan to bid to, you may need to alternatively subscribe to our second site, bidx.com. You may click the "Try the Bidx.com service" link from the top of this same pop-up to navigate to the correct site.*

11. A Create an Info Tech Digital ID pop-up will appear. Confirm that the name of the person listed in the screen is the authorized signer for your company, your company name matches how you would like to submit bids to the agency(s), and click SUBMIT.

NOTE: *If the person listed for your company is not the authorized signer, cancel ID generation. The back of this quick start guide will assist you with changing the contact information associated with your login, or inviting the appropriate authorized signer to your company.*

12. The wizard will load and then prompt you to back up your new Digital ID. Click BACKUP, then enter a password for the backup file of your Digital ID in the Password and Verify Password fields. This password will be used when importing the Digital ID to another computer for bidding. **DO NOT FORGET THIS PASSWORD**, as there is no way for the Bid Express team to retrieve or reset it. Click OK.

OVER

13. Save the Digital ID backup file to a memory stick, CD, company server, or other secure location outside of this computer for safe keeping.
14. Add the signer's name to the file name from Info Tech Express Digital ID.pfx so it will more recognizable when used for importing the backup file, (eg. John_Smith_Digital_ID.pfx). This will ensure you do not confuse your company's other Digital IDs. Once you have entered the Digital ID name and location, click **SAVE**. The Bid Express service returns you to the Bid Express Digital ID Generation window. Click **NEXT**.
15. Click **PRINT** to print a copy of the new registration page to have signed/notarized and mailed to our Customer Support team; the address will be on the page.

NOTE: *Customer Support must receive this page for processing before the due date of the job you wish to bid. When you have finished printing the document, close the print window and click **FINISH**.*
16. When your Digital ID is activated, the red Digital ID field on the home page of your new account will disappear and you will be able to begin purchasing and bidding on solicitations posted by the agencies with which you work.

How to bid...

1. To select a solicitation to bid, click on the drop down menu in the top left corner of the screen and choose Bid Express. From the Bid Express homepage, click the Solicitations tab at the top of the screen. Find the solicitation from the list; if you have a keyword for the job, type it in the search box to the top right.
2. Click on the blue job name. When you've determined you want to bid the job, click the green Select for Bidding button at the top right. You will then be prompted to opt for the Pay As You Go approach or a Monthly Subscription. After completing your purchase, you will be navigated into the project to complete your bid.
3. As you are working, make sure to click Save Draft as you work. When the bid is ready for submission, simply click the green Submit Bid button at the top and then click Submit Bid again to confirm. The job will submit and you will receive an email for your bid submission receipt.

Change your contact information or invite a user...

1. Click the drop down menu in the top left corner of the screen and select My Account.
2. If you do not wish to invite additional users to your business but need your Info Tech Digital ID to reflect the name of your authorized signer, click the blue **EDIT** button in the top right corner of the My Account section. Change just the First and Last Name fields and click **UPDATE**. You may now generate a digital ID to reflect this person's name.
3. If you need to invite a new user to your company, scroll down to the Employees field from the My Account screen. Type the email address of the additional user(s) and click Invite Employee.

NOTE: *You will need to assign the new user a role from this same screen after they've completed their registration, and a role from the Bid Express site. **CLICK** the Help tab at the top of the Bid Express page for an explanation of roles under the My Business section.*

4. Click the drop down in the top left corner of your account and select Bid Express to do so. You can manage the additional roles for each user from the My Business tab.

NOTE: *If you want to create a Joint Venture Digital ID for bidding, follow the steps above from the beginning. You will need to create a separate account for the Joint Venture because our system will see it as a separate company entirely.*

Where to get help...

Customer support hours are **7:00 a.m. to 8:00 p.m. EST**, Monday through Friday (excluding major U.S. holidays). Our toll free number is **(888) 352-BIDX(2439)**, our email is **support@bidexpress.com**.